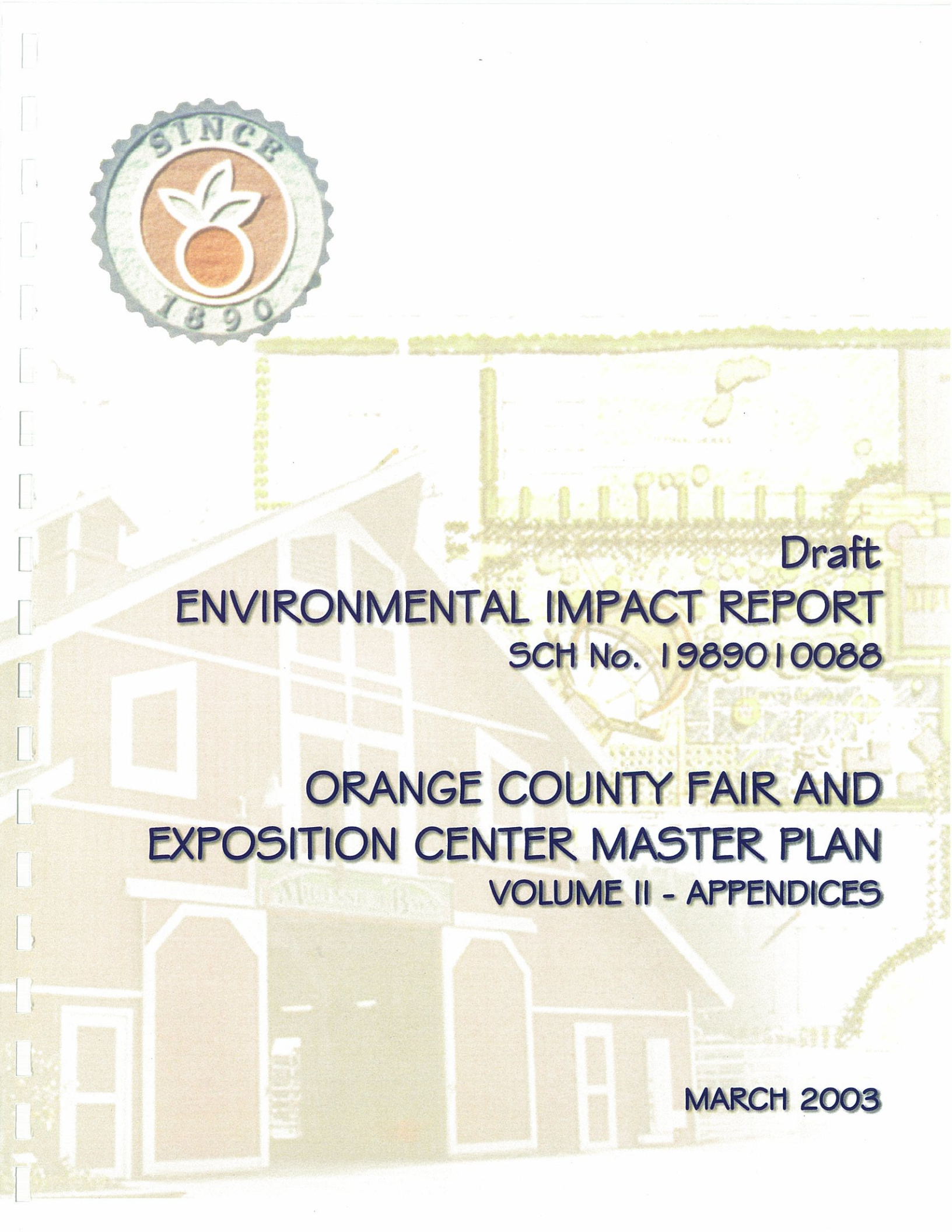


Draft
ENVIRONMENTAL IMPACT REPORT
SCH No. 1989010088

ORANGE COUNTY FAIR AND EXPOSITION CENTER MASTER PLAN
VOLUME II - APPENDICES

MARCH 2003

DRAFT
ENVIRONMENTAL IMPACT REPORT

ORANGE COUNTY FAIR AND EXPOSITION CENTER MASTER PLAN

STATE CLEARINGHOUSE NUMBER: 1989010088

VOLUME II—APPENDICES

Submitted to:

32ND DISTRICT AGRICULTURAL ASSOCIATION
RUBEN SMITH, PRESIDENT
BECKY BAILEY-FINDLEY, CEO/GENERAL MANAGER

88 Fair Drive
Costa Mesa, California 92626

Prepared by:

LSA Associates, Inc.
20 Executive Park, Suite 200
Irvine, California 92614
(949) 553-0666

LSA Project No. CCZ030

LSA

March 2003

TABLE OF CONTENTS

APPENDICES—VOLUME II

A: INITIAL STUDY/NOTICE OF PREPARATION, COMMENTS IN RESPONSE TO THE NOP, AND RESPONSES TO QUESTIONNAIRES
B: PHOTOMETRIC STUDY
C: GEOTECHNICAL STUDY
D: HYDROLOGY REPORT

APPENDIX A

INITIAL STUDY/NOTICE OF PREPARATION, COMMENTS IN RESPONSE TO THE NOP, AND RESPONSES TO QUESTIONNAIRES

INITIAL STUDY/NOTICE OF PREPARATION

NOTICE OF PREPARATION

To: Notice of Preparation Recipients (see attached distribution list)

Subject: Notice of Preparation of a Draft Environmental Impact Report

Lead Agency Orange County Fair and Exposition Center	**Consulting Firm**
Agency Name 32 District Agriculture Association	Firm Name LSA Associates, Inc.
Street Address 88 Fair Drive	Street Address 20 Executive Park, Suite 200
City/State/Zip Costa Mesa, CA 92626	City/State/Zip Irvine, CA 92614
Contact Becky Bailey-Findley, CEO	Contact Frank Haselton

The Orange County Fair and Exposition Center will be the Lead Agency and will prepare an environmental impact report for the project identified below. We need to know the views of your agency as to the scope and content of the environmental information which is germane to your agency's statutory responsibilities in connection with the proposed project. Your agency will need to use the EIR prepared by our agency when considering your permit or other approval for the project.

The project description, location, and the potential environmental effects are contained in the attached materials. A copy of the Initial Study (☒ is ☐ is not) attached.

Due to the time limits mandated by State law, your response must be sent at the earliest possible date but ***not later than 30 days*** after receipt of this notice.

Please send your response to Becky Bailey-Findley, CEO, Orange County Fair and Exposition Center, at the address shown above. We will need the name for a contact person in your agency.

Project Title: Orange County Fair and Exposition Center Master Plan

Project Location: Costa Mesa (City (nearest)) Orange (County)

Project Description: Please see attached

Date 5-17-02

Signature Becky Bailey-Findley

Title Chief Executive Officer

Telephone (714) 708-3247

I. INTRODUCTION

The Orange County Fair and Exposition Center (32nd District Agricultural Association) is considering adoption of a Master Plan representing a redevelopment of the portion of the Fairgrounds. Under the requirements of the California Environmental Quality Act (CEQA), the Fair Board of Directors (Board), acting as the Lead Agency for environmental review, must evaluate the potentially significant environmental effects of implementing the proposed Master Plan. Based upon initial review of the draft Master Plan, the Board determined that an Environmental Impact Report (EIR) must be prepared to assess the proposed Master Plan's effects on the environment, to identify potentially significant impacts, to identify feasible mitigation measures to reduce or eliminate potentially significant environmental impacts, and to discuss feasible alternatives to the project that may accomplish basic project objectives while lessening or eliminating any potential significant project impacts.

This Notice of Preparation (NOP) is being circulated pursuant to the California Public Resources Code Section 21153(a) and CEQA Guidelines Section 15082. Public agencies and the public are invited to comment on the proposed scope and content of the environmental information to be included in the EIR. A 30 day comment period is provided to return written comments to the Orange County Fair and Exposition Center (OCFEC) at the following address:

Ms. Becky Bailey-Findley, CEO
Orange County Fair and Exposition Center
88 Fair Drive
Costa Mesa, CA 92626

II. PROJECT LOCATION

The proposed project is located in central Costa Mesa, on the north side of Fair Drive, between Newport Boulevard (southbound) to the east and Fairview Drive to the west. Arlington Drive is located along the site's north boundary. Regional access is provided to the site by State Route 55 (SR 55) to the north and east. Figure 1 depicts the proposed project's location.

III. SURROUNDING USES

The Orange County Fair and Exposition Center is a public facility surrounded by a variety of educational facilities, parks, and low-density to high-density residential areas. Figure 2 is an aerial photograph showing the surrounding land uses in the immediate vicinity of the Orange County Fair and Exposition Center. Orange Coast College is located to the northwest, Costa Mesa High School and Davis Elementary School to the north, and Vanguard University to the south. Single family residential areas are located northeast of Arlington Drive, north of Tewinkle Park. In addition, existing single/multiple family residences are located west of Fairview Road and south of SR 55. The Santa Ana Country Club golf course (private), Civic Center Park, and Tewinkle Park are recreation/ open space facilities in the immediate surrounding area. The National Guard Armory is located near the northeast corner of the property. General commercial areas are located primarily along Harbor Boulevard to the west and southeast of SR 55.

Source: USGS 7.5' Topographic Quadrangle, "Newport Beach, Calif."

6/8/01(CCZ030)

Figure 1

N

LSA

Scale in Feet

0 1000 2000

Location Map

6/8/01(CCZ030)

N

LSA

Scale in Feet

0 300 600

Figure 2

Surrounding Land Uses

IV. PROPOSED PROJECT DESCRIPTION

The OCFEC has existed at this location for over 50 years. Since its origins at this location, OCFEC has evolved into a year-round exhibition and event center. The primary function of OCFEC is to host the annual 17 day summer fair. Approximately 800,000 people attended the 2001 summer fair. However, there are events and exhibitions occurring on the fairgrounds each weekend, including the Orange County Marketplace, a swap meet that occupies a portion of the OCFEC's parking lot.

Currently, the Fairgrounds complex includes the following major facilities, parking areas, and subareas.

- Pacific Amphitheater - An open air arena providing fixed seating for 8,500 persons. The berm area provides for approximately 10,000 additional spectators. The facility was used primarily for musical concerts during the annual Fair Event.
- Arlington Theater - A lawn area with a capacity for 6,500 patrons, primarily attending concert events.
- Grandstand Arena - A 7,800 seat arena used primarily for rodeos, circuses, motorcycle races, and additional outdoor events.
- Showroom Buildings - Six buildings totaling 106,000 square feet, which are rented for various shows.
- Equestrian Center - Approximately 11.5 acres utilized for boarding and training of horses, as well as horse shows.
- Centennial Farms - An approximately 3.5 acre outdoor agricultural and livestock area showcasing educational programs for school aged children.
- Outdoor Areas - Three outdoor areas totaling 13.5 acres, used primarily for shows and expositions. One area, comprising 7.5 acres, is also used as Exhibitor parking when needed and if available.
- Mall Areas - Three areas adjacent to the outdoor areas, used primarily as show areas for cars, etc.
- Parking Lots - The main parking areas (Parking Lots A through D) are located along the southern and western sides of the site. Parking capacity is distributed throughout the site, with 2,193 spaces in parking lot A, 1,514 spaces in parking lot B, 765 spaces in parking lot C, and 940 spaces in parking lot D. Parking capacity in parking lots E and F, which are located on the northwest corner of the site, can accommodate up to 582 and 283 vehicles, respectively. Lots G and H, located along the eastern boundary adjacent to southbound Newport Boulevard, have 537 and 713 parking spaces, respectively. In addition, smaller parking areas are located throughout the property. The Orange County Marketplace uses parking lot A for its weekend business activities.

Figure 3 depicts the existing fairgrounds and the various use areas (air photo).

Table A indicates the existing buildings, areas, and associated square footage of the OCFEC.

LEGEND

Parcel Id	Existing Use	Acres
1	Adminstration Bldg/Grounds	2
2	Centennial Farm	3
3	Amphitheater	12
4	Memorial Gardens Bldg, Small Exhibit Bldgs	5
5	Large Exhibit Bldgs	8
6	Fair Rides / Parking	11
7	Horse Trailer Storage / Parking	6
8	Equestrian	14
9	Animal Display Exhibit Structures	6
10	Grand Stand Arena	4
11	Maintenance Yard	2
12	Arlington Theatre	4
13	Camping; Vendor Parking (Fair) / Kid Carnival	6
14	Parking (U.C. Extension)	4
15	Parking (Overflow)	6
16, 17	Parking	62
17	Swap Meet	31

LSA

5/24/01 (OCF030 - Fairgrnds.apr)

400 0 400 Feet

Figure 3
Orange County Fair
& Exposition Center

Table A: Existing Facilities

Amphitheater	351,560 sq. ft. (18,500 seats)
Centennial Farms	168,000 sq. ft.
Festival Grounds/Camping	306,250 sq. ft.
Carnival Lot	318,150 sq. ft.
Exhibit Buildings	
Building 8	12,222 sq. ft.
Building 10	36,000 sq. ft.
Parade of Products (POP)	16,146 sq. ft.
Building 12	22,000 sq. ft.
Silo	2,730 sq. ft.
Barn	5,190 sq. ft.
Building 17	11,040 sq. ft.
Building 16	13,969 sq. ft.
Building 14	18,000 sq. ft.
Building 15	6,822 sq. ft.
Building 13	6,822 sq. ft.
TOTAL	150,941 sq. ft.
Plazas/Courts	
Main Mall	40,625 sq. ft.
South Lawn	31,250 sq. ft.
TOTAL	71,875 sq. ft.
Storage	11,130 sq. ft.
Yard	28,050 sq. ft.
Livestock Area	97,200 sq. ft.
Arena	110,136 sq. ft.
Equestrian Center	500,940 sq. ft.
Little Theater	5,960 sq. ft.
Memorial Gardens	3,411 sq. ft.
Arlington Theater	97,344 sq. ft.
Offices	
Maintenance	14,495 sq. ft.
4H	2,500 sq. ft.
Administration	5,970 sq. ft.
Livestock	2,000 sq. ft.
TOTAL	24,965 sq. ft.
Total Number of Parking Spaces	9,388 ±± *

The proposed project will involve removing and replacing existing structures, constructing new additional structures, constructing additional parking areas, and establishing a coherent and thematic landscape, sign, and lighting plan. In general, the project will result in a core of facilities surrounded by a parking area. The core of facilities will be divided into two general areas - a Park (open space) area and Campus (buildings) area.

The Park area, the west portion of the core of facilities, will include a remodeled amphitheater that will have a reduced capacity (18,500 to 8,500 people). The first phase in remodeling the amphitheater will be to remove a large earthen berm that was used for seating up to 10,000 people. This berm contains approximately 200,000 cubic yards of earthen material. The amphitheater will be re-opened with an approximate maximum capacity of 8,500. East and north of the amphitheater will be a large, passive park area. Several small exhibit buildings will be removed to accommodate the proposed park. The midway (carnival lot) will be relocated north of this park area. Centennial Farms, a working farm exhibit, will be expanded to the west, incorporating an area that is currently occupied by a portion of the earthen berm.

The Campus portion of the fairgrounds will contain a series of buildings and open space plazas. The existing four exhibits buildings will remain. A covered structure linking the eastern exhibit buildings will be created. The existing exhibit building located south of the maintenance yard (Building No. 17) will be replaced by a building containing a large, industrial kitchen and restaurant. A new exhibit building (approximately 85,000 square feet) will be located north of the exhibits buildings and west of the maintenance yard. A new storage structure will be located east of the maintenance yard. A covered judging ring will be located east of the new kitchen/restaurant and south of the new storage structure. The livestock area will remain in the same location, with the stalls and pens replaced by similar, upgraded structures. The existing arena will be relocated south of the livestock area. Two multipurpose buildings (approximately 20,000 square feet each) will be constructed south of the existing exhibit buildings and east of the primary entry/arrival court complex.

The primary entry (off of Fair Drive) will be improved and landscaped. A new arrival court will be constructed at the north terminus of this entry, replacing the existing administrative building. The principal entries off of Newport Boulevard and Fairview Drive will be improved with landscaping and gates.

The existing equestrian center will be reduced by approximately 50 percent in area (approximately seven acres). The reduced equestrian center will be located in the northeast corner of the site. The former western portion of the equestrian center will be replaced by an additional parking area and an access point on to/off of Arlington Drive.

Table B depicts the proposed project's program, and Table C illustrates the proposed net area devoted to new and/or changed uses. Figure 4 is the conceptual Master Plan.

V. DISCRETIONARY ACTIONS

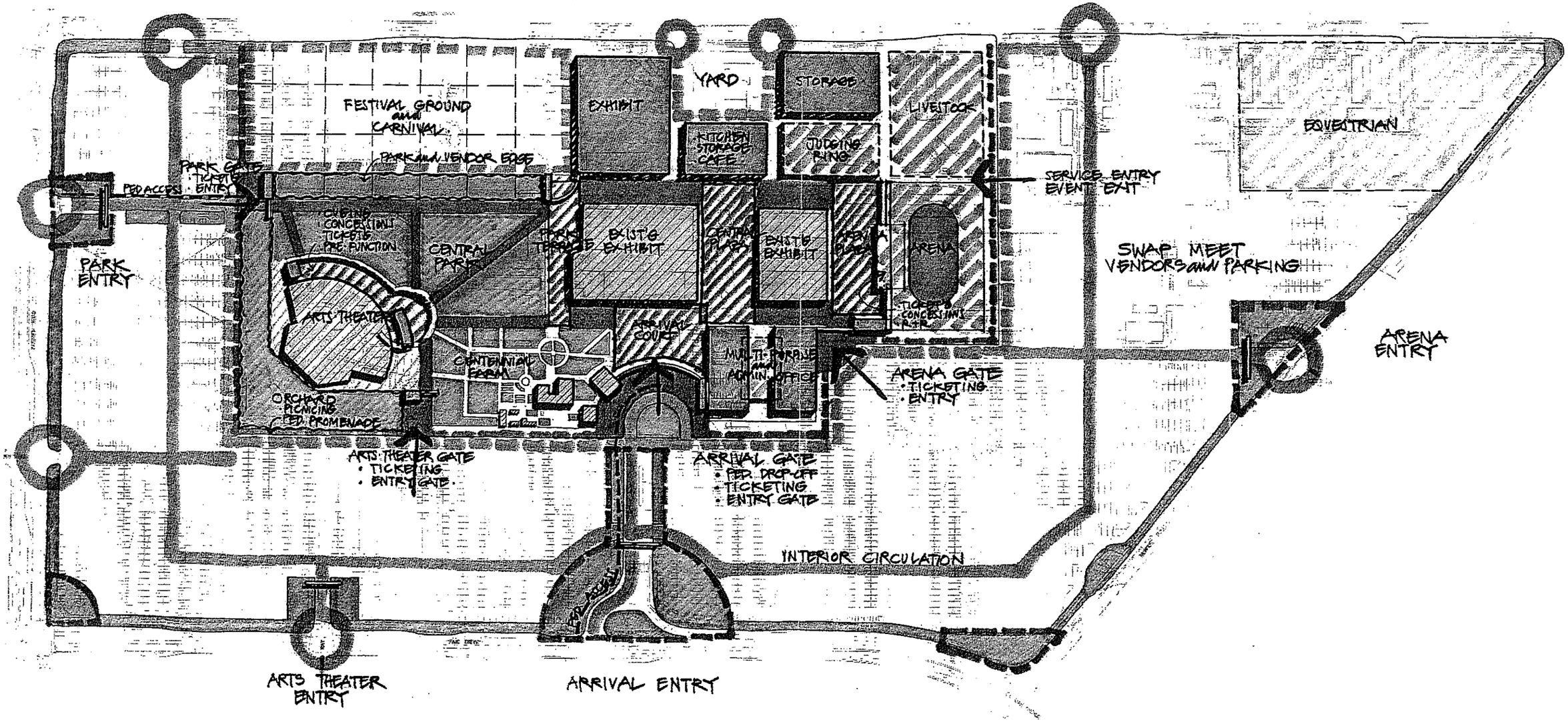
The proposed Master Plan will be implemented by a series of actions, programs, and guidelines as adopted by the Board. The primary discretionary action undertaken by the Board is the approval and adoption of the Master Plan. The EIR being prepared for the proposed project will satisfy the CEQA

Table B: Proposed Program

Amphitheater	254,400 sq. ft. (8,500 seats)
Centennial Farms	196,000 sq. ft.
Festival Grounds (excludes area for parking)	245,000 sq. ft.
Carnival Lot (includes area for non-fair parking)	322,000 sq. ft.
Exhibit Buildings	
Exhibit West of Yard	88,400 sq. ft.
Exhibit with Kitchen	34,500 sq. ft.
Existing Exhibit (West of Central Plaza)	100,800 sq. ft.
Existing Exhibit (East of Central Plaza)	49,400 sq. ft.
Exhibit, South of Central Plaza (single story)	26,400 sq. ft.
Exhibit, Southeast of Central Plaza (two story)	52,800 sq. ft.
TOTAL	352,300 sq. ft.
Plazas/Courts	
Park Terrace	25,200 sq. ft.
Arrival Court	40,000 sq. ft.
Central Plaza	52,000 sq. ft.
Arena Plaza	53,200 sq. ft.
TOTAL	170,400 sq. ft.
Storage	45,900 sq. ft.
Yard	60,000 sq. ft.
Livestock	97,200 sq. ft.
Judging Ring	43,200 sq. ft.
Arena	116,100 sq. ft
Equestrian Center	330,000 sq. ft.
Central Park	302,900 sq. ft.
Total Number of Parking Spaces	9,888 ±±

Table C: Net Change

Amphitheater	-97,160 sq. ft. (10,000 seats)
Festival Grounds (excludes area for parking)	-61,250 sq. ft.
Carnival Lot (includes area for non-fair parking)	3,850 sq. ft.
TOTAL	201,359 sq. ft.
Plazas/Courts	
TOTAL	98,525 sq. ft.
Storage	34,770 sq. ft.
Yard	31,950 sq. ft.
Judging Ring	43,200 sq. ft.
Arena	5,964 sq. ft.
Equestrian Center	-170,940 sq. ft.
Central Park	302,900 sq. ft.
Total Number of Parking Spaces	500 ±±



0 50 100 200

Not to Scale

PLAN B2

ORANGE COUNTY FAIR AND EXPOSITION

88 FAIR DRIVE

COSTA MESA, CALIFORNIA

FIGURE 4

LPA
LSA
LP3

requirements for all permits or approval needed to implement all phases of the proposed Master Plan. At this time the following actions are to be considered:

- Certification of the Environmental Impact Report (OCFEC Board).
- Adoption of a Mitigation Monitoring Plan (OCFEC Board).
- Approval and adoption of the Master Plan, including land use guidelines, a conceptual site plan, business plan and implementation strategy (OCFEC Board)
- Building permits and contract approvals (California Construction Authority)

VI. LEAD, RESPONSIBLE, AND TRUSTEE AGENCIES

According to Sections 15050 and 15367 of the State CEQA Guidelines, the OCFEC has been designated as the Lead Agency. A Lead Agency is the public agency having the principal responsibility for carrying out or approving the project. Responsible Agencies are those agencies that have discretionary approval over one or more actions involved with the development of a proposed project. Trustee Agencies are State agencies having discretionary approval or jurisdiction by law over natural resources affected by a proposed project that are held in trust of the people of the State of California.

No Responsible Agencies or Trustee Agencies have been identified. However, there are several agencies with jurisdictional interest. OCFEC will need to work with the City of Costa Mesa regarding public right-of-way and hyrology issues. The Division of Fairs and Exposition and the California State Department of Agriculture will provide general oversight of the Master Plan implementation via the California Construction Authority.

VII. ENVIRONMENTAL PROCEDURES

This NOP for the proposed project will be submitted to the State Clearinghouse, Responsible Agencies, and other interested parties that specifically requested a copy of the NOP. After the 30 day review period for the NOP is complete and all comments are received, a Draft EIR will be prepared in accordance with CEQA as amended (Public Resources Code, Section 21000 et seq.) and the State Guidelines for Implementation of CEQA (California Code of Regulations, Section 15000, et seq.). This Draft EIR will comply with the procedures for implementation of CEQA as established by Public Resources Code, Section 21000, et seq. and the CEQA Guidelines.

Detailed analysis will be conducted in order to ascertain the proposed project's potential impact on the environment and the relative degree of impact prior to implementation of mitigation measures. Where impacts are determined to be significant, mitigation measures will be prescribed with the purpose of reducing those impacts completely, or to the maximum degree feasible. An analysis of alternatives to the proposed project will also be included in the Draft EIR, including alternative site plans and the No Project Alternative. In addition, a discussion regarding cumulative impacts associated with foreseeable future projects within the vicinity of the proposed project (including the proposed project) will be included within the Draft EIR.

VIII. INITIAL STUDY CHECKLIST

An Initial Study Checklist is a preliminary environmental analysis of a proposed project prepared by the Lead Agency to determine whether a Negative Declaration or EIR must be prepared (State CEQA Guidelines Section 15365).

The Initial Study Checklist addresses each question required by the State CEQA Guidelines. An indication is provided related to the potential impacts of the proposed project. The Threshold of Significance Section provides impact criteria from the federal or State agencies, the State CEQA Guidelines, or adopted City policies. The Impacts Section indicates the potential impacts of the proposed project. The Analysis Section provides an analysis of the physical effects of the proposed project. The Analysis Section indicates whether the proposed project will have any impacts as follows:

1. Potentially Significant;
2. Potentially Significant Unless Mitigation is Incorporated;
3. Less than Significant Impact; or
4. No Impact.

The Initial Study Checklist and Response Section have been prepared according to Sections 15063, 15064, and 15065 of the State CEQA Guidelines.

IX. EVALUATION OF ENVIRONMENTAL IMPACTS

A brief explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a project-specific screening analysis).

All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts.

Once the lead agency has determined that a particular physical impact may occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect is significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required.

X. POTENTIAL ENVIRONMENTAL EFFECTS/ISSUES

A. Geophysical. Would the Project Result in or Expose People to Impacts Involving Local Fault Rupture and Expansive Soils?

Less than Significant Impact. No active fault has been identified on the project site, and the site is not designated a fault hazard zone pursuant to the Alquist-Priolo Act. The proposed project site is generally located within a regional seismically active area. Local faults (e.g., Newport-Inglewood) are well documented along with associated potential ground shaking and acceleration characteristics. In addition, the potential for liquefaction exists, as with the surrounding area. While a comprehensive and separate geotechnical analysis for this EIR is not warranted based upon the absense of hazardous geotechnical conditions, new structures will be required to be constructed in accordance with State of California geotechnical standards.

B. Hydrology & Drainage. Would the Project Result in a Substantial Increase in the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On-or Off-Site?

Less than Significant Impact. Approximately seven acres of an existing equestrian center will be converted into a portion of the proposed project's parking area - resulting in additional impermeable surface for this specific area. This, in turn, will result in increased runoff amounts that will drain to the north. Receiving this additional runoff will be a small, unimproved channel that conveys water along the south edge of Arlington Street. A storm water runoff (hydrology) study will be conducted as part of this EIR. This study will analyze the existing channel, as well as potential impacts as result of the proposed parking area.

C. Hydrology & Drainage. Would the Project Create or Contribute Runoff Water Which Would Exceed the Capacity of Existing or Planned Storm Water Drainage Systems or Provide Substantial Additional Sources of Polluted Runoff?

Less than Significant Impact. As indicated in B, above, a storm water runoff (hydrology) study will be conducted as part of this EIR. This study will analyze the existing channel, as well as potential impacts as result of the proposed parking area.

In addition, runoff generated within the Fairgrounds, including the equestrian center, will be analyzed as to water quality characteristics. Guidelines and procedures identified by the Santa Ana Regional Water Quality Board will be followed in this analysis, and in the creation of Best Management Practices and any potential mitigation measures.

D. Transportation/Circulation. Would the Project Result in Increased Vehicle Trips or Traffic Congestion Beyond Adopted Policies and/or Forecasts?

Less than Significant Impact. The proposed project includes additional event centers and exhibition uses that may have the potential to generate additional traffic within relatively short time periods. There are several existing policies and agreements in place that address traffic and

circulation issues for the Fairgrounds. A complete traffic and circulation study will be prepared as a part of this EIR, investigating 1) the existing system; 2) proposed increased traffic as a direct result of the proposed project; and 3) a cumulative analysis (proposed project plus reasonably foreseeable projects) of the immediate vicinity.

E. Transportation/Circulation. Would the Project Exceed, Either Individually or Cumulatively, A Level of Service Standard Established by the County Congestion Management Agency for the Designated Roads or Highways?

Less than Significant Impact. The proposed project is located within an urbanized area that currently experiences traffic congestion. There are several active redevelopment projects in various stages of implementation within the proposed project's vicinity. A complete traffic and circulation study will be prepared as a part of this EIR, investigating 1) the existing system; 2) proposed increased traffic as a direct result of the proposed project; and 3) providing a cumulative analysis (proposed project plus reasonably foreseeable projects) of the immediate vicinity.

F. Transportation/Circulation. Would the Project Result in Insufficient Parking Capacity On-Site or Off-Site?

Less than Significant Impact. The proposed project includes additional event centers and exhibition uses that may have the potential to generate significant amounts of traffic within relatively short time periods. There are several existing policies and agreements in place that address parking for the Fairgrounds. The aforementioned traffic and circulation study, completed as a part of this EIR, will investigate the amount of available parking spaces, access, safety and location, as well as the existing/proposed parking management system.

G. Air Quality. Would the Project Exceed Any SCAQMD Standard or Contribute to Air Quality Deterioration Beyond Projects of SCAQMD?

Potential Significant Effect. A portion of the proposed project includes removing approximately 200,000 yards of earthen material formerly used as a seating area for an amphitheater. A preliminary analysis indicates that removing this amount of material within a reasonable construction period may result in exceeding several SCAQMD thresholds for short-term construction activities (PM_{10} and ROG). A complete air quality analysis will be completed as part of this EIR, analyzing both the short-term (construction) and long-term (operational) impacts, as well as suggesting appropriate and feasible mitigation measures should there be significant impacts.

H. Air Quality. Would the Project Expose Sensitive Population Groups to Pollutants in Excess of Acceptable Levels?

Less than Significant Impact. As mentioned above, short-term construction impacts may exceed several SCAQMD thresholds. The project site is located near several schools and a community park, which are considered sensitive receptor locations. A complete air quality analysis will be completed as part of this EIR, analyzing both the short-term (construction) and long-term (operational) impacts,

as well as suggesting appropriate and feasible mitigation measures should there be significant impacts.

I. Noise. Would the Project Increase Existing Noise Levels?

Less than Significant Impact. An outdoor entertainment venue will be reopened as part of the proposed project. A comprehensive noise analysis will be conducted that will investigate potential noise levels associated with a variety of events. This analysis will also analyze the degree of impact on residential uses in the project's vicinity and recommend, if necessary, appropriate and feasible mitigation measures should there be significant impacts.

J. Noise. Would the Project Expose People to Noise Levels Exceeding Adopted County Standards?

Less than Significant Impact. An outdoor entertainment venue will be reopened as part of the proposed project. A comprehensive noise analysis will be conducted that will investigate potential noise levels associated with a variety of events. This analysis will also analyze the degree of impact on residential uses in the project's vicinity and recommend, if necessary, appropriate and feasible mitigation measures should there be significant impacts.

K. Aesthetics. Would the Project Substantially Degrade the Existing Visual Character or Quality of the Site and its Surroundings?

Less than Significant Impact. The Fairgrounds has existed in its present location for nearly 50 years. The surrounding area has evolved from mostly vacant land into a suburban area with a variety of residential, recreational, institutional, and civic uses. The Fairgrounds has a variety of signs, banners, lights, and other similar devices – typically characteristic of Fairgrounds – designed to attract visual attention to the site and its facilities. The proposed project will be consistent with this Fairground characteristic. View simulations of proposed Master Plan improvements will be prepared and incorporated into the EIR.

L. Aesthetics. Would the Project Create Light or Glare Beyond the Physical Limits of the Project Site?

Less than Significant Impact. The Fairgrounds has existed in its present location for nearly 50 years. The surrounding area has evolved from mostly vacant land into a suburban area with a variety of residential, recreational, institutional, and civic uses. The Fairgrounds has a variety of signs, banners, lights, and other similar devices – typically characteristic of Fairgrounds – designed to attract visual attention to the site and its facilities. The proposed project will be consistent with this Fairground characteristic. View simulations will be prepared and incorporated into the EIR.

There are several large light standards (100' $\pm$ in height) located in the western portion of the parking area. Several similar light standards are planned for the eastern portion of the parking area. However, this portion of the parking area is adjacent State Route 55, Vanguard University, and a

community park (non-residential uses). A photometric plan analyzing potential light and glare impacts will be prepared as part of the environmental documentation.

M. Public Services. Would the Project Result in Need(s) for New/Altered Government Facilities/Services in Maintenance of Public Facilities, Including Roads?

Less than Significant Impact. As previously noted, the drainage channel located along the south edge of Arlington Street (north side of Fairgrounds) will be analyzed as part of a comprehensive hydrological study.

N. Mandatory Findings of Significance

1. Does the project have possible environmental effects which are individually limited but cumulatively considerable?

   Less than Significant with Mitigation. As previously mentioned, the proposed project is located within an area of active redevelopment with several projects in various stages of entitlement and/or construction. The proposed project may incrementally contribute to the cumulative environmental conditions of the surrounding area.

2. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?

   Potential Significant Effect. As noted within the Air Quality portion of this Initial Study Checklist, the proposed project may result in short-term (construction related) air quality impacts, specifically associated with the removal of approximately 200,000 yards of earthen materials. The EIR will assess this issue.

ENVIRONMENTAL ANALYSIS CHECKLIST

CCZ030

ISSUES & SUPPORTING DATA SOURCES:	Potential Significant Effect	Less than Significant w/ Mitigation	Less than Significant Impact	No Impact
1. LAND USE & PLANNING. Would the project:				
a) Conflict with general plan designation or zoning?	☐	☐	☐	☒
b) Conflict with applicable environmental plans or policies of agencies with jurisdiction over the project?	☐	☐	☐	☒
c) Disrupt or divide the physical arrangement of an established community (e.g. low income, minority)?	☐	☐	☐	☒
d) Conflict with adjacent, existing or planned land uses?	☐	☐	☐	☒
2. AGRICULTURE. Would project:				
a) Convert Farmlands listed as "Prime", "Unique" or of "Statewide Importance," as shown on the State Farmland Mapping and Monitoring Program, to non-agricultural use?	☐	☐	☐	☒
b) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use?	☐	☐	☐	☒
3. POPULATION & HOUSING. Would project:				
a) Cumulatively exceed adopted regional or local population projections?	☐	☐	☐	☒
b) Induce substantial growth in an area directly or indirectly through project in an undeveloped area or extension of major infrastructure?	☐	☐	☐	☒
c) Displace existing housing affecting a substantial number of people?	☐	☐	☐	☒
4. GEOPHYSICAL. Would project result in or expose people to impacts involving:				
a) Local fault rupture?	☐	☐	☒	☐
b) Seismicity: ground shaking or liquefaction?	☐	☐	☒	☐
c) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒
d) Landslides or mudslides?	☐	☐	☐	☒
e) Erosion, changes in topography or unstable soil conditions from excavation, grading or fill?	☐	☐	☐	☒
f) Subsidence of the land?	☐	☐	☐	☒
g) Expansive soils?	☐	☐	☒	☐
h) Unique geologic or physical features?	☐	☐	☐	☒
5. HYDROLOGY&DRAINAGE. Would the project:				
a) Substantially alter the existing drainage pattern of the site or area, including the alteration of the course of a stream or river, in manner which would result in:				
i) substantial erosion or siltation on- or off-site?	☐	☐	☐	☒
ii) a substantial increase in the rate or amount of surface runoff in manner which would result in flooding on- or off-site?	☐	☐	☒	☐
b) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☒	☐
c) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☐	☒
d) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam, or inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒

ISSUES & SUPPORTING DATA SOURCES:	Potential Significant Effect	Less than Significant w/ Mitigation	Less than Significant Impact	No Impact
6. WATER QUALITY. Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☒	☐	☐
b) Substantially deplete groundwater supplies or interfere with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of a local groundwater table level?	☐	☐	☐	☒
c) Otherwise substantially degrade water quality?	☐	☒	☐	☐
7. TRANSPORTATION/CIRCULATION. Would the project result in:				
a) Increased vehicle trips or traffic congestion beyond adopted policies and/or forecasts?	☐	☐	☒	☐
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	☐	☒	☐	☐
c) Safety hazards from design features (e.g. sharp curves or dangerous intersections) or incompatible uses (e.g. farm equipment)?	☐	☐	☐	☒
d) Inadequate emergency access or access to nearby uses?	☐	☐	☐	☒
e) Insufficient parking capacity on-site or off-site?	☐	☐	☒	☐
f) Hazards or barriers for pedestrians or bicyclists?	☐	☐	☐	☒
g) Conflicts with adopted policies supporting alternative transportation (e.g. bus turnouts, bicycle racks)?	☐	☐	☐	☒
h) Rail, waterborne or air traffic impacts?	☐	☐	☐	☒
i) Change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒
8. AIR QUALITY. Would the project:				
a) Exceed any SCAQMD standard or contribute to air quality deterioration beyond projections of SCAQMD?	☒	☐	☐	☐
b) Expose sensitive population groups to pollutants in excess of acceptable levels?	☐	☐	☒	☐
c) Alter air movement, moisture, or temperature, or cause any change in climate?	☐	☐	☐	☒
d) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☒
9. NOISE. Would the project:				
a) Increase existing noise levels?	☐	☐	☒	☐
b) Expose people to noise levels exceeding adopted County standards?	☐	☐	☒	☐
c) If located within an airport land use plan or, where such plan has not been adopted, within two miles of a public airport or public use airport, expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
10. BIOLOGICAL RESOURCES. Would the project impact:				
a) Endangered, threatened or rare species or their habitats (including but not limited to plants, fish, insects, animals and birds)?	☐	☐	☐	☒
b) Locally designated species (e.g. heritage trees)?	☐	☐	☐	☒
c) Locally designated natural communities (e.g. oak forest, coastal habitat, etc.)?	☐	☐	☐	☒
d) Wetland habitat (e.g. marsh, riparian and vernal pool)?	☐	☐	☐	☒
e) Wildlife dispersal or migration corridors?	☐	☐	☐	☒
f) Adopted or proposed conservation plans and policies (e.g. Natural Community Conservation Plan or Resource Management Plan)?	☐	☐	☐	☒
11. AESTHETICS. Would the project:				
a) Affect a scenic vista or view open to the public?	☐	☐	☒	☐
b) Affect a designated scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☒	☐
d) Create light or glare beyond the physical limits of the project site?	☐	☒	☐	☐

ISSUES & SUPPORTING DATA SOURCES:	Potential Significant Effect	Less than Significant w/ Mitigation	Less than Significant Impact	No Impact
12. CULTURAL/SCIENTIFIC RESOURCES, Would the project:				
a) Disturb archaeo or paleo resources?	☐	☐	☐	☒
b) Affect historical resources?	☐	☐	☐	☒
c) Have the potential to cause a physical change which would affect unique ethnic cultural values?	☐	☐	☐	☒
13. RECREATION. Would project:				
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒
c) Conflict with adopted recreational plans or policies?	☐	☐	☐	☒
14. MINERAL RESOURCES. Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒
15. HAZARDS. Would the project:				
a) Create a hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	☒
b) Create a hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	☒
c) Exposure of people to existing sources of health hazards?	☐	☐	☐	☒
d) For a project located within an airport land use plan or, where such plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
e) For a project within the vicinity of private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
g) Expose people or structures to a significant risk or loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☒
16. PUBLIC SERVICES. Would project result in need(s) for new/altered government facilities/services in:				
a) Fire protection?	☐	☐	☐	☒
b) Police protection?	☐	☐	☐	☒
c) Schools?	☐	☐	☐	☒
d) Maintenance of public facilities, including roads?	☐	☐	☒	☐
e) Other government services?	☐	☐	☐	☒
17. UTILITIES & SERVICE SYSTEMS. Would project result in needs for new or substantial alterations in:				
a) Power or natural gas?	☐	☐	☐	☒
b) Communications systems?	☐	☐	☐	☒
c) Local or regional water treatment or distribution facilities?	☐	☐	☐	☒
d) Sewer or septic tanks?	☐	☐	☐	☒
e) Solid waste disposal?	☐	☐	☐	☒

ISSUES & SUPPORTING DATA SOURCES:	Potential Significant Effect	Less than Significant w/ Mitigation	Less than Significant Impact	No Impact
MANDATORY FINDINGS				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife population to drop below self sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☐	☒
b) Does the project have the potential to achieve the short-term environmental goals to the disadvantage of the long-term environmental goals?	☐	☐	☐	☒
c) Does the project have possible environmental effects which are individually limited but cumulatively considerable? ("cumulatively considerable" means that the incremental effects of an individual project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☐	☒	☐	☐
d) Does project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly	☒	☐	☐	☐

DETERMINATION:

Based upon the evidence in light of the whole record documented in the attached environmental checklist explanation, cited incorporations and attachments, I find that the proposed project:

COULD NOT have a significant effect on the environment, and a negative declaration (ND) will be prepared pursuant to CEQA Guidelines Article 6, 15070 through 15075. ☐

COULD have a significant effect on the environment, there will not be a significant effect in this case because the mitigation measures have been added to the project. A negative declaration (ND) will be prepared pursuant to CEQA Guidelines Article 6, 15070 through 15075. ☐

MAY have a significant effect on the environment which has not been analyzed previously. Therefore, an environmental impact report (EIR) is required. ☒

Signature: Betty Bailey-Fridley

Telephone: (714) 708-3247

NOTE: All referenced and/or incorporated documents may be reviewed by appointment only, at the County of Orange Planning & Development Services Department, 300 N. Flower Street, Santa Ana, California, unless otherwise specified. An appointment can be made by contacting the CEQA Contact Person identified above.

COMMENTS IN RESPONSE TO THE NOP

The Gas Company

Orange Coast Region

RECEIVED
MAY 07 2001

May 3, 2001

LSA Associates, Inc.
One Park Plaza, Suite 500
Irvine, CA 92614-5987

Attention: Jayna Goodman

Southern California
Gas Company
Mailing Address:
Box 3334
Anaheim, CA
92803-3334

Subject: Atlas Request for Orange County Fairgrounds in Costa Mesa

Attached is the information you requested relating to the location of gas facilities within the area of your project. Due to numerous factors, the depths of our facilities vary and should not be taken for granted. The information we have provided was obtained from a search of all our available records and is approximate in nature. If exact depth location and information is required at points of possible interference, it will be necessary to physically check the facility in question.

It is extremely important that you furnish us with "signed" final plans and subsequent plan revisions as soon as they are available. A minimum of twelve (12) weeks is needed to analyze your plans and to design required alterations due to any conflicting facilities. Depending on the magnitude of the work involved, additional time may then be required to clear the conflict. Please keep us informed of construction schedules, preconstruction meetings, etc., so that our work can be scheduled accordingly.

Upon request, at least two (2) working days prior to the start of construction, we will locate and mark our active underground facilities for the contractor at no cost. Please call Underground Service Alert (USA) at 1-800-422-4133.

If you have any questions or require additional information please contact me at (714) 634-3217.

Sincerely,

Steve Faber

Steve Faber
Planning Associate
Orange Coast Region

SF/mm
enclosure

STATE OF CALIFORNIA

Governor's Office of Planning and Research

State Clearinghouse

Gray Davis
GOVERNOR

Tal Finney
INTERIM DIRECTOR

Notice of Preparation

May 31, 2002

To: Reviewing Agencies

Re: Orange County Fair and Exposition Center Update
SCH# 1989010088

Attached for your review and comment is the Notice of Preparation (NOP) for the Orange County Fair and Exposition Center Update draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Becky Bailey-Findley
32 District Agriculture Association
88 Fair Drive
Costa Mesa, CA 92626

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Project Analyst, State Clearinghouse

Attachments
cc: Lead Agency

1400 TENTH STREET P.O. BOX 3044 SACRAMENTO, CALIFORNIA 95812-3044
916-445-0613 FAX 916-323-3018 www.opr.ca.gov

FROM :ORANGE COUNTY FAIR FAX NO. :714 708 1513 Jun. 06 2002 10:02AM P2

SCH#	1989010088
Project Title	Orange County Fair and Exposition Center Update
Lead Agency	Orange County

Type	**NOP** Notice of Preparation
Description	The proposed project will involve removing and replacing existing structures, constructing new additional structures, constructing additional parking areas, and establishing a coherent and thematic landscape, sign, and lighting plan. In general, the will result in a core of facilities surrounded by a parking area. The core of facilities will be divided into two general areas: a Park (Open Space) area and Campus (buildings) area.

Lead Agency Contact

Name	Becky Bailey-Findley		
Agency	32 District Agriculture Association		
Phone	714-708-3247	**Fax**	
email			
Address	88 Fair Drive		
City	Costa Mesa	**State** CA **Zip** 92626	

Project Location

County	Orange		
City	Costa Mesa		
Region			
Cross Streets	Fair Drive, Newport Boulevard, Fairview Drive		
Parcel No.			
Township	**Range**	**Section**	**Base**

Proximity to:

Highways	SR 55
Airports	
Railways	
Waterways	
Schools	
Land Use	Fairgrounds

Project Issues	Air Quality; Water Quality; Traffic/Circulation; Aesthetic/Visual; Other Issues
Reviewing Agencies	Resources Agency; Department of Conservation; Office of Historic Preservation; Department of Parks and Recreation; Department of Fish and Game, Region 5; Native American Heritage Commission; State Lands Commission; Caltrans, District 12; California Highway Patrol; Air Resources Board, Major Industrial Projects; Regional Water Quality Control Board, Region 8

Date Received 05/31/2002 **Start of Review** 05/31/2002 **End of Review** 07/01/2002

Note: Blanks in data fields result from insufficient information provided by lead agency.

Jun. 06 2002 10:02AM P3 FAX NO. :714 708 1513 2PM :ORANGE COUNTY FAIR

FROM :ORANGE COUNTY FAIR FAX NO. :714 708 1513 Jun. 06 2002 10:02AM P4

NOI Distribution List

County: Orange SCH# 1985041008

Resources Agency

- [■] Resources Agency — Nadell Gayou
- [ ] Dept. of Boating & Waterways — Bill Curry
- [ ] California Coastal Commission — Elizabeth A. Fuchs
- [X] Dept. of Conservation — Roseanne Taylor
- [ ] Dept. of Forestry & Fire Protection — Allen Robertson
- [X] Office of Historic Preservation — Hans Kreutzberg
- [■] Dept of Parks & Recreation — B. Noah Tilghman, Environmental Stewardship Section
- [ ] Reclamation Board — Pam Bruner
- [ ] S.F. Bay Conservation & Dev't. Comm. — Steve McAdam
- [ ] Dept. of Water Resources — Resources Agency, Nadell Gayou

Health & Welfare

- [ ] Health & Welfare — Wayne Hubbard, Dept. of Health/Drinking Water

Food & Agriculture

- [ ] Food & Agriculture — Steve Shaffer, Dept. of Food and Agriculture

Fish and Game

- [ ] Dept. of Fish & Game — Scott Flint, Environmental Services Division
- [ ] Dept. of Fish & Game 1 — Donald Koch, Region 1
- [ ] Dept. of Fish & Game 2 — Banky Curtis, Region 2
- [ ] Dept. of Fish & Game 3 — Robert Floerke, Region 3
- [ ] Dept. of Fish & Game 4 — William Laudermilk, Region 4
- [■] Dept. of Fish & Game 5 — Don Chadwick, Region 5, Habitat Conservation Program
- [ ] Dept. of Fish & Game 6 — Gabrina Gatchel, Region 6, Habitat Conservation Program
- [ ] Dept. of Fish & Game 6 I/M — Tammy Allen, Region 6, Inyo/Mono, Habitat Conservation Program
- [ ] Dept. of Fish & Game M — Tom Napoli, Marine Region

Independent Commissions

- [ ] California Energy Commission — Environmental Office
- [■] Native American Heritage Comm. — Debbie Treadway
- [ ] Public Utilities Commission — Ken Lewis
- [■] State Lands Commission — Betty Silva
- [ ] Governor's Office of Planning & Research — State Clearinghouse Planner
- [ ] Colorado River Board — Gerald R. Zimmerman
- [ ] Tahoe Regional Planning Agency (TRPA) — Lyn Barnett
- [ ] Office of Emergency Services — John Rowden, Manager
- [ ] Delta Protection Commission — Debby Eddy
- [ ] Santa Monica Mountains Conservancy — Paul Edelman

Dept. of Transportation

- [ ] Dept. of Transportation 1 — IGR/Planning, District 1
- [ ] Dept. of Transportation 2 — Vicki Roe, Local, Development Review, District 2
- [ ] Dept. of Transportation 3 — Jeff Pulverman, District 3
- [ ] Dept. of Transportation 4 — Jean Finney, District 4
- [ ] Dept. of Transportation 5 — James Kilmer, District 5
- [ ] Dept. of Transportation 6 — Marc Birnbaum, District 6
- [ ] Dept. of Transportation 7 — Stephen J. Buswell, District 7
- [ ] Dept. of Transportation 8 — Mike Sim, District 8
- [ ] Dept. of Transportation 9 — Colleen O'Brien, District 9
- [ ] Dept. of Transportation 10 — Chris Sayre, District 10
- [ ] Dept. of Transportation 11 — Lou Salazar, District 11
- [■] Dept. of Transportation 12 — Aileen Kennedy, District 12

Business, Trans & Housing

- [ ] Housing & Community Development — Cathy Creswell, Housing Policy Division
- [ ] Caltrans - Division of Aeronautics — Sandy Hesnard
- [X] California Highway Patrol — Lt. Julie Page, Office of Special Projects
- [ ] Dept. of Transportation — Ron Helgeson, Caltrans - Planning
- [ ] Dept. of General Services — Robert Sleppy, Environmental Services Section

Air Resources Board

- [ ] Airport Projects — Jim Lemer
- [ ] Transportation Projects — Kurt Karperos
- [X] Industrial Projects — Mike Tollstrup
- [ ] California Integrated Waste Management Board — Sue O'Leary
- [ ] State Water Resources Control Board — Diana Edwards, Division of Clean Water Programs
- [ ] State Water Re Board — Greg Frantz, Division of Water Qua
- [ ] State Water Resourc Board — Mike Falkenstein, Division of Water Rig
- [ ] Dept. of Toxic Subst CEQA Tracking Cente

Regional Water Quali Board (RWQCB)

- [ ] RWQCB 1 — Cathleen Hudson, North Coast Region (1
- [ ] RWQCB 2 — Environmental Docum Coordinator, San Francisco Bay Re
- [ ] RWQCB 3 — Central Coast Region
- [ ] RWQCB 4 — Jonathan Bishop, Los Angeles Region (
- [ ] RWQCB 5S — Central Valley Region
  - [ ] RWQCB 5F — Central Valley R Fresno Branch O
  - [ ] RWQCB 5R — Central Valley Re Redding Branch
- [ ] RWQCB 6 — Lahontan Region (6)
  - [ ] RWQCB 6V — Lahontan Region Victorville Branch
- [ ] RWQCB 7 — Colorado River Basin
- [X] RWQCB 8 — Santa Ana Region (8)
- [ ] RWQCB 9 — San Diego Region (9)

South Coast
Air Quality Management District
21865 E. Copley Drive, Diamond Bar, CA 91765-4182
(909) 396-2000 • http://www.aqmd.gov

June 4, 2002

Ms. Becky Bailey-Findley, CEO
Orange County Fair and Exposition Center
32 District Agriculture Association
88 Fair Drive
Costa Mesa, CA 92626

RECEIVED
JUN 20 2002

Dear Ms. Bailey-Findley:

Notice of Preparation of a Draft Environmental Impact Report for Orange County Fair and Exposition Center Master Plan

The South Coast Air Quality Management District (AQMD) appreciates the opportunity to comment on the above-mentioned document. The AQMD's comments are recommendations regarding the analysis of potential air quality impacts from the proposed project that should be included in the Draft Environmental Impact Report (EIR).

Air Quality Analysis

The AQMD adopted its California Environmental Quality Act (CEQA) Air Quality Handbook in 1993 to assist other public agencies with the preparation of air quality analyses. The AQMD recommends that the Lead Agency use this Handbook as guidance when preparing its air quality analysis. Copies of the Handbook are available from the AQMD's Subscription Services Department by calling (909) 396-3720.

The Lead Agency should identify any potential adverse air quality impacts that could occur from all phases of the project and all air pollutant sources related to the project. Air quality impacts from both construction and operations should be considered. Construction-related air quality impacts typically include, but are not limited to, emissions from the use of heavy-duty equipment from grading, earth-loading/unloading, paving, architectural coatings, off-road mobile sources (e.g., heavy-duty construction equipment) and on-road mobile sources (e.g., construction worker vehicle trips, material transport trips). Operation-related air quality impacts may include, but are not limited to, emissions from stationary sources (e.g., boilers), area sources (e.g., solvents and coatings), and vehicular trips (e.g., on- and off-road tailpipe emissions and entrained dust). Air quality impacts from indirect sources, that is, sources that generate or attract vehicular trips should be included in the evaluation. An analysis of all toxic air contaminant impacts due to the decommissioning or use of equipment potentially generating such air pollutants should also be included.

Mitigation Measures

In the event that the project generates significant adverse air quality impacts, CEQA requires that all feasible mitigation measures be utilized during project construction and operation to minimize or eliminate significant adverse air quality impacts. To assist the Lead Agency with identifying possible mitigation measures for the project, please refer to Chapter 11 of the AQMD CEQA Air Quality Handbook for sample air quality mitigation measures. Additionally, AQMD's Rule 403 – Fugitive Dust, and the Implementation Handbook contain numerous measures for controlling construction-related emissions that should be considered for use as CEQA mitigation if not otherwise required. Pursuant to state CEQA Guidelines §15126.4 (a)(1)(D), any impacts resulting from mitigation measures must also be discussed.

Data Sources

AQMD rules and relevant air quality reports and data are available by calling the AQMD's Public Information Center at (909) 396-2039. Much of the information available through the Public Information Center is also available via the AQMD's World Wide Web Homepage (http://www.aqmd.gov).

The AQMD is willing to work with the Lead Agency to ensure that project-related emissions are accurately identified, categorized, and evaluated. Please call Dr. Charles Blankson, Transportation Specialist, CEQA Section, at (909) 396-3304 if you have any questions regarding this letter.

Sincerely,

Steve Smith

Steve Smith, Ph.D.
Program Supervisor, CEQA Section
Planning, Rule Development and Area Sources

SS:CB:li

LAC020531-05LI
Control Number

ORANGE COUNTY FIRE AUTHORITY
P.O. Box 86, Orange, CA 92856-0086 • 145 South Water St., Orange, CA 92866

Chip Prather, Fire Chief *(714) 744-0400*

RECEIVED
JUN 14 2002

June 10, 2002

Orange County Fair and Exposition Center
88 Fair Drive
Costa Mesa, CA 92626
Attn: Becky Bailey-Findley, CEO

Re: Notice of Preparation OC Fair and Exposition Center Master Plan

Dear Ms. Bailey-Findley:

Thank you for the opportunity to comment on the Notice of Preparation for the Fair and Exposition Center Master Plan. In response to our review, we concur with the findings that no negative impacts will result with the proposed changes to the facilities and services provided to the facilities. As I am sure you are aware, the facility is protected primarily through the use of automatic aid units from the city of Costa Mesa. Please note that all standard conditions and guidelines will be applied, as appropriate in the process, when actual improvements are made. Given the nature of events at the facility, we would recommend the use of installed fire protection systems whenever possible to provide the greatest level of protection to those how use your facility.

If you have any additional questions or concerns regarding this project, please contact my officer at (714) 744-0484 or at genebegnell@ocfa.org.

Sincerely,

Gene F. Begnell
Battalion Chief, Strategic Services

Pc: Costa Mesa Fire Department

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-4082
(916) 657-5390 - Fax

June 12, 2002

Becky Bailey-Findley
32 District Agriculture Association
88 Fair Drive
Costa Mesa, CA 92626

RE: SCH# 1989010088 – Orange County Fair and Exposition Center Update

Dear Ms. Bailey-Findley:

The Native American Heritage Commission has reviewed the Notice of Preparation (NOP) regarding the above project. To adequately assess and mitigate project-related impacts on archaeological resources, the Commission recommends the following actions be required:

- ✓ Contact the appropriate Information Center for a record search. The record search will determine:
  - If a part or all of the area of project effect (APE) has been previously surveyed for cultural resources.
  - If any known cultural resources have already been recorded on or adjacent to the APE.
  - If the probability is low, moderate, or high that cultural resources are located in the APE.
  - If a survey is required to determine whether previously unrecorded cultural resources are present.
- ✓ If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
  - The final report containing site forms, site significance, and mitigation measurers should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for pubic disclosure.
  - The final written report should be submitted within 3 months after work has been completed to the appropriate regional archaeological Information Center.
- ✓ Contact the Native American Heritage Commission for:
  - A Sacred Lands File Check.
  - A list of appropriate Native American Contacts for consultation concerning the project site and to assist in the mitigation measures.
- ✓ Lack of surface evidence of archeological resources does not preclude their subsurface existence.
  - Lead agencies should include in their mitigation plan provisions for the identification and evaluation of accidentally discovered archeological resources, per California Environmental Quality Act (CEQA) §15064.5 (f). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American, with knowledge in cultural resources, should monitor all ground-disturbing activities.
  - Lead agencies should include in their mitigation plan provisions for the disposition of recovered artifacts, in consultation with culturally affiliated Native Americans.
  - Lead agencies should include provisions for discovery of Native American human remains in their mitigation plan. Health and Safety Code §7050.5, CEQA §15064.5 (e), and Public Resources Code §5097.98 mandates the process to be followed in the event of an accidental discovery of any human remains in a location other than a dedicated cemetery.

Sincerely,

Rob Wood
Environmental Specialist III
(916) 653-4040

CC: State Clearinghouse

Community Development Department

City of Irvine, One Civic Center Plaza, P.O. Box 19575, Irvine, California 92623-9575 (949) 724-6000

June 12, 2002

Ms. Becky Bailey-Findley
CEO, Orange County Fair and Exposition Center
32 District Agriculture Association
88 Fair Drive
Costa Mesa, CA 92626

SUBJECT: NOTICE OF PREPARATION OF A DRAFT EIR FOR THE ORANGE COUNTY FAIR AND EXPOSITION CENTER MASTER PLAN

Dear Ms. Bailey-Findley:

The City of Irvine has received and reviewed the information on the above referenced project. Based on our review, Planning Services staff has no specific comments at this time.

Please provide a copy of the completed DEIR for the Master Plan to the City of Irvine when it becomes available for our subsequent review.

Thank you for the opportunity to review the project. We would appreciate information on any change in the project description as the planning process proceeds. If you have any questions, please contact me at (949) 724-6546.

Sincerely,

AMY URCIS
Associate Planner

cc: Leslie Aranda, Principal Planner

My Documents\AU\IAR-OCFairNOP.ltr

SOUTHERN CALIFORNIA

ASSOCIATION of GOVERNMENTS

Main Office

818 West Seventh Street

12th Floor

Los Angeles, California

90017-3435

t (213) 236-1800

f (213) 236-1825

www.scag.ca.gov

Officers: President: Councilmember Hal Bernson, Los Angeles • First Vice President: Mayor Pro Tem Bev Perry, Brea • Second Vice President: Supervisor Charles Smith, Orange County • Immediate Past President: Supervisor Jon Mikels, San Bernardino County

Imperial County: Hank Kuiper, Imperial County • Jo Shields, Brawley

Los Angeles County: Yvonne Brathwaite Burke, Los Angeles County • Zev Yaroslavsky, Los Angeles County • Melanie Andrews, Compton • Harry Baldwin, San Gabriel • Bruce Barrows, Cerritos • George Bass, Bell • Hal Bernson, Los Angeles • Ken Blackwood, Lomita • Robert Bruesch, Rosemead • Gene Daniels, Paramount • Ruth Galanter, Los Angeles • Eric Garcetti, Los Angeles • Wendy Greuel, Los Angeles • James Hahn, Los Angeles • Janice Hahn, Los Angeles • Nate Holden, Los Angeles • Sandra Jacobs, El Segundo • Tom LaBonge, Los Angeles • Bonnie Lowenthal, Long Beach • Lawrence Kirkley, Inglewood • Keith McCarthy, Downey • Cindy Miscikowski, Los Angeles • Pam O'Connor, Santa Monica • Nick Pacheco, Los Angeles • Alex Padilla, Los Angeles • Jan Perry, Los Angeles • Beatrice Proo, Pico Rivera • Mark Ridley-Thomas, Los Angeles • Ed Reyes, Los Angeles • Karen Rosenthal, Claremont • Dick Stanford, Azusa • Tom Sykes, Walnut • Paul Talbot, Alhambra • Sidney Tyler, Jr., Pasadena • Dennis Washburn, Calabasas • Jack Weiss, Los Angeles • Bob Yousefian, Glendale • Dennis P. Zine, Los Angeles

Orange County: Charles Smith, Orange County • Ron Bates, Los Alamitos • Ralph Bauer, Huntington Beach • Art Brown, Buena Park • Lou Bone, Tustin • Elizabeth Cowan, Costa Mesa • Cathryn DeYoung, Laguna Niguel • Richard Dixon, Lake Forest • Alta Duke, La Palma • Shirley McCracken, Anaheim • Bev Perry, Brea • Tod Ridgeway, Newport Beach

Riverside County: Bob Buster, Riverside County • Ron Loveridge, Riverside • Greg Pettis, Cathedral City • Ron Roberts, Temecula • Jan Rudman, Corona • Charles White, Moreno Valley

San Bernardino County: Jon Mikels, San Bernardino County • Bill Alexander, Rancho Cucamonga • Lee Ann Garcia, Grand Terrace • Bob Hunter, Victorville • Susan Lien, San Bernardino • Gary Ovitt, Ontario • Debra Robertson, Rialto

Ventura County: Judy Mikels, Ventura County • Glen Becerra, Simi Valley • Carl Morehouse, San Buenaventura • Toni Young, Port Hueneme

Riverside County Transportation Commission: Robin Lowe, Hemet

Ventura County Transportation Commission: Bill Davis, Simi Valley

June 20, 2002

Ms. Becky Bailey-Findley, CEO
32 District Agriculture Association
88 Fair Drive
Costa Mesa, CA 92626

RE: SCAG Clearinghouse No. I 20020293 Orange County Fair and Exposition Center Master Plan

Dear Ms. Bailey-Findley:

Thank you for submitting the **Orange County Fair and Exposition Center Master Plan** to SCAG for review and comment. As areawide clearinghouse for regionally significant projects, SCAG reviews the consistency of local plans, projects and programs with regional plans. This activity is based on SCAG's responsibilities as a regional planning organization pursuant to state and federal laws and regulations. Guidance provided by these reviews is intended to assist local agencies and project sponsors to take actions that contribute to the attainment of regional goals and policies.

We have reviewed the **Orange County Fair and Exposition Center Master Plan**, and have determined that the proposed Project is not regionally significant per SCAG Intergovernmental Review (IGR) Criteria and California Environmental Quality Act (CEQA) Guidelines (Section 15206). Therefore, the proposed Project does not warrant comments at this time. Should there be a change in the scope of the proposed Project, we would appreciate the opportunity to review and comment at that time.

A description of the proposed Project was published in SCAG's **June 1, 2002** Intergovernmental Review Clearinghouse Report for public review and comment.

The project title and SCAG Clearinghouse number should be used in all correspondence with SCAG concerning this Project. Correspondence should be sent to the attention of the Clearinghouse Coordinator. If you have any questions, please contact me at (213) 236-1867. Thank you.

Sincerely,

JEFFREY M. SMITH, AICP
Senior Regional Planner
Intergovernmental Review

City of Huntington Beach

2000 MAIN STREET CALIFORNIA 92648

DEPARTMENT OF PLANNING

Phone 536-5271
Fax 374-1540
374-1648

June 24, 2002

Becky Bailey-Findley, CEO
Orange County Fair and Exposition Center
88 Fair Drive
Costa Mesa, CA 92626

Subject: Orange County Fair and Exposition Center Notice of Preparation

Dear Ms. Bailey-Findley:

The City of Huntington Beach has reviewed the Notice of Preparation and Initial Study for the proposed changes to the Orange County Fair and Exposition Center. The City of Huntington Beach looks forward to reviewing the draft EIR, specifically the traffic study.

Thank you for the opportunity to comment on the Notice of Preparation.

Sincerely,

Mary Beth Broeren
Principal Planner

STATE OF CALIFORNIA—BUSINESS AND TRANSPORTATION AGENCY GRAY DAVIS, *Governor*

DEPARTMENT OF TRANSPORTATION
DISTRICT 12
3337 Michelson Drive Suite 380
Irvine, CA. 92612-8894

June 26, 2002

Ms. Becky Bailey-Findley
32 District Agriculture Association
88 Fair Drive
Costa Mesa, CA 92626

File: IGR/CEQA
SCH#: 1989010088
Log #: 1080
SR #: 55

Subject: NOP of Draft Environmental Impact Report (DEIR) for the Orange County Fair and Exposition Center Master Plan

Dear Ms. Bailey-Findley,

Thank you for the opportunity to review and comment on **the Notice of Preparation (NOP) of Draft Environmental Impact Report (DEIR) for the Orange County Fair and Exposition Center Master Plan** dated June 4, 2002. The project consists of removing and replacing existing structures, constructing new additional structures, constructing additional parking areas, and establishing a coherent and thematic landscape, sign, and lighting plan. In general, the project will result in a core of facilities surrounded by a parking area. The core of facilities will be divided into two general areas – a Park (open space) area and Campus (buildings) area. The project is located in central Costa Mesa, on the north side of Fair Drive, between Newport Boulevard to the east and Fairview Drive to the west. Arlington Drive is located along the site's north boundary. Regional access is provided to the site by State Route 55 to the north and east.

Caltrans District 12 status is a review agency on this project, and has the following comments:

1. In the Initial Study Checklist, *Section X., Potential Environmental Effects/Issues, Part D., E., and F., Transportation/Circulation*, a traffic and circulation study is discussed. Please note that the environmental document needs to examine how the project will impact State Transportation Facilities, as well as planned changes to State Facilities.

2. If any project work (e.g. storage of materials, street widening, emergency access improvements, sewer connections, sound walls, stormdrain construction, street connections, etc.) occurs in the vicinity of the Caltrans Right-of-Way, an encroachment permit would be required and environmental concerns must be adequately addressed. If the environmental documentation for the project does not meet Caltrans requirements, additional documentation (e.g. Native American Heritage Commission consultation for cultural resources) would be required before approval of the encroachment permit. Please coordinate with Caltrans to meet requirements for any work within or near Caltrans Right-of-Way. **(See Attachment: *Environmental Review Requirements for Encroachment Permits*)**

3. All work within the State Right of Way must conform to Caltrans Standard Plans and Standard Specifications for Water Pollution Control, including production of a Water Pollution Control Program (WPCP) or Storm Water Pollution Prevention Plan (SWPPP) as required. Any runoff draining into Caltrans Right of Way from construction operations, or from the resulting project, cannot be approved

by District 12 Environmental Planning. Measures must be incorporated to contain all vehicle loads and avoid any tracking of materials, which may fall or blow onto Caltrans roadways or facilities. **(See Attachment: *Water Pollution Control Provisions)***

Please continue to keep us informed of this project and other future developments, which could potentially impact the transportation facilities. If you have any questions or need to contact us, please do not hesitate to call Lan Zhou at (949) 756-7827.

Sincerely,

Robert F. Joseph, Chief
Advanced Planning Branch

Attachements

c: Terry Roberts, Office of Planning and Research
Ron Helgeson, Caltrans HQ IGR/Community Planning
Leslie Manderscheid, Environmental Planning
Saied Hashemi, Traffic Operations

ENVIRONMENTAL REVIEW REQUIREMENTS FOR ENCROACHMENT PERMITS

Any Party, outside of Caltrans, that does work on a State Highway or Interstate Highway in California needs to apply for an encroachment permit. To acquire any encroachment permit, environmental concerns must be addressed. Environmental review of encroachment permit applications may take 3 weeks if the application is complete or longer if the application is incomplete. For soil disturbing activities (e.g. geotechnical borings, grading, usage of unpaved roads from which dirt and other materials may be tracked onto the State/Interstate highways, etc.), compliance with Water Quality and Cultural Resources Provisions are emphasized. Surveys may/ may not be soil-disturbing activities, depending on the site and survey method.

A complete application for environmental review includes the following:

1. If an environmental document (CE, EIR/EIS, ND, etc.) has been completed for the project, copy of the final, approved document must be submitted with the application.

2. **Water Quality Provision:** All work within the State Right of Way must conform to Caltrans Standard Plans and Standard Specifications for Water Pollution Control including production of a Water Pollution Control Program or Storm Water Pollution Prevention Plan as required. The applicant must provide Encroachments with a copy of the Storm Water Pollution Prevention Plan (SWPPP) including Best Management Practices (BMPs) to be implemented for construction activities impacting Caltrans Right of Way, prepared for this as required by the NPDES Statewide Storm Water Permit for General Construction Activities. If no SWPPP has been prepared for this project, then the applicant must follow the requirements described in the attached Water Pollution Control Provisions (please see attachment).

3. **Cultural Resources Provisions:** If not included in the environmental document, before permit approval and project construction, the encroachment permit applicant must complete a *Cultural Resource Assessment* pursuant to Caltrans Environmental Handbook, Volume 2, Appendix B-1, and Exhibit 1, as amended. The Cultural Resources Assessment ascertains the presence or absence of cultural resources within a one-mile radius of the project area and evaluates the impact to any historical/cultural resource. Cultural Resources include "those resources significant in American history, architecture, archaeology, and culture, including Native American Resources" (Caltrans Environmental Handbook, Volume 2, Chapter1, as amended)]. The Cultural Resource Assessment must include:
   a) a clear project description and map indicating project work, staging areas, site access, etc.;
   b) a Record Search conducted at the South Central Coastal Information Center (SCCIC) located at California State University, Fullerton. For information call (714) 278-5395;
   c) proof of Native American consultation. Consultation involves contacting the Native American Heritage Commission (NAHC), requesting a search of their Sacred Lands File, and following the recommendations provided by the NAHC. For information call (916) 653-4082;
   d) documentation of any historic properties (e.g. prehistoric and historic sites, buildings, structures, objects, or districts listed on, eligible for, or potentially eligible for listing on the National Register of Historic Places) within a one mile radius of the project area;
   e) and a survey by qualified archaeologist for all areas that have not been previously researched.

   The SCCIC and NAHC have an approximate turn around time of 2 weeks.

4. **Biological Resources Provisions:** Work conducted within Caltrans Right of Way should have the appropriate plant and wildlife surveys completed by a qualified biologist. If the information is not included in the environmental document, Environmental Planning requests that the applicant submit a copy of the biological study, survey, or technical report by a qualified biologist that provides details on the existing vegetation and wildlife at the project site and any vegetation that is to be removed during project activities. Official lists and databases should also be consulted for sensitive species such as the California Natural Diversity Database and lists provided by the U.S. Fish and Wildlife Service and the California Department of Fish and Game. Any impacts that affect waterways and drainages and/or open space during construction, or that occur indirectly as a result of the project must be coordinated with the appropriate resource agencies. As guidance, we ask that the applicant include:
   a) clear description of project activities and the project site
   b) completed environmental significance checklist (not just yes and no answers, but a description should be given as to the reason for the response),
   c) staging/storage areas noted on project plans,
   d) proposed time of year for work and duration of activities (with information available),
   e) any proposed mitigation (if applicable to the project),
   f) and a record of any prior resource agency correspondence (if applicable to the project).

ATTACHMENT
CALTRANS DISTRICT 12

WATER POLLUTION CONTROL PROVISIONS

Any runoff draining into Caltrans Right of Way must fully conform to the current discharge requirements of the Regional Water Quality Control Board (RWQCB) to avoid impacting water quality. Permittee shall fully conform to the requirements of the Caltrans Statewide National Pollutant Discharge Elimination System (NPDES) Storm Water Permit, Order No. 99-06-DWQ, NPDES No. CAS000003, adopted by the State Water Resources Control Board (SWRCB) on July 15, 1999, in addition to the BMPs specified in the Caltrans Storm Water Management Plan (SWMP). When applicable, the Permittee will also conform to the requirements of the General NPDES Permit for Construction Activities, Order No. 99-08-DWQ, NPDES No. CAS000002, and any subsequent General Permit in effect at the time of issuance of this Encroachment Permit. These permits regulate storm water and non-storm water discharges associated with year-round construction activities.

Please note that project activities should pay extra attention to storm water pollution control during the "Rainy Season" (October 1st – May 1st) and follow the Water Pollution Control BMPs to minimize impact to receiving waters. Measures must be incorporated to contain all vehicle loads and avoid any tracking of materials, which may fall or blow onto Caltrans Right of Way.

For all projects resulting in 2 hectares (5 acres) or more of soil disturbance or otherwise subject to the NPDES program, the Contractor will develop, implement, and maintain a Storm Water Pollution Prevention Plan (SWPPP) conforming to the requirements of the Caltrans Specification Section 7-1.01G "Water Pollution Control", Caltrans Statewide NPDES Permit, the General NPDES Permit for Construction Activities, and the Caltrans Storm Water Quality Handbooks "Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual", and "Construction Site Best Management Practices (BMPs) Manual" effective November 2000, and subsequent revisions. In addition, the SWPPP must conform to the requirements of the SWRCB Resolution No. 2001-046, the Sampling and Analytical Procedures (SAP) Plan.

For all projects resulting in less than 2 hectares (5 acres) of soil disturbance or not otherwise subject to the requirements of the NPDES program, the Contractor will develop, implement, and maintain a Water Pollution Control Program (WPCP) conforming to the requirements of Caltrans Specifications Section 7-1-.01G, "Water Pollution Control", and the Caltrans Storm Water Quality Handbooks "Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual", and "Construction Site Best Management Practices (BMPs) Manual" effective November 2000, and subsequent revisions.

Copies of the Permits and the Construction Contractor's Guide and Specifications of the Caltrans Storm Water Quality Handbook may be obtained from the Department of Transportation, Material Operations Branch, Publication Distribution Unit, 1900 Royal Oaks Drive, Sacramento, California 95815, Telephone: (916) 445-3520. Copies of the Permits and Handbook are also available for review at Caltrans District 12, 3347 Michelson Drive, Suite 100, Irvine, California 92612, Telephone: (949) 724-2260. Electronic copies can be found at http://www.dot.ca.gov/hq/construc/stormwater.html

CITY OF NEWPORT BEACH

P.O. BOX 1768, NEWPORT BEACH, CA 92659-1768

RECEIVED
JUL - 1 2002

June 26, 2002

Becky Bailey-Findley,CEO
Orange County Fair and Exposition Center
32nd District Agriculture Association
88 Fair Drive
Costa Mesa, CA 92626

RE: NOTICE OF PREPARATION: ORANGE COUNTY FAIR AND EXPOSITION CENTER MASTER PLAN

Dear Ms. Bailey-Findley:

Thank you for the opportunity to respond to the Notice of Preparation (NOP) for the Draft Environmental Impact Report relating to the pending Fairgrounds Master Plan. After reviewing the initial study and the specific components of the project, the City of Newport Beach does not have any comments regarding the potential environmental impacts resulting from the proposed plan at this time.

As an aside to the NOP, the City's of Costa Mesa and Newport Beach have recently joined forces in an effort to address the growing need for a skateboard park in the area. The Fairgrounds site has been identified as an ideal location for such a facility. It is possible that if the Fairgrounds were interested in reserving space and allowing the development of a skateboard park, Newport Beach could assist with construction costs. Costa Mesa might be willing to do the same.

Please give me a call so that we can discuss the inclusion of a skateboard park in the proposed Master Plan. My phone number is (949) 644 - 3238.

Best wishes,

Tamara J. Campbell

Tamara J. Campbell, AICP
Senior Planner
City of Newport Beach

CITY OF COSTA MESA

P.O. BOX 1200 • 77 FAIR DRIVE • CALIFORNIA 92628-1200

DEVELOPMENT SERVICES DEPARTMENT

June 28, 2002

Ms. Becky Bailey-Findley, CEO
Orange County Fair and Exposition Center
88 Fair Drive
Costa Mesa CA 92626

Subject: **ORANGE COUNTY FAIR AND EXPOSITION CENTER MASTER PLAN NOTICE OF PREPARATION**

Dear Ms. Bailey-Findley,

Thank you for the opportunity to review the Orange County Fair and Exposition Center Master Plan Notice of Preparation. The City's comments are attached to this letter for review and use in the preparation of the Draft Environmental Impact Report (EIR). These include comments from the Planning Division, Transportation Services Division, Police Department, and Fire Department.

All future correspondence regarding the Master Plan EIR should be addressed to me. I will be responsible for coordinating the distribution of these correspondences, as appropriate.

I look forward to receiving the Draft EIR, and I hereby request that the City be given 4 copies of the EIR (including the technical appendices) to expedite our review.

Sincerely,

Kimberly Brandt

KIMBERLY BRANDT
Senior Planner

cc: City Council
Allan Roeder, City Manager
Jerry Scheer, City Attorney
Don Lamm, Deputy City Mgr.- Dev. Svs. Director
Perry Valantine, Assistant Development Svs. Director
Mike Robinson, Planning and Redevelopment Mgr.
Bill Morris, Public Services Director
Peter Naghavi, Transportation Services Manager
David Snowden, Police Chief
Sue Hupp, Crime Prevention Specialist
Jim Ellis, Fire Chief
Tom Macduff, Fire Marshal

City of Costa Mesa's Comments to the
OCFEC Master Plan Notice of Preparation

III. Surrounding Land Uses: Please include the Costa Mesa Civic Center and correct spelling in Figure 2.

IV. Proposed Project Description: Please discuss existing use of the Fairgrounds during the weekdays including the Farmers' Market on Thursday. The EIR should include statistics on the increase in weekday use of the parking lots for miscellaneous commercial uses such as used automobile sales and vehicle road testing/ driving schools.

Please include in the EIR complete background information on the Pacific Amphitheater.

Please include in the description the amount of on-site landscaping, both existing and proposed.

Please delineate in Tables A and B how many acres are devoted to parking areas.

Please clarify Table C; it is confusing as it is currently drafted. For instance what does the total of "201,359" refer to?

Please discuss any proposed changes to fairgrounds activities. Will there be more exhibitions throughout the year, potential attendance at exhibit halls, usage of amphitheater, etc.

V. Discretionary Actions: The NOP refers to "land use guidelines"; what is the intended use of these guidelines?

VI. Lead, Responsible, and Trustee Agencies. This sections states that there are no responsible agencies for this project. Yet in the following section, it is stated that the NOP was sent to Responsible Agencies. Please clarify this discrepancy.

X. Potential Environmental Effects/Issues

Sections D and E should be listed as a **Potential Significant Effect** It is premature to conclude that the project's transportation impacts will be less than significant, prior to the completion of the Draft EIR. Additionally, the City of Costa Mesa level of service thresholds and policies should be used for the determination of adverse impacts.

Other traffic-related issues include truck haul routes, and impacts on the City's Police Department for traffic control.

The EIR should include a Traffic Management Plan to ensure all impacts are identified and mitigated. It is expected that the project will result in additional traffic being generated to the area impacting several intersections throughout the City. These impacts should be evaluated and addressed in detail for fairgrounds activity during the Orange County Fair (fair time) and during the regular periods of the year (non-fair time).

The EIR should also compare the traffic projections for the project to the assumptions in the City's traffic model for the project site.

Section F. Again, the City believes it is premature to find the parking impacts to be "less that significant" prior to the completion of the Draft EIR. Section F should be listed as a "**Potentially Significant Effect**" The EIR should address in detail the parking demand for the proposed project.

Sections G and H: The air quality analysis should include construction grading mitigation measures including hours of construction/grading and dust mitigation.

Sections I and J. Again, it is premature to find noise impacts to be less than significant at this time. The noise analysis should use the Costa Mesa Noise Ordinance and 2000 General Plan for thresholds and the determination of adverse impacts. In addition, any other noise thresholds established during the historic litigation related to the amphitheater should be applied, where appropriate. The City believes that the amphitheater earthen berm provides noise mitigation. Therefore, the noise analysis should address noise impacts on surrounding area from the amphitheater with and without the berm.

Biological Resources. The Initial Study has dismissed potential impacts to Biological Resources as a result of the project; the City disagrees with this conclusion. The project includes removal of the earthen berm, which contains mature trees; therefore, the EIR should include a biological survey of the fairgrounds and discuss potential impacts to wildlife habitat and nesting sites. Additionally, older City records indicate the previous location/siting of burrowing owls on the Fairgrounds property. The site should once again be surveyed for burrowing owls.

Sections K and L. The EIR should include a photometric plan. In addition to view simulations and lighting impacts analysis, the EIR should also address the visual impacts of the Fairground signage. The Fairgrounds Master Plan should include a comprehensive sign program for the entire property and a perimeter landscape plan.

Section M. The EIR should address impacts to the Police Department in respect to traffic control and protection services. Increased demand for fire and medical responses should also be addressed. (It should be noted that there is an area sheltered by landscaping between the chain link fence and Newport Boulevard. The existing landscaping is over 6 feet high and creates a haven between the chain link fence and the street for transients. The landscape concept plan should replace this landscaping.)

County of Orange
Planning & Development Services Department

THOMAS B. MATHEWS
DIRECTOR

300 N. FLOWER ST.
SANTA ANA, CALIFORNIA

MAILING ADDRESS:
P.O. BOX 4048
SANTA ANA, CA 92702-4048

NCL 02-63

June 27, 2002

Becky Bailey-Findley, CEO
Orange County Fair and Exposition Center
88 Fair Drive
Costa Mesa, CA 92626

SUBJECT: NOP for the Orange County Fair and Exposition Center Master Plan

Dear Ms. Bailey-Findley:

The above referenced item is a Notice of Preparation (NOP) of a Draft Environmental Impact Report (DEIR) for the Orange County Fair and Exposition Center. The project site is located in central Costa Mesa, on the north side of Fair Drive, between Newport Boulevard (southbound) to the east and Fairview Drive to the west. The proposed project involves removing and replacing existing structures, constructing new additional structures, constructing additional parking areas, and establishing a coherent and thematic landscape, sign, and lighting plan. In general, the project will result in a core of facilities surrounded by a parking area.

The County of Orange has reviewed the NOP and offers the following comments:

FLOOD

1. The proposed project is for the adoption of a Master Plan for a series of actions, programs and guidelines for the future redevelopment of portions of the fairgrounds at the Orange County Fair & Exposition Center (OCFEC). Project site is tributary indirectly to the Orange County Flood Control District (OCFCD) facility Paularino Channel (F03). The potential for adversely impacting the OCFCD facility should be identified and appropriate mitigation proposed in the DEIR. Hydrologic and hydraulic studies should be conducted to assess the existing channel capacities and water quality issues.

2. Please note that the surface runoff at Paularino Channel drains indirectly to the Upper Newport Bay, which is identified by the Santa Ana Regional Water Quality Control Board (RWQCB) for water quality problems for sediments, nutrients pathogens, etc. The post project runoff from the project implementation should be analyzed, both

qualitatively and quantitatively, to ensure that it meets the limits of the Total Maximum Daily Loads (TMDLs) established by the Regional Board. Please be aware that a Watershed Reconnaissance Study for Newport Bay has been completed by the U.S. Army Corps of Engineers to assist in the restoration of the system. We suggest Chris Crompton, Manager of Environmental Resources be consulted on all water quality related issues. Mr. Crompton may be reached at (714) 567-6360.

OPEN SPACE/RECREATION

Class I (paved off-road) Bikeways:

3. The DEIR should contain the following information:

   a. Bikeways are mitigation measures to help reduce air pollution, traffic congestion, parking congestion, and noise. Class I bikeways in particular, because they are off-road and suitable for bicyclists and pedestrians with a wide range of ages and abilities, serve to encourage bicycling and walking as alternative modes of transportation and recreation.

   b. A portion of the Orange County Fair employees and visitors would be expected to walk or bicycle to the project site, especially if off-road bikeways were available. Currently a Class I bikeway exists along the south and east sides of the project site. Furthermore, the project site is located only about 2 miles from the Santa Ana River Bikeway, a regional Class I bikeway that extends from the Riverside County border to the Pacific Ocean.

4. Recommendations: We recommend the following mitigation measures to encourage bicycling and walking to the project site:

   a. Continue the Class I bikeway around the entire perimeter of the project site, and include landscaping with shade trees.

   b. Support the City's ongoing effort to implement Class I bikeways between the project site and the Santa Ana River Bikeway.

   c. Install bike racks and/or lockers near all Fair entrances and other appropriate areas throughout the site.

   d. Design entrances to incorporate easy access for bicyclists, including off-road connections between the perimeters Class I bikeway and bike racks/lockers.

Regional Riding and Hiking Trail:

5. The DEIR should contain the following information:

a. The County's Master Plan of Regional Riding and Hiking Trails (MPRRHT) identifies the Santa Ana Heights Trail, a regional trail proposed to extend from the project's Equestrian Center to Upper Newport Bay Ecological Preserve. The trail, which is used by mountain bicyclists, hikers, and equestrians, is designed to allow trail users to reach the extensive trail and bikeway network in the Back Bay area.

b. The County is already working with the Santa Ana Heights Project Advisory Committee (PAC) and the OCFCD to extend the trail from the Upper Newport Bay Ecological Preserve to the intersection of Santa Ana Avenue and Mesa Drive, via the Santa Ana Delhi Channel and Santa Ana Avenue. The County will also work with the City of Costa Mesa to continue the trail along Mesa Drive, to the intersection of Mesa Drive and Newport Boulevard.

6. We recommend the DEIR incorporate the following mitigation measures, consistent with the MPRRHT requirement to link the Santa Ana Heights trail to the Orange County Fairgrounds stable facility, as well as special attention given to the trail as it crosses Newport Boulevard:

a. The OCFEC dedicate a recreation easement and/or enter into license agreement for regional riding and hiking trail purposes over the alignment of the Santa Ana Heights Trail (connection to the Equestrian Center, or designated proposed staging area per the MPRRHT), to the County of Orange.

b. OCFEC shall design and construct the portion of the regional trail from the Equestrian Center to the intersection of Newport Boulevard and Mesa Drive, per County regional trail standards. These standards include, but are not limited to, a 10-foot-wide usable trail surface of decomposed granite (DG), 3 feet of shy distance on each side, and horse-height traffic signal buttons at the intersection. HBP suggests the trail be routed along the east edge of the Equestrian Center and proposed Swap Meet area, within a landscaped setback with shade trees.

7. Because the Santa Ana Heights PAC has a strong interest in completing the regional trail, the County requests that subject NOP and subsequent environmental documents be sent to the PAC for its review. For information on the PAC, please contact Mr. Mark Esslinger of the County's Planning and Development Services Department, at (714) 834-5049.

<u>Equestrian Center Resizing:</u>

8. The NOP indicates the future proposed equestrian center to be reduced in size from 500, 900 square feet (11.5 acres), to 330, 000 square feet (7.57 acres). This represents a substantial reduction of 170, 940 square feet (3.92 acres) for the equestrian center. Insofar as this facility boards and trains horses in addition to accommodation of horse shows, the DEIR should provide the following:

a. An impact analysis of the loss of equestrian facilities acreage to recreational equestrian users, including but not limited to the following:

i. An evaluation of the number of existing horses accommodated and the number of horses to be forced to other quarters.

ii. Viable evaluation of alternative venues for equestrian users loosing facilities for horses.

2. Insofar as it appears the proposed project will negatively impact recreational equestrian users, HBP recommends the proposed project be redesigned so as not to reduce the size of the existing equestrian center

HISTORICAL

9. The proposed project description states that the Orange County fair has operated at this location for over 50 years. The DEIR should address potential impacts to any historical structures, buildings or heritage trees that may be removed or replaced as a result of this project.

10. The Orange County Historical Commission would appreciate receiving a copy of the DEIR and any related cultural resources or historic structure reports for their review.

WASTE MANAGEMENT

11. The project, to develop a Master Plan for the O.C. Fair and Exposition Center, which will require redevelopment of a portion of the Fairgrounds, proposes to remove and replace existing structures and construct new structures and additional parking areas. The O.C. Fair, a 17-day event, drew 800,000 people last summer. In addition, events and exhibitions occur each weekend, including the O.C. Marketplace, a swap meet that occupies a portion of the parking lot. These activities and the construction and demolition material that is to be generated by the construction planned will generate significant amounts of waste.

Notwithstanding the availability of Refuse Disposal Capacity in the County system, Orange County recommends that the project developer contact the City's recycling coordinator in Costa Mesa to ensure that the proposed project is in compliance with the city's waste reduction and recycling program. These programs implement state law, which requires that each city and county demonstrate a reduction of at least 50 percent in the amount of waste from that jurisdiction that had gone into landfills in the year 1990. Also, the state requires that this level of reduction be sustained in perpetuity. Waste haulers are expected to contribute by recycling residential and commercial waste they have collected, and project developers are expected to employ measures to reduce the amount of construction-generated waste by 50 percent or more.

In order to understand the solid waste capacity issue for Orange County, it is necessary to distinguish between refuse disposal capacity and flow rate or daily capacity. Refuse disposal capacity refers to the available air space capacity at one or more County landfills. Daily capacity refers to the maximum amount of daily permitted tonnage that may be disposed. The landfill permit establishes these capacities.

Refuse Disposal Capacity: The County of Orange owns and operates three active landfills. These are the Olinda Alpha Landfill near Brea, the Frank R. Bowerman Landfill near Irvine, and the Prima Deshecha Landfill in San Juan Capistrano. The Frank R. Bowerman Landfill is the closest facility to the project, and will likely be the solid waste facility most often receiving the waste from the subject project. Notwithstanding, the City of Costa Mesa is under contract to the County's Integrated Waste Management Department (IWMD) to commit all of its waste to the County landfill system (not to a particular facility) until the year 2007.

The California Integrated Waste Management Board requires that all counties have an approved Countywide Integrated Waste Management Plan (CIWMP). To be approved, the CIWMP must demonstrate sufficient solid waste disposal capacity for at least 15 years, or identify additional available capacity outside of the county's jurisdiction. Orange County's CIWMP, approved in 1996, contains future solid waste disposal demand based on the County population projections previously adopted by the Board of Supervisors. The Orange County landfill system has capacity in excess of 15 years. Consequently, it may be assumed that adequate capacity for the subject project is available for the foreseeable future.

Daily Capacity: In order to ensure that the maximum permitted daily tonnage at a particular site is not exceeded, refuse trucks may have to transport material to one of the other two facilities identified above. Accordingly, your document should address transport of refuse from this project to any of the three active landfills.

At this time, IWMD does not have information on solid waste generation rates in Orange County. Any questions about solid waste generation rates should be forwarded to the California Integrated Waste Management Board in Sacramento.

Thank you for the opportunity to respond to the NOP. Please send one complete set of the DEIR to me at the above address when it becomes available. If you have any questions, please contact Charlotte Harryman at (714) 834-2522.

Sincerely,

for Timothy Neely, Manager
Environmental Planning Services Division

ch

The Gas Company®

A Sempra Energy® utility

Southern California Gas Company
Technical Services Department
1919 S. State College Blvd., Bldg. A
Anaheim CA. 92806

SEP 16 2002

September 9, 2002

Orange County Fair and Exposition Center
88 Fair Drive
Costa Mesa, CA. 92626

Attention: Becky Bailey-Findley

Subject: N.O.P. of a Draft E.I.R. Orange County Fair and Exposition Center Master Plan

Thank you for providing the opportunity to respond to this E.I.R. (Environmental Impact Report) Document. We are pleased to inform you that Southern California Gas Company has facilities in the area where the aforementioned project is proposed. Gas service to the project can be provided from an existing gas main located in various locations. The service will be in accordance with the Company's policies and extension rules on file with the California Public Utilities Commission when the contractual arrangements are made.

This letter is not a contractual commitment to serve the proposed project but is only provided as an informational service. The availability of natural gas service is based upon conditions of gas supply and regulatory agencies. As a public utility, Southern California Gas Company is under the jurisdiction of the California Public Utilities Commission. Our ability to serve can also be affected by actions of federal regulatory agencies. Should these agencies take any action, which affect gas supply or the conditions under which service is available, gas service will be provided in accordance with the revised conditions.

This letter is also provided without considering any conditions or non-utility laws and regulations (such as environmental regulations), which could affect construction of a main and/or service line extension (i.e., if hazardous wastes were encountered in the process of installing the line). The regulations can only be determined around the time contractual arrangements are made and construction has begun.

Estimates of gas usage for residential and non-residential projects are developed on an individual basis and are obtained from the Commercial-Industrial/Residential Market Services Staff by calling (800) 427-2000 (Commercial/Industrial Customers) (800) 427-2200 (Residential Customers). We have developed several programs, which are available upon request to provide assistance in selecting the most energy efficient appliances or systems for a particular project. If you desire further information on any of our energy conservation programs, please contact this office for assistance.

Sincerely,

Carey Downs
Technical Supervisor
West Region-Anaheim

Cc: Nicole Dubois-LSA Associates
dja
eir02.doc

RESPONSES TO QUESTIONNAIRES

RESPONSE SHEET

SEP 17 2002

Orange County Sheriff's Department
North Operations Division
550 North Flower Street
Santa Ana, CA 92703

For your convenience, we have provided space on this questionnaire for your answers. If you choose to answer these questions in a letter form, please number your responses to correspond to the questions. Please fax your responses to (949) 553-8076. Mail originals to: LSA Associates, Inc., Attn: Nicole Dubois, 20 Executive Park, Suite 200, Irvine, CA 92614.

1. What are the locations, types, and capacity of your facilities that service the area, and how near capacity are they now operating?

   This Department does not have a permanent facility on the fairgrounds.

2. What level of service do you presently provide to the project area?

   We provide law enforcement services. We are contracted by the fairgrounds to provide law enforcement services 24/7. In addition, we deploy patrol personnel, over 900 shifts, during the 17-day annual Fair. We also deploy personnel through the year to the weekly marketplace and large events on the fairgrounds.

3. Are there any current plans for expansion of your services or facilities in the area? If yes, please briefly describe.

   SERVICES
   Due to the increased scheduling of major events at the fairgrounds, the request for patrol deputies assigned to major events have increased over the last 12 years. The request for more services may possibly again increase if the Pacific Amphitheater is re-opened.
   FACILITY
   The Department does not have a facility at the fairgounds. During the 17-day annual Fair, we operate from a Command Center Bus and Trailer parked on a lawn near Gate 5.

4. Will the project create a need to expand existing facilities or staff or to construct a new facility, or otherwise adversely impact the types of services you provide? Please explain.

   The expansion project may increase the number of large events that will require direct law enforcement services. With the Fair requiring over 900 shifts and the deployment of personnel for large events, a permanent facility for law enforcement should be considered. This facility could be used as a Command Center and Base of Operations.

5. What standard consumption or generation rates do you use in assessing service demands?

   N/A

6. Can you recommend any measures for mitigating project impacts that might be incorporated into the project?

   None

Prepared by: Lt. Dennis DeMaio

Title: Lieutenant

Date: September 6, 2002

Phone: (714) 647-4559

RESPONSE SHEET

Costa Mesa Fire Department
PO Box 1200
Costa Mesa, CA 92628-1200

SEP 2 3 2002

For your convenience, we have provided space on this questionnaire for your answers. If you choose to answer these questions in a letter form, please number your responses to correspond to the questions. Please fax your responses to (949) 553-8076. Mail originals to: LSA Associates, Inc., Attn: Nicole Dubois, 20 Executive Park, Suite 200, Irvine, CA 92614.

1. What are the locations, types, and capacity of your facilities that service the area, and how near capacity are they now operating?

1) FIRE STATIONS (6)

2) @PRIMARY STATION (VANGUARD/FAIR)
(B) BAKER/CENTURY (F) 3350 SUNFLOWER
(C) ROYAL PALM/ADAMS
(D) 2300 PLACENTIA
(E) 1865 PARK

2. What level of service do you presently provide to the project area?

CURRENTLY WE PROVIDE FIRE/EMS PROTECTION TO THE FAIRGROUNDS

3. Are there any current plans for expansion of your services or facilities in the area? If yes, please briefly describe.

NO, THERE ARE NO CURRENT PLANS

4. Will the project create a need to expand existing facilities or staff or to construct a new facility, or otherwise adversely impact the types of services you provide? Please explain.

NO, THIS PROJECT DOES NOT EFFECT THE FIRE DEPARTMENT.

5. What standard consumption or generation rates do you use in assessing service demands?

NONE

6. Can you recommend any measures for mitigating project impacts that might be incorporated into the project?

(1) LIMIT PROJECT WORK ON WEEKENDS WHEN OC MARKET PLACE IS IN OPERATION. ALSO, DURING THE O.C. FAIR AS TRAFFIC FOR BOTH IS IN LARGE VOLUMES.

Prepared by: FRED SEGUIN

Title: FIRE CAPTAIN "MEB5" C SHIFT

Date: 9/17/02

Phone: (714) 754-5005

Costa Mesa Sanitary District

... an Independent Special District

Board of Directors
Arlene Schafer
Greg Woodside
Art Perry
James Ferryman
Dan Worthington

September 25, 2002

SEP 30 2002

Ms. Becky Bailey-Findley
Chief Executive Officer
Orange County Fair and Exposition Center
88 Fair Drive
Costa Mesa, CA 92626

RE: Orange County Fairgrounds Master Plan

Dear Becky:

Thank you for the opportunity to comment on the proposed master plan for the Fairgrounds. In addition to providing comments on the master plan, this letter will recap the status of various items that relate to sewer service in and around the Fairgrounds.

Existing Sewer Service to the Fairgrounds

In 1990, the Fairgrounds, the Costa Mesa Sanitary District, and the Orange County Sanitation District (then known as County Sanitation Districts of Orange County) entered into a three party agreement whereby the two main sewer lines on Fairgrounds property were transferred from the Orange County Sanitation District (OCSD) to the Fairgrounds. The two sewers were constructed as part of the airbase and because they acted essentially as private on-site sewers the transfer was made. Attached is an exhibit that shows these two sewers. When these sewers leave the Fairgrounds property they tie into public sewers.

There are various other on-site private sewer lines that tie into these two main lines, however, no records exist with either OCSD or CMSD as to the location of these lines. Field personnel from the Fairgrounds may know of their location.

Current Improvement Project for Off-site Public Sewers

As of this date, the westerly public sewer system serving the Fairgrounds is being improved. The improvement consists of a new sewer in Arlington Drive, rehabilitation of the existing sewer through Davis School and Costa Mesa High School, and a new sewer on Costa Mesa High School property flowing to Fairview Road. The sewer improvement is a joint effort between OCSD and the CMSD and upon completion, the system will be transferred to the Costa Mesa Sanitary District in accordance with the concept of having local sewers owned by the local sewer agency. Upon completion, the standard CMSD yearly sewer fees will be due from the Fairgrounds and the fees are based on the square footage of all buildings connected to the system.

Phone
(714) 754-5043

Fax
(714) 432-1436

Mailing Address
P. O. Box 1200
Costa Mesa, CA
92628-1200

Street Address
77 Fair Drive
Costa Mesa, CA
92626-6520

Printed on Recycled Paper

Impact of the Proposed Fairgrounds Master Plan

The two main private sewers leaving the fairgrounds property tie into CMSD sewers and theses CMSD sewers will be receiving flows from the projected master plan development. Based on the layout, size and use of the buildings as shown in the May 2002 Notice of Preparation provided to this office, there are no anticipated negative impacts from the future sewer flows. When the sewer now under construction in Arlington Drive was designed, considerations were given for anticipated maximum and peak flows from the Fairgrounds property. The easterly CMSD sewer also appears adequate to handle the master plan flows, however, there is an unknown crisscross of the on-site sewers so the actual number of present and future master plan connections to the easterly sewer is unknown.

It is requested the Fairgrounds provide a map of the on-site sewers and the present and future buildings that will be served by each line. In general, new sewer connections should be directed to the westerly sewer system.

Existing CMSD Sewers on Fairgrounds Property

In 1995, the CMSD initiated a construction project to upgrade its pressure sewer line force main that traversed the southeast corner of the Fairgrounds property. In cooperation with the City of Costa Mesa and the Fairgrounds, the line was relocated under the bicycle trail from the intersection of Fair Drive and Newport Blvd to the main Fairgrounds entrance and a new concrete bicycle trail constructed over top of the line.

In conjunction with the construction, three easement documents were prepared. They are an easement from the Fairgrounds to the CMSD for the new pressure sewer line, an easement from the Fairgrounds to the City for the bicycle trail for the entire bicycle trail along Fair Drive from Newport Blvd. to Fairview Road, and an easement from the Fairgrounds to the City for the right turn lane from Fair Drive into the Fairgrounds main entrance. This easement was never completed after the construction of the right turn lane was completed in 1986.

Prior to preparation of the three easement documents, discussions were held with Rick Pickering of the Fairgrounds and Gerald Anderson from the State's Sacramento office. The documents were first sent to Mr. Anderson on May 14, 1996, however, no review or comments were returned. The Sanitary District followed up the submittal with many phone calls and the City made phone calls and sent additional copies of the easement documents for comments. Because the Sacramento office has never followed through with any type of response, the documents remain unrecorded.

It is suggested that assistance from the local Fairgrounds administrative office be provided to complete the review and recording process for the easements. Without the recording, there may be some Fairgrounds liabilities because the responsibility for the bicycle trail, sidewalk, and right turn lane have not been transferred to the City.

Table A: Existing Facilities

Amphitheater	351,560 sq. ft. (18,500 seats)
Centennial Farms	168,000 sq. ft.
Festival Grounds/Camping	306,250 sq. ft.
Carnival Lot	318,150 sq. ft.
Exhibit Buildings	
Building 8	12,222 sq. ft.
Building 10	36,000 sq. ft.
Parade of Products (POP)	16,146 sq. ft.
Building 12	22,000 sq. ft.
Silo	2,730 sq. ft.
Barn	5,190 sq. ft.
Building 17	11,040 sq. ft.
Building 16	13,969 sq. ft.
Building 14	18,000 sq. ft.
Building 15	6,822 sq. ft.
Building 13	6,822 sq. ft.
TOTAL	150,941 sq. ft.
Plazas/Courts	
Main Mall	40,625 sq. ft.
South Lawn	31,250 sq. ft.
TOTAL	71,875 sq. ft.
Storage	11,130 sq. ft.
Yard	28,050 sq. ft.
Livestock Area	97,200 sq. ft.
Arena	110,136 sq. ft.
Equestrian Center	500,940 sq. ft.
Little Theater	5,960 sq. ft.
Memorial Gardens	3,411 sq. ft.
Arlington Theater	97,344 sq. ft.
Offices	
Maintenance	14,495 sq. ft.
4H	2,500 sq. ft.
Administration	5,970 sq. ft.
Livestock	2,000 sq. ft.
TOTAL	24,965 sq. ft.
Total Number of Parking Spaces	9,388 ± *

The proposed project will involve removing and replacing existing structures, constructing new additional structures, constructing additional parking areas, and establishing a coherent and thematic landscape, sign, and lighting plan. In general, the project will result in a core of facilities surrounded by a parking area. The core of facilities will be divided into two general areas - a Park (open space) area and Campus (buildings) area.

The Park area, the west portion of the core of facilities, will include a remodeled amphitheater that will have a reduced capacity (18,500 to 8,500 people). The first phase in remodeling the amphitheater will be to remove a large earthen berm that was used for seating up to 10,000 people. This berm contains approximately 200,000 cubic yards of earthen material. The amphitheater will be re-opened with an approximate maximum capacity of 8,500. East and north of the amphitheater will be a large, passive park area. Several small exhibit buildings will be removed to accommodate the proposed park. The midway (carnival lot) will be relocated north of this park area. Centennial Farms, a working farm exhibit, will be expanded to the west, incorporating an area that is currently occupied by a portion of the earthen berm.

The Campus portion of the fairgrounds will contain a series of buildings and open space plazas. The existing four exhibits buildings will remain. A covered structure linking the eastern exhibit buildings will be created. The existing exhibit building located south of the maintenance yard (Building No. 17) will be replaced by a building containing a large, industrial kitchen and restaurant. A new exhibit building (approximately 85,000 square feet) will be located north of the exhibits buildings and west of the maintenance yard. A new storage structure will be located east of the maintenance yard. A covered judging ring will be located east of the new kitchen/restaurant and south of the new storage structure. The livestock area will remain in the same location, with the stalls and pens replaced by similar, upgraded structures. The existing arena will be relocated south of the livestock area. Two multipurpose buildings (approximately 20,000 square feet each) will be constructed south of the existing exhibit buildings and east of the primary entry/arrival court complex.

The primary entry (off of Fair Drive) will be improved and landscaped. A new arrival court will be constructed at the north terminus of this entry, replacing the existing administrative building. The principal entries off of Newport Boulevard and Fairview Drive will be improved with landscaping and gates.

The existing equestrian center will be reduced by approximately 50 percent in area (approximately seven acres). The reduced equestrian center will be located in the northeast corner of the site. The former western portion of the equestrian center will be replaced by an additional parking area and an access point on to/off of Arlington Drive.

Table B depicts the proposed project's program, and Table C illustrates the proposed net area devoted to new and/or changed uses. Figure 4 is the conceptual Master Plan.

V. DISCRETIONARY ACTIONS

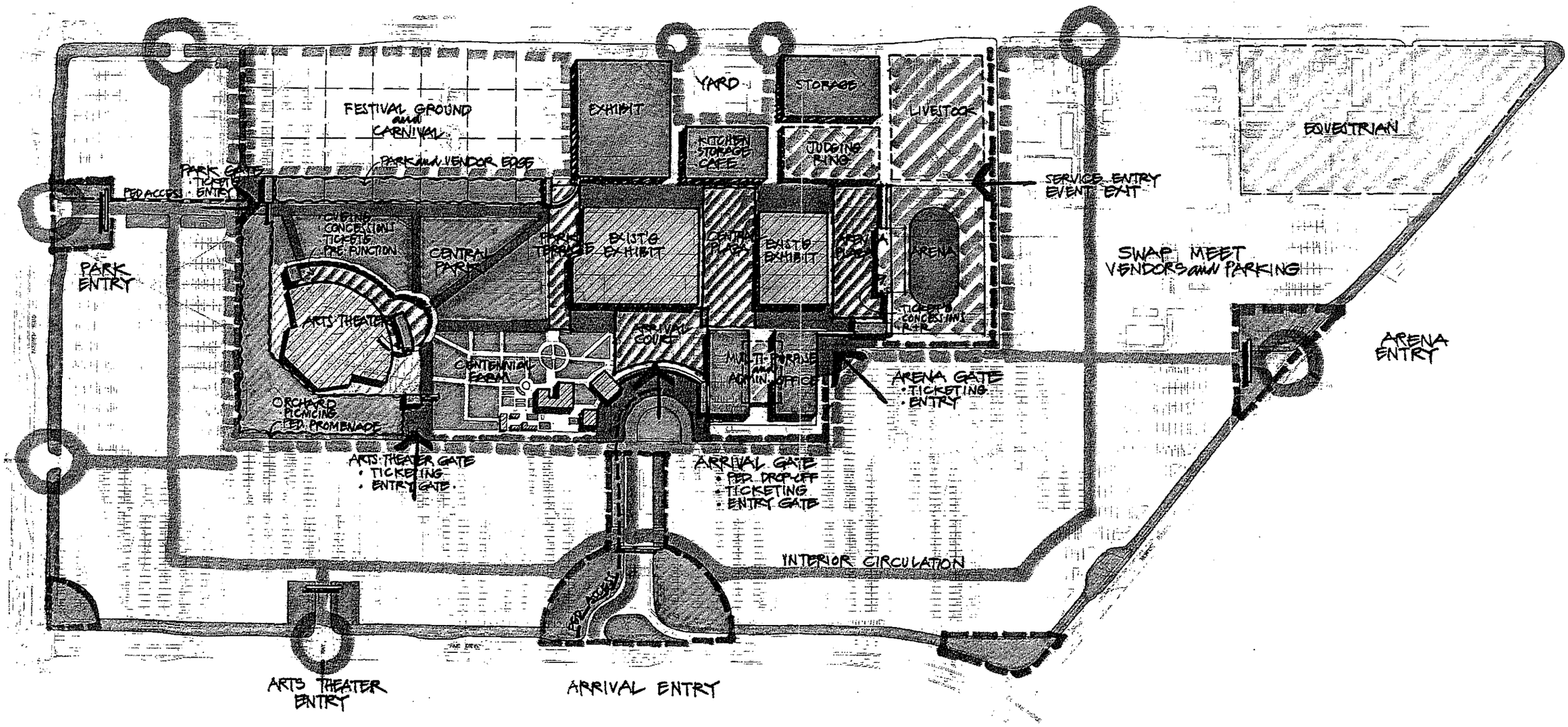
The proposed Master Plan will be implemented by a series of actions, programs, and guidelines as adopted by the Board. The primary discretionary action undertaken by the Board is the approval and adoption of the Master Plan. The EIR being prepared for the proposed project will satisfy the CEQA

Table B: Proposed Program

Amphitheater	254,400 sq. ft. (8,500 seats)
Centennial Farms	196,000 sq. ft.
Festival Grounds (excludes area for parking)	245,000 sq. ft.
Carnival Lot (includes area for non-fair parking)	322,000 sq. ft.
Exhibit Buildings	
Exhibit West of Yard	88,400 sq. ft.
Exhibit with Kitchen	34,500 sq. ft.
Existing Exhibit (West of Central Plaza)	100,800 sq. ft.
Existing Exhibit (East of Central Plaza)	49,400 sq. ft.
Exhibit, South of Central Plaza (single story)	26,400 sq. ft.
Exhibit, Southeast of Central Plaza (two story)	52,800 sq. ft.
TOTAL	352,300 sq. ft.
Plazas/Courts	
Park Terrace	25,200 sq. ft.
Arrival Court	40,000 sq. ft.
Central Plaza	52,000 sq. ft.
Arena Plaza	53,200 sq. ft.
TOTAL	170,400 sq. ft.
Storage	45,900 sq. ft.
Yard	60,000 sq. ft.
Livestock	97,200 sq. ft.
Judging Ring	43,200 sq. ft.
Arena	116,100 sq. ft
Equestrian Center	330,000 sq. ft.
Central Park	302,900 sq. ft.
Total Number of Parking Spaces	9,888 ±±

Table C: Net Change

Amphitheater	-97,160 sq. ft. (10,000 seats)
Festival Grounds (excludes area for parking)	-61,250 sq. ft.
Carnival Lot (includes area for non-fair parking)	3,850 sq. ft.
TOTAL	201,359 sq. ft.
Plazas/Courts	
TOTAL	98,525 sq. ft.
Storage	34,770 sq. ft.
Yard	31,950 sq. ft.
Judging Ring	43,200 sq. ft.
Arena	5,964 sq. ft.
Equestrian Center	-170,940 sq. ft.
Central Park	302,900 sq. ft.
Total Number of Parking Spaces	500 ±±



PLAN B2

ORANGE COUNTY FAIR AND EXPOSITION

88 FAIR DRIVE

COSTA MESA, CALIFORNIA

FIGURE 4

LPA
LSA
LP3

Not to Scale

requirements for all permits or approval needed to implement all phases of the proposed Master Plan. At this time the following actions are to be considered:

- Certification of the Environmental Impact Report (OCFEC Board).
- Adoption of a Mitigation Monitoring Plan (OCFEC Board).
- Approval and adoption of the Master Plan, including land use guidelines, a conceptual site plan, business plan and implementation strategy (OCFEC Board)
- Building permits and contract approvals (California Construction Authority)

VI. LEAD, RESPONSIBLE, AND TRUSTEE AGENCIES

According to Sections 15050 and 15367 of the State CEQA Guidelines, the OCFEC has been designated as the Lead Agency. A Lead Agency is the public agency having the principal responsibility for carrying out or approving the project. Responsible Agencies are those agencies that have discretionary approval over one or more actions involved with the development of a proposed project. Trustee Agencies are State agencies having discretionary approval or jurisdiction by law over natural resources affected by a proposed project that are held in trust of the people of the State of California.

No Responsible Agencies or Trustee Agencies have been identified. However, there are several agencies with jurisdictional interest. OCFEC will need to work with the City of Costa Mesa regarding public right-of-way and hyrology issues. The Division of Fairs and Exposition and the California State Department of Agriculture will provide general oversight of the Master Plan implementation via the California Construction Authority.

VII. ENVIRONMENTAL PROCEDURES

This NOP for the proposed project will be submitted to the State Clearinghouse, Responsible Agencies, and other interested parties that specifically requested a copy of the NOP. After the 30 day review period for the NOP is complete and all comments are received, a Draft EIR will be prepared in accordance with CEQA as amended (Public Resources Code, Section 21000 et seq.) and the State Guidelines for Implementation of CEQA (California Code of Regulations, Section 15000, et seq.). This Draft EIR will comply with the procedures for implementation of CEQA as established by Public Resources Code, Section 21000, et seq. and the CEQA Guidelines.

Detailed analysis will be conducted in order to ascertain the proposed project's potential impact on the environment and the relative degree of impact prior to implementation of mitigation measures. Where impacts are determined to be significant, mitigation measures will be prescribed with the purpose of reducing those impacts completely, or to the maximum degree feasible. An analysis of alternatives to the proposed project will also be included in the Draft EIR, including alternative site plans and the No Project Alternative. In addition, a discussion regarding cumulative impacts associated with foreseeable future projects within the vicinity of the proposed project (including the proposed project) will be included within the Draft EIR.

VIII. INITIAL STUDY CHECKLIST

An Initial Study Checklist is a preliminary environmental analysis of a proposed project prepared by the Lead Agency to determine whether a Negative Declaration or EIR must be prepared (State CEQA Guidelines Section 15365).

The Initial Study Checklist addresses each question required by the State CEQA Guidelines. An indication is provided related to the potential impacts of the proposed project. The Threshold of Significance Section provides impact criteria from the federal or State agencies, the State CEQA Guidelines, or adopted City policies. The Impacts Section indicates the potential impacts of the proposed project. The Analysis Section provides an analysis of the physical effects of the proposed project. The Analysis Section indicates whether the proposed project will have any impacts as follows:

1. Potentially Significant;
2. Potentially Significant Unless Mitigation is Incorporated;
3. Less than Significant Impact; or
4. No Impact.

The Initial Study Checklist and Response Section have been prepared according to Sections 15063, 15064, and 15065 of the State CEQA Guidelines.

IX. EVALUATION OF ENVIRONMENTAL IMPACTS

A brief explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a project-specific screening analysis).

All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts.

Once the lead agency has determined that a particular physical impact may occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect is significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required.

X. POTENTIAL ENVIRONMENTAL EFFECTS/ISSUES

A. Geophysical. Would the Project Result in or Expose People to Impacts Involving Local Fault Rupture and Expansive Soils?

Less than Significant Impact. No active fault has been identified on the project site, and the site is not designated a fault hazard zone pursuant to the Alquist-Priolo Act. The proposed project site is generally located within a regional seismically active area. Local faults (e.g., Newport-Inglewood) are well documented along with associated potential ground shaking and acceleration characteristics. In addition, the potential for liquefaction exists, as with the surrounding area. While a comprehensive and separate geotechnical analysis for this EIR is not warranted based upon the absense of hazardous geotechnical conditions, new structures will be required to be constructed in accordance with State of California geotechnical standards.

B. Hydrology & Drainage. Would the Project Result in a Substantial Increase in the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On-or Off-Site?

Less than Significant Impact. Approximately seven acres of an existing equestrian center will be converted into a portion of the proposed project's parking area - resulting in additional impermeable surface for this specific area. This, in turn, will result in increased runoff amounts that will drain to the north. Receiving this additional runoff will be a small, unimproved channel that conveys water along the south edge of Arlington Street. A storm water runoff (hydrology) study will be conducted as part of this EIR. This study will analyze the existing channel, as well as potential impacts as result of the proposed parking area.

C. Hydrology & Drainage. Would the Project Create or Contribute Runoff Water Which Would Exceed the Capacity of Existing or Planned Storm Water Drainage Systems or Provide Substantial Additional Sources of Polluted Runoff?

Less than Significant Impact. As indicated in B, above, a storm water runoff (hydrology) study will be conducted as part of this EIR. This study will analyze the existing channel, as well as potential impacts as result of the proposed parking area.

In addition, runoff generated within the Fairgrounds, including the equestrian center, will be analyzed as to water quality characteristics. Guidelines and procedures identified by the Santa Ana Regional Water Quality Board will be followed in this analysis, and in the creation of Best Management Practices and any potential mitigation measures.

D. Transportation/Circulation. Would the Project Result in Increased Vehicle Trips or Traffic Congestion Beyond Adopted Policies and/or Forecasts?

Less than Significant Impact. The proposed project includes additional event centers and exhibition uses that may have the potential to generate additional traffic within relatively short time periods. There are several existing policies and agreements in place that address traffic and

circulation issues for the Fairgrounds. A complete traffic and circulation study will be prepared as a part of this EIR, investigating 1) the existing system; 2) proposed increased traffic as a direct result of the proposed project; and 3) a cumulative analysis (proposed project plus reasonably foreseeable projects) of the immediate vicinity.

E. Transportation/Circulation. Would the Project Exceed, Either Individually or Cumulatively, A Level of Service Standard Established by the County Congestion Management Agency for the Designated Roads or Highways?

Less than Significant Impact. The proposed project is located within an urbanized area that currently experiences traffic congestion. There are several active redevelopment projects in various stages of implementation within the proposed project's vicinity. A complete traffic and circulation study will be prepared as a part of this EIR, investigating 1) the existing system; 2) proposed increased traffic as a direct result of the proposed project; and 3) providing a cumulative analysis (proposed project plus reasonably foreseeable projects) of the immediate vicinity.

F. Transportation/Circulation. Would the Project Result in Insufficient Parking Capacity On-Site or Off-Site?

Less than Significant Impact. The proposed project includes additional event centers and exhibition uses that may have the potential to generate significant amounts of traffic within relatively short time periods. There are several existing policies and agreements in place that address parking for the Fairgrounds. The aforementioned traffic and circulation study, completed as a part of this EIR, will investigate the amount of available parking spaces, access, safety and location, as well as the existing/proposed parking management system.

G. Air Quality. Would the Project Exceed Any SCAQMD Standard or Contribute to Air Quality Deterioration Beyond Projects of SCAQMD?

Potential Significant Effect. A portion of the proposed project includes removing approximately 200,000 yards of earthen material formerly used as a seating area for an amphitheater. A preliminary analysis indicates that removing this amount of material within a reasonable construction period may result in exceeding several SCAQMD thresholds for short-term construction activities (PM_{10} and ROG). A complete air quality analysis will be completed as part of this EIR, analyzing both the short-term (construction) and long-term (operational) impacts, as well as suggesting appropriate and feasible mitigation measures should there be significant impacts.

H. Air Quality. Would the Project Expose Sensitive Population Groups to Pollutants in Excess of Acceptable Levels?

Less than Significant Impact. As mentioned above, short-term construction impacts may exceed several SCAQMD thresholds. The project site is located near several schools and a community park, which are considered sensitive receptor locations. A complete air quality analysis will be completed as part of this EIR, analyzing both the short-term (construction) and long-term (operational) impacts,

as well as suggesting appropriate and feasible mitigation measures should there be significant impacts.

I. Noise. Would the Project Increase Existing Noise Levels?

Less than Significant Impact. An outdoor entertainment venue will be reopened as part of the proposed project. A comprehensive noise analysis will be conducted that will investigate potential noise levels associated with a variety of events. This analysis will also analyze the degree of impact on residential uses in the project's vicinity and recommend, if necessary, appropriate and feasible mitigation measures should there be significant impacts.

J. Noise. Would the Project Expose People to Noise Levels Exceeding Adopted County Standards?

Less than Significant Impact. An outdoor entertainment venue will be reopened as part of the proposed project. A comprehensive noise analysis will be conducted that will investigate potential noise levels associated with a variety of events. This analysis will also analyze the degree of impact on residential uses in the project's vicinity and recommend, if necessary, appropriate and feasible mitigation measures should there be significant impacts.

K. Aesthetics. Would the Project Substantially Degrade the Existing Visual Character or Quality of the Site and its Surroundings?

Less than Significant Impact. The Fairgrounds has existed in its present location for nearly 50 years. The surrounding area has evolved from mostly vacant land into a suburban area with a variety of residential, recreational, institutional, and civic uses. The Fairgrounds has a variety of signs, banners, lights, and other similar devices – typically characteristic of Fairgrounds – designed to attract visual attention to the site and its facilities. The proposed project will be consistent with this Fairground characteristic. View simulations of proposed Master Plan improvements will be prepared and incorporated into the EIR.

L. Aesthetics. Would the Project Create Light or Glare Beyond the Physical Limits of the Project Site?

Less than Significant Impact. The Fairgrounds has existed in its present location for nearly 50 years. The surrounding area has evolved from mostly vacant land into a suburban area with a variety of residential, recreational, institutional, and civic uses. The Fairgrounds has a variety of signs, banners, lights, and other similar devices – typically characteristic of Fairgrounds – designed to attract visual attention to the site and its facilities. The proposed project will be consistent with this Fairground characteristic. View simulations will be prepared and incorporated into the EIR.

There are several large light standards (100' $\pm$ in height) located in the western portion of the parking area. Several similar light standards are planned for the eastern portion of the parking area. However, this portion of the parking area is adjacent State Route 55, Vanguard University, and a

community park (non-residential uses). A photometric plan analyzing potential light and glare impacts will be prepared as part of the environmental documentation.

M. Public Services. Would the Project Result in Need(s) for New/Altered Government Facilities/Services in Maintenance of Public Facilities, Including Roads?

Less than Significant Impact. As previously noted, the drainage channel located along the south edge of Arlington Street (north side of Fairgrounds) will be analyzed as part of a comprehensive hydrological study.

N. Mandatory Findings of Significance

1. Does the project have possible environmental effects which are individually limited but cumulatively considerable?

   Less than Significant with Mitigation. As previously mentioned, the proposed project is located within an area of active redevelopment with several projects in various stages of entitlement and/or construction. The proposed project may incrementally contribute to the cumulative environmental conditions of the surrounding area.

2. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?

   Potential Significant Effect. As noted within the Air Quality portion of this Initial Study Checklist, the proposed project may result in short-term (construction related) air quality impacts, specifically associated with the removal of approximately 200,000 yards of earthen materials. The EIR will assess this issue.

ENVIRONMENTAL ANALYSIS CHECKLIST

CCZ030

ISSUES & SUPPORTING DATA SOURCES:	Potential Significant Effect	Less than Significant w/ Mitigation	Less than Significant Impact	No Impact
1. LAND USE & PLANNING. Would the project:				
a) Conflict with general plan designation or zoning?	☐	☐	☐	☒
b) Conflict with applicable environmental plans or policies of agencies with jurisdiction over the project?	☐	☐	☐	☒
c) Disrupt or divide the physical arrangement of an established community (e.g. low income, minority)?	☐	☐	☐	☒
d) Conflict with adjacent, existing or planned land uses?	☐	☐	☐	☒
2. AGRICULTURE. Would project:				
a) Convert Farmlands listed as "Prime", "Unique" or of "Statewide Importance," as shown on the State Farmland Mapping and Monitoring Program, to non-agricultural use?	☐	☐	☐	☒
b) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use?	☐	☐	☐	☒
3. POPULATION & HOUSING. Would project:				
a) Cumulatively exceed adopted regional or local population projections?	☐	☐	☐	☒
b) Induce substantial growth in an area directly or indirectly through project in an undeveloped area or extension of major infrastructure?	☐	☐	☐	☒
c) Displace existing housing affecting a substantial number of people?	☐	☐	☐	☒
4. GEOPHYSICAL. Would project result in or expose people to impacts involving:				
a) Local fault rupture?	☐	☐	☒	☐
b) Seismicity: ground shaking or liquefaction?	☐	☐	☒	☐
c) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒
d) Landslides or mudslides?	☐	☐	☐	☒
e) Erosion, changes in topography or unstable soil conditions from excavation, grading or fill?	☐	☐	☐	☒
f) Subsidence of the land?	☐	☐	☐	☒
g) Expansive soils?	☐	☐	☒	☐
h) Unique geologic or physical features?	☐	☐	☐	☒
5. HYDROLOGY&DRAINAGE. Would the project:				
a) Substantially alter the existing drainage pattern of the site or area, including the alteration of the course of a stream or river, in manner which would result in:				
i) substantial erosion or siltation on- or off-site?	☐	☐	☐	☒
ii) a substantial increase in the rate or amount of surface runoff in manner which would result in flooding on- or off-site?	☐	☐	☒	☐
b) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☒	☐
c) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☐	☒
d) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam, or inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒

ISSUES & SUPPORTING DATA SOURCES:	Potential Significant Effect	Less than Significant w/ Mitigation	Less than Significant Impact	No Impact
6. WATER QUALITY. Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☒	☐	☐
b) Substantially deplete groundwater supplies or interfere with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of a local groundwater table level?	☐	☐	☐	☒
c) Otherwise substantially degrade water quality?	☐	☒	☐	☐
7. TRANSPORTATION/CIRCULATION. Would the project result in:				
a) Increased vehicle trips or traffic congestion beyond adopted policies and/or forecasts?	☐	☐	☒	☐
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	☐	☒	☐	☐
c) Safety hazards from design features (e.g. sharp curves or dangerous intersections) or incompatible uses (e.g. farm equipment)?	☐	☐	☐	☒
d) Inadequate emergency access or access to nearby uses?	☐	☐	☐	☒
e) Insufficient parking capacity on-site or off-site?	☐	☐	☒	☐
f) Hazards or barriers for pedestrians or bicyclists?	☐	☐	☐	☒
g) Conflicts with adopted policies supporting alternative transportation (e.g. bus turnouts, bicycle racks)?	☐	☐	☐	☒
h) Rail, waterborne or air traffic impacts?	☐	☐	☐	☒
i) Change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒
8. AIR QUALITY. Would the project:				
a) Exceed any SCAQMD standard or contribute to air quality deterioration beyond projections of SCAQMD?	☒	☐	☐	☐
b) Expose sensitive population groups to pollutants in excess of acceptable levels?	☐	☐	☒	☐
c) Alter air movement, moisture, or temperature, or cause any change in climate?	☐	☐	☐	☒
d) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☒
9. NOISE. Would the project:				
a) Increase existing noise levels?	☐	☐	☒	☐
b) Expose people to noise levels exceeding adopted County standards?	☐	☐	☒	☐
c) If located within an airport land use plan or, where such plan has not been adopted, within two miles of a public airport or public use airport, expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
10. BIOLOGICAL RESOURCES. Would the project impact:				
a) Endangered, threatened or rare species or their habitats (including but not limited to plants, fish, insects, animals and birds)?	☐	☐	☐	☒
b) Locally designated species (e.g. heritage trees)?	☐	☐	☐	☒
c) Locally designated natural communities (e.g. oak forest, coastal habitat, etc.)?	☐	☐	☐	☒
d) Wetland habitat (e.g. marsh, riparian and vernal pool)?	☐	☐	☐	☒
e) Wildlife dispersal or migration corridors?	☐	☐	☐	☒
f) Adopted or proposed conservation plans and policies (e.g. Natural Community Conservation Plan or Resource Management Plan)?	☐	☐	☐	☒
11. AESTHETICS. Would the project:				
a) Affect a scenic vista or view open to the public?	☐	☐	☒	☐
b) Affect a designated scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☒	☐
d) Create light or glare beyond the physical limits of the project site?	☐	☒	☐	☐

ISSUES & SUPPORTING DATA SOURCES:	Potential Significant Effect	Less than Significant w/ Mitigation	Less than Significant Impact	No Impact
12. CULTURAL/SCIENTIFIC RESOURCES, Would the project:				
a) Disturb archaeo or paleo resources?	☐	☐	☐	☒
b) Affect historical resources?	☐	☐	☐	☒
c) Have the potential to cause a physical change which would affect unique ethnic cultural values?	☐	☐	☐	☒
13. RECREATION. Would project:				
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒
c) Conflict with adopted recreational plans or policies?	☐	☐	☐	☒
14. MINERAL RESOURCES. Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒
15. HAZARDS. Would the project:				
a) Create a hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	☒
b) Create a hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	☒
c) Exposure of people to existing sources of health hazards?	☐	☐	☐	☒
d) For a project located within an airport land use plan or, where such plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
e) For a project within the vicinity of private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
g) Expose people or structures to a significant risk or loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☒
16. PUBLIC SERVICES. Would project result in need(s) for new/altered government facilities/services in:				
a) Fire protection?	☐	☐	☐	☒
b) Police protection?	☐	☐	☐	☒
c) Schools?	☐	☐	☐	☒
d) Maintenance of public facilities, including roads?	☐	☐	☒	☐
e) Other government services?	☐	☐	☐	☒
17. UTILITIES & SERVICE SYSTEMS. Would project result in needs for new or substantial alterations in:				
a) Power or natural gas?	☐	☐	☐	☒
b) Communications systems?	☐	☐	☐	☒
c) Local or regional water treatment or distribution facilities?	☐	☐	☐	☒
d) Sewer or septic tanks?	☐	☐	☐	☒
e) Solid waste disposal?	☐	☐	☐	☒

ISSUES & SUPPORTING DATA SOURCES:	Potential Significant Effect	Less than Significant w/ Mitigation	Less than Significant Impact	No Impact
MANDATORY FINDINGS				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife population to drop below self sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☐	☒
b) Does the project have the potential to achieve the short-term environmental goals to the disadvantage of the long-term environmental goals?	☐	☐	☐	☒
c) Does the project have possible environmental effects which are individually limited but cumulatively considerable? ("cumulatively considerable" means that the incremental effects of an individual project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☐	☒	☐	☐
d) Does project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly	☒	☐	☐	☐

DETERMINATION:

Based upon the evidence in light of the whole record documented in the attached environmental checklist explanation, cited incorporations and attachments, I find that the proposed project:

COULD NOT have a significant effect on the environment, and a negative declaration (ND) will be prepared pursuant to CEQA Guidelines Article 6, 15070 through 15075. ☐

COULD have a significant effect on the environment, there will not be a significant effect in this case because the mitigation measures have been added to the project. A negative declaration (ND) will be prepared pursuant to CEQA Guidelines Article 6, 15070 through 15075. ☐

MAY have a significant effect on the environment which has not been analyzed previously. Therefore, an environmental impact report (EIR) is required. ☒

Signature: Betty Bailey-Fridley
Telephone: (714) 708-3247

NOTE: All referenced and/or incorporated documents may be reviewed by appointment only, at the County of Orange Planning & Development Services Department, 300 N. Flower Street, Santa Ana, California, unless otherwise specified. An appointment can be made by contacting the CEQA Contact Person identified above.

COMMENTS IN RESPONSE TO THE NOP

The Gas Company

Orange Coast Region

May 3, 2001

RECEIVED
MAY 07 2001

Southern California
Gas Company
Mailing Address:
Box 3334
Anaheim, CA
92803-3334

LSA Associates, Inc.
One Park Plaza, Suite 500
Irvine, CA 92614-5987

Attention: Jayna Goodman

Subject: Atlas Request for Orange County Fairgrounds in Costa Mesa

Attached is the information you requested relating to the location of gas facilities within the area of your project. Due to numerous factors, the depths of our facilities vary and should not be taken for granted. The information we have provided was obtained from a search of all our available records and is approximate in nature. If exact depth location and information is required at points of possible interference, it will be necessary to physically check the facility in question.

It is extremely important that you furnish us with "signed" final plans and subsequent plan revisions as soon as they are available. A minimum of twelve (12) weeks is needed to analyze your plans and to design required alterations due to any conflicting facilities. Depending on the magnitude of the work involved, additional time may then be required to clear the conflict. Please keep us informed of construction schedules, preconstruction meetings, etc., so that our work can be scheduled accordingly.

Upon request, at least two (2) working days prior to the start of construction, we will locate and mark our active underground facilities for the contractor at no cost. Please call Underground Service Alert (USA) at 1-800-422-4133.

If you have any questions or require additional information please contact me at (714) 634-3217.

Sincerely,

Steve Faber

Steve Faber
Planning Associate
Orange Coast Region

SF/mm
enclosure

STATE OF CALIFORNIA

Governor's Office of Planning and Research

State Clearinghouse

Gray Davis
GOVERNOR

Tal Finney
INTERIM DIRECTOR

Notice of Preparation

May 31, 2002

To: Reviewing Agencies

Re: Orange County Fair and Exposition Center Update
SCH# 1989010088

Attached for your review and comment is the Notice of Preparation (NOP) for the Orange County Fair and Exposition Center Update draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Becky Bailey-Findley
32 District Agriculture Association
88 Fair Drive
Costa Mesa, CA 92626

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Project Analyst, State Clearinghouse

Attachments
cc: Lead Agency

1400 TENTH STREET P.O. BOX 3044 SACRAMENTO, CALIFORNIA 95812-3044
916-445-0613 FAX 916-323-3018 www.opr.ca.gov

FROM :ORANGE COUNTY FAIR FAX NO. :714 708 1513 Jun. 06 2002 10:02AM P2

SCH#	1989010088
Project Title	Orange County Fair and Exposition Center Update
Lead Agency	Orange County

Type	**NOP** Notice of Preparation
Description	The proposed project will involve removing and replacing existing structures, constructing new additional structures, constructing additional parking areas, and establishing a coherent and thematic landscape, sign, and lighting plan. In general, the will result in a core of facilities surrounded by a parking area. The core of facilities will be divided into two general areas: a Park (Open Space) area and Campus (buildings) area.

Lead Agency Contact

Name	Becky Bailey-Findley		
Agency	32 District Agriculture Association		
Phone	714-708-3247	**Fax**	
email			
Address	88 Fair Drive		
City	Costa Mesa	**State** CA **Zip** 92626	

Project Location

County	Orange			
City	Costa Mesa			
Region				
Cross Streets	Fair Drive, Newport Boulevard, Fairview Drive			
Parcel No.				
Township	**Range**	**Section**	**Base**	

Proximity to:

Highways	SR 55
Airports	
Railways	
Waterways	
Schools	
Land Use	Fairgrounds

Project Issues	Air Quality; Water Quality; Traffic/Circulation; Aesthetic/Visual; Other Issues

Reviewing Agencies	Resources Agency; Department of Conservation; Office of Historic Preservation; Department of Parks and Recreation; Department of Fish and Game, Region 5; Native American Heritage Commission; State Lands Commission; Caltrans, District 12; California Highway Patrol; Air Resources Board, Major Industrial Projects; Regional Water Quality Control Board, Region 8

Date Received 05/31/2002 **Start of Review** 05/31/2002 **End of Review** 07/01/2002

Note: Blanks in data fields result from insufficient information provided by lead agency.

Jun. 06 2002 10:02AM P3 FAX NO. :714 708 1513 ORANGE COUNTY FAIR :PM

NOP Distribution List

County: Orange SCH# 1989010088

Resources Agency

- [x] Resources Agency — Nadell Gayou
- [ ] Dept. of Boating & Waterways — Bill Curry
- [ ] California Coastal Commission — Elizabeth A. Fuchs
- [x] Dept. of Conservation — Roseanne Taylor
- [ ] Dept. of Forestry & Fire Protection — Allen Robertson
- [x] Office of Historic Preservation — Hans Kreutzberg
- [x] Dept of Parks & Recreation — B. Noah Tilghman, Environmental Stewardship Section
- [ ] Reclamation Board — Pam Bruner
- [ ] S.F. Bay Conservation & Dev't. Comm. — Steve McAdam
- [ ] Dept. of Water Resources — Resources Agency, Nadell Gayou

Health & Welfare

- [ ] Health & Welfare — Wayne Hubbard, Dept. of Health/Drinking Water

Food & Agriculture

- [ ] Food & Agriculture — Steve Shaffer, Dept. of Food and Agriculture

Fish and Game

- [ ] Dept. of Fish & Game — Scott Flint, Environmental Services Division
- [ ] Dept. of Fish & Game 1 — Donald Koch, Region 1
- [ ] Dept. of Fish & Game 2 — Banky Curtis, Region 2
- [ ] Dept. of Fish & Game 3 — Robert Floerke, Region 3
- [ ] Dept. of Fish & Game 4 — William Laudermilk, Region 4
- [x] Dept. of Fish & Game 5 — Don Chadwick, Region 5, Habitat Conservation Program
- [ ] Dept. of Fish & Game 6 — Gabrina Gatchel, Region 6, Habitat Conservation Program
- [ ] Dept. of Fish & Game 6 I/M — Tammy Allen, Region 6, Inyo/Mono, Habitat Conservation Program
- [ ] Dept. of Fish & Game M — Tom Napoli, Marine Region

Independent Commissions

- [ ] California Energy Commission — Environmental Office
- [x] Native American Heritage Comm. — Debbie Treadway
- [ ] Public Utilities Commission — Ken Lewis
- [x] State Lands Commission — Betty Silva
- [ ] Governor's Office of Planning & Research — State Clearinghouse Planner
- [ ] Colorado River Board — Gerald R. Zimmerman
- [ ] Tahoe Regional Planning Agency (TRPA) — Lyn Barnett
- [ ] Office of Emergency Services — John Rowden, Manager
- [ ] Delta Protection Commission — Debby Eddy
- [ ] Santa Monica Mountains Conservancy — Paul Edelman

Dept. of Transportation

- [ ] Dept. of Transportation 1 — IGR/Planning, District 1
- [ ] Dept. of Transportation 2 — Vicki Roe, Local, Development Review, District 2
- [ ] Dept. of Transportation 3 — Jeff Pulverman, District 3
- [ ] Dept. of Transportation 4 — Jean Finney, District 4
- [ ] Dept. of Transportation 5 — James Kilmer, District 5
- [ ] Dept. of Transportation 6 — Marc Birnbaum, District 6
- [ ] Dept. of Transportation 7 — Stephen J. Buswell, District 7
- [ ] Dept. of Transportation 8 — Mike Sim, District 8
- [ ] Dept. of Transportation 9 — Colleen O'Brien, District 9
- [ ] Dept. of Transportation 10 — Chris Sayre, District 10
- [ ] Dept. of Transportation 11 — Lou Salazar, District 11
- [x] Dept. of Transportation 12 — Aileen Kennedy, District 12

Business, Trans & Housing

- [ ] Housing & Community Development — Cathy Creswell, Housing Policy Division
- [ ] Caltrans - Division of Aeronautics — Sandy Hesnard
- [x] California Highway Patrol — Lt. Julie Page, Office of Special Projects
- [ ] Dept. of Transportation — Ron Helgeson, Caltrans - Planning
- [ ] Dept. of General Services — Robert Sleppy, Environmental Services Section

Air Resources Board

- [ ] Airport Projects — Jim Lerner
- [ ] Transportation Projects — Kurt Karperos
- [x] Industrial Projects — Mike Tollstrup

- [ ] California Integrated Waste Management Board — Sue O'Leary
- [ ] State Water Resources Control Board — Diane Edwards, Division of Clean Water Programs
- [ ] State Water Re Board — Greg Frantz, Division of Water Qua
- [ ] State Water Resouc Board — Mike Falkenstein, Division of Water Righ
- [ ] Dept. of Toxic Subst CEQA Tracking Cente

Regional Water Quali Board (RWQCB)

- [ ] RWQCB 1 — Cathleen Hudson, North Coast Region (1
- [ ] RWQCB 2 — Environmental Docum Coordinator, San Francisco Bay Re
- [ ] RWQCB 3 — Central Coast Region
- [ ] RWQCB 4 — Jonathan Bishop, Los Angeles Region (
- [ ] RWQCB 5S — Central Valley Region
  - [ ] RWQCB 5F — Central Valley Re, Fresno Branch O
  - [ ] RWQCB 5R — Central Valley Re, Redding Branch
- [ ] RWQCB 6 — Lahontan Region (6)
  - [ ] RWQCB 6V — Lahontan Region, Victorville Branch
- [ ] RWQCB 7 — Colorado River Basin
- [x] RWQCB 8 — Santa Ana Region (8)
- [ ] RWQCB 9 — San Diego Region (9)

South Coast
Air Quality Management District
21865 E. Copley Drive, Diamond Bar, CA 91765-4182
(909) 396-2000 • http://www.aqmd.gov

June 4, 2002

Ms. Becky Bailey-Findley, CEO
Orange County Fair and Exposition Center
32 District Agriculture Association
88 Fair Drive
Costa Mesa, CA 92626

RECEIVED
JUN 20 2002

Dear Ms. Bailey-Findley:

Notice of Preparation of a Draft Environmental Impact Report for Orange County Fair and Exposition Center Master Plan

The South Coast Air Quality Management District (AQMD) appreciates the opportunity to comment on the above-mentioned document. The AQMD's comments are recommendations regarding the analysis of potential air quality impacts from the proposed project that should be included in the Draft Environmental Impact Report (EIR).

Air Quality Analysis

The AQMD adopted its California Environmental Quality Act (CEQA) Air Quality Handbook in 1993 to assist other public agencies with the preparation of air quality analyses. The AQMD recommends that the Lead Agency use this Handbook as guidance when preparing its air quality analysis. Copies of the Handbook are available from the AQMD's Subscription Services Department by calling (909) 396-3720.

The Lead Agency should identify any potential adverse air quality impacts that could occur from all phases of the project and all air pollutant sources related to the project. Air quality impacts from both construction and operations should be considered. Construction-related air quality impacts typically include, but are not limited to, emissions from the use of heavy-duty equipment from grading, earth-loading/unloading, paving, architectural coatings, off-road mobile sources (e.g., heavy-duty construction equipment) and on-road mobile sources (e.g., construction worker vehicle trips, material transport trips). Operation-related air quality impacts may include, but are not limited to, emissions from stationary sources (e.g., boilers), area sources (e.g., solvents and coatings), and vehicular trips (e.g., on- and off-road tailpipe emissions and entrained dust). Air quality impacts from indirect sources, that is, sources that generate or attract vehicular trips should be included in the evaluation. An analysis of all toxic air contaminant impacts due to the decommissioning or use of equipment potentially generating such air pollutants should also be included.

Mitigation Measures

In the event that the project generates significant adverse air quality impacts, CEQA requires that all feasible mitigation measures be utilized during project construction and operation to minimize or eliminate significant adverse air quality impacts. To assist the Lead Agency with identifying possible mitigation measures for the project, please refer to Chapter 11 of the AQMD CEQA Air Quality Handbook for sample air quality mitigation measures. Additionally, AQMD's Rule 403 – Fugitive Dust, and the Implementation Handbook contain numerous measures for controlling construction-related emissions that should be considered for use as CEQA mitigation if not otherwise required. Pursuant to state CEQA Guidelines §15126.4 (a)(1)(D), any impacts resulting from mitigation measures must also be discussed.

Data Sources

AQMD rules and relevant air quality reports and data are available by calling the AQMD's Public Information Center at (909) 396-2039. Much of the information available through the Public Information Center is also available via the AQMD's World Wide Web Homepage (http://www.aqmd.gov).

The AQMD is willing to work with the Lead Agency to ensure that project-related emissions are accurately identified, categorized, and evaluated. Please call Dr. Charles Blankson, Transportation Specialist, CEQA Section, at (909) 396-3304 if you have any questions regarding this letter.

Sincerely,

Steve Smith

Steve Smith, Ph.D.
Program Supervisor, CEQA Section
Planning, Rule Development and Area Sources

SS:CB:li

LAC020531-05LI
Control Number

ORANGE COUNTY FIRE AUTHORITY
P.O. Box 86, Orange, CA 92856-0086 • 145 South Water St., Orange, CA 92866

Chip Prather, Fire Chief *(714) 744-0400*

RECEIVED
JUN 14 2002

June 10, 2002

Orange County Fair and Exposition Center
88 Fair Drive
Costa Mesa, CA 92626
Attn: Becky Bailey-Findley, CEO

Re: Notice of Preparation OC Fair and Exposition Center Master Plan

Dear Ms. Bailey-Findley:

Thank you for the opportunity to comment on the Notice of Preparation for the Fair and Exposition Center Master Plan. In response to our review, we concur with the findings that no negative impacts will result with the proposed changes to the facilities and services provided to the facilities. As I am sure you are aware, the facility is protected primarily through the use of automatic aid units from the city of Costa Mesa. Please note that all standard conditions and guidelines will be applied, as appropriate in the process, when actual improvements are made. Given the nature of events at the facility, we would recommend the use of installed fire protection systems whenever possible to provide the greatest level of protection to those how use your facility.

If you have any additional questions or concerns regarding this project, please contact my officer at (714) 744-0484 or at genebegnell@ocfa.org.

Sincerely,

Gene F. Begnell
Battalion Chief, Strategic Services

Pc: Costa Mesa Fire Department

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-4082
(916) 657-5390 - Fax

June 12, 2002

Becky Bailey-Findley
32 District Agriculture Association
88 Fair Drive
Costa Mesa, CA 92626

RE: SCH# 1989010088 – Orange County Fair and Exposition Center Update

Dear Ms. Bailey-Findley:

The Native American Heritage Commission has reviewed the Notice of Preparation (NOP) regarding the above project. To adequately assess and mitigate project-related impacts on archaeological resources, the Commission recommends the following actions be required:

- ✓ Contact the appropriate Information Center for a record search. The record search will determine:
  - If a part or all of the area of project effect (APE) has been previously surveyed for cultural resources.
  - If any known cultural resources have already been recorded on or adjacent to the APE.
  - If the probability is low, moderate, or high that cultural resources are located in the APE.
  - If a survey is required to determine whether previously unrecorded cultural resources are present.
- ✓ If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
  - The final report containing site forms, site significance, and mitigation measurers should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for pubic disclosure.
  - The final written report should be submitted within 3 months after work has been completed to the appropriate regional archaeological Information Center.
- ✓ Contact the Native American Heritage Commission for:
  - A Sacred Lands File Check.
  - A list of appropriate Native American Contacts for consultation concerning the project site and to assist in the mitigation measures.
- ✓ Lack of surface evidence of archeological resources does not preclude their subsurface existence.
  - Lead agencies should include in their mitigation plan provisions for the identification and evaluation of accidentally discovered archeological resources, per California Environmental Quality Act (CEQA) §15064.5 (f). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American, with knowledge in cultural resources, should monitor all ground-disturbing activities.
  - Lead agencies should include in their mitigation plan provisions for the disposition of recovered artifacts, in consultation with culturally affiliated Native Americans.
  - Lead agencies should include provisions for discovery of Native American human remains in their mitigation plan. Health and Safety Code §7050.5, CEQA §15064.5 (e), and Public Resources Code §5097.98 mandates the process to be followed in the event of an accidental discovery of any human remains in a location other than a dedicated cemetery.

Sincerely,

Rob Wood
Environmental Specialist III
(916) 653-4040

CC: State Clearinghouse

Community Development Department

City of Irvine, One Civic Center Plaza, P.O. Box 19575, Irvine, California 92623-9575 (949) 724-6000

June 12, 2002

Ms. Becky Bailey-Findley
CEO, Orange County Fair and Exposition Center
32 District Agriculture Association
88 Fair Drive
Costa Mesa, CA 92626

SUBJECT: NOTICE OF PREPARATION OF A DRAFT EIR FOR THE ORANGE COUNTY FAIR AND EXPOSITION CENTER MASTER PLAN

Dear Ms. Bailey-Findley:

The City of Irvine has received and reviewed the information on the above referenced project. Based on our review, Planning Services staff has no specific comments at this time.

Please provide a copy of the completed DEIR for the Master Plan to the City of Irvine when it becomes available for our subsequent review.

Thank you for the opportunity to review the project. We would appreciate information on any change in the project description as the planning process proceeds. If you have any questions, please contact me at (949) 724-6546.

Sincerely,

AMY URCIS
Associate Planner

cc: Leslie Aranda, Principal Planner

My Documents\AU\AR-OCFairNOP.ltr

SOUTHERN CALIFORNIA

ASSOCIATION of GOVERNMENTS

Main Office

818 West Seventh Street

12th Floor

Los Angeles, California

90017-3435

t (213) 236-1800

f (213) 236-1825

www.scag.ca.gov

Officers: President: Councilmember Hal Bernson, Los Angeles • First Vice President: Mayor Pro Tem Bev Perry, Brea • Second Vice President: Supervisor Charles Smith, Orange County • Immediate Past President: Supervisor Jon Mikels, San Bernardino County

Imperial County: Hank Kuiper, Imperial County • Jo Shields, Brawley

Los Angeles County: Yvonne Brathwaite Burke, Los Angeles County • Zev Yaroslavsky, Los Angeles County • Melanie Andrews, Compton • Harry Baldwin, San Gabriel • Bruce Barrows, Cerritos • George Bass, Bell • Hal Bernson, Los Angeles • Ken Blackwood, Lomita • Robert Bruesch, Rosemead • Gene Daniels, Paramount • Ruth Galanter, Los Angeles • Eric Garcetti, Los Angeles • Wendy Greuel, Los Angeles • James Hahn, Los Angeles • Janice Hahn, Los Angeles • Nate Holden, Los Angeles • Sandra Jacobs, El Segundo • Tom LaBonge, Los Angeles • Bonnie Lowenthal, Long Beach • Lawrence Kirkley, Inglewood • Keith McCarthy, Downey • Cindy Miscikowski, Los Angeles • Pam O'Connor, Santa Monica • Nick Pacheco, Los Angeles • Alex Padilla, Los Angeles • Jan Perry, Los Angeles • Beatrice Proo, Pico Rivera • Mark Ridley-Thomas, Los Angeles • Ed Reyes, Los Angeles • Karen Rosenthal, Claremont • Dick Stanford, Azusa • Tom Sykes, Walnut • Paul Talbot, Alhambra • Sidney Tyler, Jr., Pasadena • Dennis Washburn, Calabasas • Jack Weiss, Los Angeles • Bob Yousefian, Glendale • Dennis P. Zine, Los Angeles

Orange County: Charles Smith, Orange County • Ron Bates, Los Alamitos • Ralph Bauer, Huntington Beach • Art Brown, Buena Park • Lou Bone, Tustin • Elizabeth Cowan, Costa Mesa • Cathryn DeYoung, Laguna Niguel • Richard Dixon, Lake Forest • Alta Duke, La Palma • Shirley McCracken, Anaheim • Bev Perry, Brea • Tod Ridgeway, Newport Beach

Riverside County: Bob Buster, Riverside County • Ron Loveridge, Riverside • Greg Pettis, Cathedral City • Ron Roberts, Temecula • Jan Rudman, Corona • Charles White, Moreno Valley

San Bernardino County: Jon Mikels, San Bernardino County • Bill Alexander, Rancho Cucamonga • Lee Ann Garcia, Grand Terrace • Bob Hunter, Victorville • Susan Lien, San Bernardino • Gary Ovitt, Ontario • Debra Robertson, Rialto

Ventura County: Judy Mikels, Ventura County • Glen Becerra, Simi Valley • Carl Morehouse, San Buenaventura • Toni Young, Port Hueneme

Riverside County Transportation Commission: Robin Lowe, Hemet

Ventura County Transportation Commission: Bill Davis, Simi Valley

June 20, 2002

Ms. Becky Bailey-Findley, CEO
32 District Agriculture Association
88 Fair Drive
Costa Mesa, CA 92626

RE: SCAG Clearinghouse No. I 20020293 Orange County Fair and Exposition Center Master Plan

Dear Ms. Bailey-Findley:

Thank you for submitting the **Orange County Fair and Exposition Center Master Plan** to SCAG for review and comment. As areawide clearinghouse for regionally significant projects, SCAG reviews the consistency of local plans, projects and programs with regional plans. This activity is based on SCAG's responsibilities as a regional planning organization pursuant to state and federal laws and regulations. Guidance provided by these reviews is intended to assist local agencies and project sponsors to take actions that contribute to the attainment of regional goals and policies.

We have reviewed the **Orange County Fair and Exposition Center Master Plan**, and have determined that the proposed Project is not regionally significant per SCAG Intergovernmental Review (IGR) Criteria and California Environmental Quality Act (CEQA) Guidelines (Section 15206). Therefore, the proposed Project does not warrant comments at this time. Should there be a change in the scope of the proposed Project, we would appreciate the opportunity to review and comment at that time.

A description of the proposed Project was published in SCAG's **June 1, 2002** Intergovernmental Review Clearinghouse Report for public review and comment.

The project title and SCAG Clearinghouse number should be used in all correspondence with SCAG concerning this Project. Correspondence should be sent to the attention of the Clearinghouse Coordinator. If you have any questions, please contact me at (213) 236-1867. Thank you.

Sincerely,

JEFFREY M. SMITH, AICP
Senior Regional Planner
Intergovernmental Review

City of Huntington Beach

2000 MAIN STREET CALIFORNIA 92648

DEPARTMENT OF PLANNING

Phone 536-5271
Fax 374-1540
374-1648

June 24, 2002

Becky Bailey-Findley, CEO
Orange County Fair and Exposition Center
88 Fair Drive
Costa Mesa, CA 92626

Subject: Orange County Fair and Exposition Center Notice of Preparation

Dear Ms. Bailey-Findley:

The City of Huntington Beach has reviewed the Notice of Preparation and Initial Study for the proposed changes to the Orange County Fair and Exposition Center. The City of Huntington Beach looks forward to reviewing the draft EIR, specifically the traffic study.

Thank you for the opportunity to comment on the Notice of Preparation.

Sincerely,

Mary Beth Broeren
Principal Planner

STATE OF CALIFORNIA—BUSINESS AND TRANSPORTATION AGENCY GRAY DAVIS, *Governor*

DEPARTMENT OF TRANSPORTATION

DISTRICT 12
3337 Michelson Drive Suite 380
Irvine, CA. 92612-8894

June 26, 2002

Ms. Becky Bailey-Findley
32 District Agriculture Association
88 Fair Drive
Costa Mesa, CA 92626

File: IGR/CEQA
SCH#: 1989010088
Log #: 1080
SR #: 55

Subject: NOP of Draft Environmental Impact Report (DEIR) for the Orange County Fair and Exposition Center Master Plan

Dear Ms. Bailey-Findley,

Thank you for the opportunity to review and comment on **the Notice of Preparation (NOP) of Draft Environmental Impact Report (DEIR) for the Orange County Fair and Exposition Center Master Plan** dated June 4, 2002. The project consists of removing and replacing existing structures, constructing new additional structures, constructing additional parking areas, and establishing a coherent and thematic landscape, sign, and lighting plan. In general, the project will result in a core of facilities surrounded by a parking area. The core of facilities will be divided into two general areas – a Park (open space) area and Campus (buildings) area. The project is located in central Costa Mesa, on the north side of Fair Drive, between Newport Boulevard to the east and Fairview Drive to the west. Arlington Drive is located along the site's north boundary. Regional access is provided to the site by State Route 55 to the north and east.

Caltrans District 12 status is a review agency on this project, and has the following comments:

1. In the Initial Study Checklist, *Section X., Potential Environmental Effects/Issues, Part D., E., and F., Transportation/Circulation*, a traffic and circulation study is discussed. Please note that the environmental document needs to examine how the project will impact State Transportation Facilities, as well as planned changes to State Facilities.

2. If any project work (e.g. storage of materials, street widening, emergency access improvements, sewer connections, sound walls, stormdrain construction, street connections, etc.) occurs in the vicinity of the Caltrans Right-of-Way, an encroachment permit would be required and environmental concerns must be adequately addressed. If the environmental documentation for the project does not meet Caltrans requirements, additional documentation (e.g. Native American Heritage Commission consultation for cultural resources) would be required before approval of the encroachment permit. Please coordinate with Caltrans to meet requirements for any work within or near Caltrans Right-of-Way. **(See Attachment: *Environmental Review Requirements for Encroachment Permits*)**

3. All work within the State Right of Way must conform to Caltrans Standard Plans and Standard Specifications for Water Pollution Control, including production of a Water Pollution Control Program (WPCP) or Storm Water Pollution Prevention Plan (SWPPP) as required. Any runoff draining into Caltrans Right of Way from construction operations, or from the resulting project, cannot be approved

by District 12 Environmental Planning. Measures must be incorporated to contain all vehicle loads and avoid any tracking of materials, which may fall or blow onto Caltrans roadways or facilities. **(See Attachment: *Water Pollution Control Provisions)***

Please continue to keep us informed of this project and other future developments, which could potentially impact the transportation facilities. If you have any questions or need to contact us, please do not hesitate to call Lan Zhou at (949) 756-7827.

Sincerely,

Robert F. Joseph, Chief
Advanced Planning Branch

Attachements

c: Terry Roberts, Office of Planning and Research
Ron Helgeson, Caltrans HQ IGR/Community Planning
Leslie Manderscheid, Environmental Planning
Saied Hashemi, Traffic Operations

ENVIRONMENTAL REVIEW REQUIREMENTS FOR ENCROACHMENT PERMITS

Any Party, outside of Caltrans, that does work on a State Highway or Interstate Highway in California needs to apply for an encroachment permit. To acquire any encroachment permit, environmental concerns must be addressed. Environmental review of encroachment permit applications may take 3 weeks if the application is complete or longer if the application is incomplete. For soil disturbing activities (e.g. geotechnical borings, grading, usage of unpaved roads from which dirt and other materials may be tracked onto the State/Interstate highways, etc.), compliance with Water Quality and Cultural Resources Provisions are emphasized. Surveys may/ may not be soil-disturbing activities, depending on the site and survey method.

A complete application for environmental review includes the following:

1. If an environmental document (CE, EIR/EIS, ND, etc.) has been completed for the project, copy of the final, approved document must be submitted with the application.

2. **Water Quality Provision:** All work within the State Right of Way must conform to Caltrans Standard Plans and Standard Specifications for Water Pollution Control including production of a Water Pollution Control Program or Storm Water Pollution Prevention Plan as required. The applicant must provide Encroachments with a copy of the Storm Water Pollution Prevention Plan (SWPPP) including Best Management Practices (BMPs) to be implemented for construction activities impacting Caltrans Right of Way, prepared for this as required by the NPDES Statewide Storm Water Permit for General Construction Activities. If no SWPPP has been prepared for this project, then the applicant must follow the requirements described in the attached Water Pollution Control Provisions (please see attachment).

3. **Cultural Resources Provisions:** If not included in the environmental document, before permit approval and project construction, the encroachment permit applicant must complete a *Cultural Resource Assessment* pursuant to Caltrans Environmental Handbook, Volume 2, Appendix B-1, and Exhibit 1, as amended. The Cultural Resources Assessment ascertains the presence or absence of cultural resources within a one-mile radius of the project area and evaluates the impact to any historical/cultural resource. Cultural Resources include "those resources significant in American history, architecture, archaeology, and culture, including Native American Resources" (Caltrans Environmental Handbook, Volume 2, Chapter1, as amended)]. The Cultural Resource Assessment must include:
   a) a clear project description and map indicating project work, staging areas, site access, etc.;
   b) a Record Search conducted at the South Central Coastal Information Center (SCCIC) located at California State University, Fullerton. For information call (714) 278-5395;
   c) proof of Native American consultation. Consultation involves contacting the Native American Heritage Commission (NAHC), requesting a search of their Sacred Lands File, and following the recommendations provided by the NAHC. For information call (916) 653-4082;
   d) documentation of any historic properties (e.g. prehistoric and historic sites, buildings, structures, objects, or districts listed on, eligible for, or potentially eligible for listing on the National Register of Historic Places) within a one mile radius of the project area;
   e) and a survey by qualified archaeologist for all areas that have not been previously researched.

   The SCCIC and NAHC have an approximate turn around time of 2 weeks.

4. **Biological Resources Provisions:** Work conducted within Caltrans Right of Way should have the appropriate plant and wildlife surveys completed by a qualified biologist. If the information is not included in the environmental document, Environmental Planning requests that the applicant submit a copy of the biological study, survey, or technical report by a qualified biologist that provides details on the existing vegetation and wildlife at the project site and any vegetation that is to be removed during project activities. Official lists and databases should also be consulted for sensitive species such as the California Natural Diversity Database and lists provided by the U.S. Fish and Wildlife Service and the California Department of Fish and Game. Any impacts that affect waterways and drainages and/or open space during construction, or that occur indirectly as a result of the project must be coordinated with the appropriate resource agencies. As guidance, we ask that the applicant include:
   a) clear description of project activities and the project site
   b) completed environmental significance checklist (not just yes and no answers, but a description should be given as to the reason for the response),
   c) staging/storage areas noted on project plans,
   d) proposed time of year for work and duration of activities (with information available),
   e) any proposed mitigation (if applicable to the project),
   f) and a record of any prior resource agency correspondence (if applicable to the project).

ATTACHMENT
CALTRANS DISTRICT 12

WATER POLLUTION CONTROL PROVISIONS

Any runoff draining into Caltrans Right of Way must fully conform to the current discharge requirements of the Regional Water Quality Control Board (RWQCB) to avoid impacting water quality. Permittee shall fully conform to the requirements of the Caltrans Statewide National Pollutant Discharge Elimination System (NPDES) Storm Water Permit, Order No. 99-06-DWQ, NPDES No. CAS000003, adopted by the State Water Resources Control Board (SWRCB) on July 15, 1999, in addition to the BMPs specified in the Caltrans Storm Water Management Plan (SWMP). When applicable, the Permittee will also conform to the requirements of the General NPDES Permit for Construction Activities, Order No. 99-08-DWQ, NPDES No. CAS000002, and any subsequent General Permit in effect at the time of issuance of this Encroachment Permit. These permits regulate storm water and non-storm water discharges associated with year-round construction activities.

Please note that project activities should pay extra attention to storm water pollution control during the "Rainy Season" (October 1st – May 1st) and follow the Water Pollution Control BMPs to minimize impact to receiving waters. Measures must be incorporated to contain all vehicle loads and avoid any tracking of materials, which may fall or blow onto Caltrans Right of Way.

For all projects resulting in 2 hectares (5 acres) or more of soil disturbance or otherwise subject to the NPDES program, the Contractor will develop, implement, and maintain a Storm Water Pollution Prevention Plan (SWPPP) conforming to the requirements of the Caltrans Specification Section 7-1.01G "Water Pollution Control", Caltrans Statewide NPDES Permit, the General NPDES Permit for Construction Activities, and the Caltrans Storm Water Quality Handbooks "Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual", and "Construction Site Best Management Practices (BMPs) Manual" effective November 2000, and subsequent revisions. In addition, the SWPPP must conform to the requirements of the SWRCB Resolution No. 2001-046, the Sampling and Analytical Procedures (SAP) Plan.

For all projects resulting in less than 2 hectares (5 acres) of soil disturbance or not otherwise subject to the requirements of the NPDES program, the Contractor will develop, implement, and maintain a Water Pollution Control Program (WPCP) conforming to the requirements of Caltrans Specifications Section 7-1-.01G, "Water Pollution Control", and the Caltrans Storm Water Quality Handbooks "Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual", and "Construction Site Best Management Practices (BMPs) Manual" effective November 2000, and subsequent revisions.

Copies of the Permits and the Construction Contractor's Guide and Specifications of the Caltrans Storm Water Quality Handbook may be obtained from the Department of Transportation, Material Operations Branch, Publication Distribution Unit, 1900 Royal Oaks Drive, Sacramento, California 95815, Telephone: (916) 445-3520. Copies of the Permits and Handbook are also available for review at Caltrans District 12, 3347 Michelson Drive, Suite 100, Irvine, California 92612, Telephone: (949) 724-2260. Electronic copies can be found at http://www.dot.ca.gov/hq/construc/stormwater.html

CITY OF NEWPORT BEACH

P.O. BOX 1768, NEWPORT BEACH, CA 92659-1768

RECEIVED

JUL - 1 2002

June 26, 2002

Becky Bailey-Findley,CEO
Orange County Fair and Exposition Center
32nd District Agriculture Association
88 Fair Drive
Costa Mesa, CA 92626

RE: NOTICE OF PREPARATION: ORANGE COUNTY FAIR AND EXPOSITION CENTER MASTER PLAN

Dear Ms. Bailey-Findley:

Thank you for the opportunity to respond to the Notice of Preparation (NOP) for the Draft Environmental Impact Report relating to the pending Fairgrounds Master Plan. After reviewing the initial study and the specific components of the project, the City of Newport Beach does not have any comments regarding the potential environmental impacts resulting from the proposed plan at this time.

As an aside to the NOP, the City's of Costa Mesa and Newport Beach have recently joined forces in an effort to address the growing need for a skateboard park in the area. The Fairgrounds site has been identified as an ideal location for such a facility. It is possible that if the Fairgrounds were interested in reserving space and allowing the development of a skateboard park, Newport Beach could assist with construction costs. Costa Mesa might be willing to do the same.

Please give me a call so that we can discuss the inclusion of a skateboard park in the proposed Master Plan. My phone number is (949) 644 - 3238.

Best wishes,

Tamara J. Campbell

Tamara J. Campbell, AICP
Senior Planner
City of Newport Beach

CITY OF COSTA MESA

P.O. BOX 1200 • 77 FAIR DRIVE • CALIFORNIA 92628-1200

DEVELOPMENT SERVICES DEPARTMENT

June 28, 2002

Ms. Becky Bailey-Findley, CEO
Orange County Fair and Exposition Center
88 Fair Drive
Costa Mesa CA 92626

Subject: ORANGE COUNTY FAIR AND EXPOSITION CENTER MASTER PLAN NOTICE OF PREPARATION

Dear Ms. Bailey-Findley,

Thank you for the opportunity to review the Orange County Fair and Exposition Center Master Plan Notice of Preparation. The City's comments are attached to this letter for review and use in the preparation of the Draft Environmental Impact Report (EIR). These include comments from the Planning Division, Transportation Services Division, Police Department, and Fire Department.

All future correspondence regarding the Master Plan EIR should be addressed to me. I will be responsible for coordinating the distribution of these correspondences, as appropriate.

I look forward to receiving the Draft EIR, and I hereby request that the City be given 4 copies of the EIR (including the technical appendices) to expedite our review.

Sincerely,

Kimberly Brandt

KIMBERLY BRANDT
Senior Planner

cc: City Council
Allan Roeder, City Manager
Jerry Scheer, City Attorney
Don Lamm, Deputy City Mgr.- Dev. Svs. Director
Perry Valantine, Assistant Development Svs. Director
Mike Robinson, Planning and Redevelopment Mgr.
Bill Morris, Public Services Director
Peter Naghavi, Transportation Services Manager
David Snowden, Police Chief
Sue Hupp, Crime Prevention Specialist
Jim Ellis, Fire Chief
Tom Macduff, Fire Marshal

City of Costa Mesa's Comments to the OCFEC Master Plan Notice of Preparation

III. Surrounding Land Uses: Please include the Costa Mesa Civic Center and correct spelling in Figure 2.

IV. Proposed Project Description: Please discuss existing use of the Fairgrounds during the weekdays including the Farmers' Market on Thursday. The EIR should include statistics on the increase in weekday use of the parking lots for miscellaneous commercial uses such as used automobile sales and vehicle road testing/ driving schools.

Please include in the EIR complete background information on the Pacific Amphitheater.

Please include in the description the amount of on-site landscaping, both existing and proposed.

Please delineate in Tables A and B how many acres are devoted to parking areas.

Please clarify Table C; it is confusing as it is currently drafted. For instance what does the total of "201,359" refer to?

Please discuss any proposed changes to fairgrounds activities. Will there be more exhibitions throughout the year, potential attendance at exhibit halls, usage of amphitheater, etc.

V. Discretionary Actions: The NOP refers to "land use guidelines"; what is the intended use of these guidelines?

VI. Lead, Responsible, and Trustee Agencies. This sections states that there are no responsible agencies for this project. Yet in the following section, it is stated that the NOP was sent to Responsible Agencies. Please clarify this discrepancy.

X. Potential Environmental Effects/Issues

Sections D and E should be listed as a **Potential Significant Effect** It is premature to conclude that the project's transportation impacts will be less than significant, prior to the completion of the Draft EIR. Additionally, the City of Costa Mesa level of service thresholds and policies should be used for the determination of adverse impacts.

Other traffic-related issues include truck haul routes, and impacts on the City's Police Department for traffic control.

The EIR should include a Traffic Management Plan to ensure all impacts are identified and mitigated. It is expected that the project will result in additional traffic being generated to the area impacting several intersections throughout the City. These impacts should be evaluated and addressed in detail for fairgrounds activity during the Orange County Fair (fair time) and during the regular periods of the year (non-fair time).

The EIR should also compare the traffic projections for the project to the assumptions in the City's traffic model for the project site.

Section F. Again, the City believes it is premature to find the parking impacts to be "less that significant" prior to the completion of the Draft EIR. Section F should be listed as a "**Potentially Significant Effect**" The EIR should address in detail the parking demand for the proposed project.

Sections G and H: The air quality analysis should include construction grading mitigation measures including hours of construction/grading and dust mitigation.

Sections I and J. Again, it is premature to find noise impacts to be less than significant at this time. The noise analysis should use the Costa Mesa Noise Ordinance and 2000 General Plan for thresholds and the determination of adverse impacts. In addition, any other noise thresholds established during the historic litigation related to the amphitheater should be applied, where appropriate. The City believes that the amphitheater earthen berm provides noise mitigation. Therefore, the noise analysis should address noise impacts on surrounding area from the amphitheater with and without the berm.

Biological Resources. The Initial Study has dismissed potential impacts to Biological Resources as a result of the project; the City disagrees with this conclusion. The project includes removal of the earthen berm, which contains mature trees; therefore, the EIR should include a biological survey of the fairgrounds and discuss potential impacts to wildlife habitat and nesting sites. Additionally, older City records indicate the previous location/siting of burrowing owls on the Fairgrounds property. The site should once again be surveyed for burrowing owls.

Sections K and L. The EIR should include a photometric plan. In addition to view simulations and lighting impacts analysis, the EIR should also address the visual impacts of the Fairground signage. The Fairgrounds Master Plan should include a comprehensive sign program for the entire property and a perimeter landscape plan.

Section M. The EIR should address impacts to the Police Department in respect to traffic control and protection services. Increased demand for fire and medical responses should also be addressed. (It should be noted that there is an area sheltered by landscaping between the chain link fence and Newport Boulevard. The existing landscaping is over 6 feet high and creates a haven between the chain link fence and the street for transients. The landscape concept plan should replace this landscaping.)

County of Orange
Planning & Development Services Department

THOMAS B. MATHEWS
DIRECTOR

300 N. FLOWER ST.
SANTA ANA, CALIFORNIA

MAILING ADDRESS:
P.O. BOX 4048
SANTA ANA, CA 92702-4048

NCL 02-63

June 27, 2002

Becky Bailey-Findley, CEO
Orange County Fair and Exposition Center
88 Fair Drive
Costa Mesa, CA 92626

SUBJECT: NOP for the Orange County Fair and Exposition Center Master Plan

Dear Ms. Bailey-Findley:

The above referenced item is a Notice of Preparation (NOP) of a Draft Environmental Impact Report (DEIR) for the Orange County Fair and Exposition Center. The project site is located in central Costa Mesa, on the north side of Fair Drive, between Newport Boulevard (southbound) to the east and Fairview Drive to the west. The proposed project involves removing and replacing existing structures, constructing new additional structures, constructing additional parking areas, and establishing a coherent and thematic landscape, sign, and lighting plan. In general, the project will result in a core of facilities surrounded by a parking area.

The County of Orange has reviewed the NOP and offers the following comments:

FLOOD

1. The proposed project is for the adoption of a Master Plan for a series of actions, programs and guidelines for the future redevelopment of portions of the fairgrounds at the Orange County Fair & Exposition Center (OCFEC). Project site is tributary indirectly to the Orange County Flood Control District (OCFCD) facility Paularino Channel (F03). The potential for adversely impacting the OCFCD facility should be identified and appropriate mitigation proposed in the DEIR. Hydrologic and hydraulic studies should be conducted to assess the existing channel capacities and water quality issues.

2. Please note that the surface runoff at Paularino Channel drains indirectly to the Upper Newport Bay, which is identified by the Santa Ana Regional Water Quality Control Board (RWQCB) for water quality problems for sediments, nutrients pathogens, etc. The post project runoff from the project implementation should be analyzed, both

qualitatively and quantitatively, to ensure that it meets the limits of the Total Maximum Daily Loads (TMDLs) established by the Regional Board. Please be aware that a Watershed Reconnaissance Study for Newport Bay has been completed by the U.S. Army Corps of Engineers to assist in the restoration of the system. We suggest Chris Crompton, Manager of Environmental Resources be consulted on all water quality related issues. Mr. Crompton may be reached at (714) 567-6360.

OPEN SPACE/RECREATION

Class I (paved off-road) Bikeways:

3. The DEIR should contain the following information:

   a. Bikeways are mitigation measures to help reduce air pollution, traffic congestion, parking congestion, and noise. Class I bikeways in particular, because they are off-road and suitable for bicyclists and pedestrians with a wide range of ages and abilities, serve to encourage bicycling and walking as alternative modes of transportation and recreation.

   b. A portion of the Orange County Fair employees and visitors would be expected to walk or bicycle to the project site, especially if off-road bikeways were available. Currently a Class I bikeway exists along the south and east sides of the project site. Furthermore, the project site is located only about 2 miles from the Santa Ana River Bikeway, a regional Class I bikeway that extends from the Riverside County border to the Pacific Ocean.

4. Recommendations: We recommend the following mitigation measures to encourage bicycling and walking to the project site:

   a. Continue the Class I bikeway around the entire perimeter of the project site, and include landscaping with shade trees.

   b. Support the City's ongoing effort to implement Class I bikeways between the project site and the Santa Ana River Bikeway.

   c. Install bike racks and/or lockers near all Fair entrances and other appropriate areas throughout the site.

   d. Design entrances to incorporate easy access for bicyclists, including off-road connections between the perimeters Class I bikeway and bike racks/lockers.

Regional Riding and Hiking Trail:

5. The DEIR should contain the following information:

a. The County's Master Plan of Regional Riding and Hiking Trails (MPRRHT) identifies the Santa Ana Heights Trail, a regional trail proposed to extend from the project's Equestrian Center to Upper Newport Bay Ecological Preserve. The trail, which is used by mountain bicyclists, hikers, and equestrians, is designed to allow trail users to reach the extensive trail and bikeway network in the Back Bay area.

b. The County is already working with the Santa Ana Heights Project Advisory Committee (PAC) and the OCFCD to extend the trail from the Upper Newport Bay Ecological Preserve to the intersection of Santa Ana Avenue and Mesa Drive, via the Santa Ana Delhi Channel and Santa Ana Avenue. The County will also work with the City of Costa Mesa to continue the trail along Mesa Drive, to the intersection of Mesa Drive and Newport Boulevard.

6. We recommend the DEIR incorporate the following mitigation measures, consistent with the MPRRHT requirement to link the Santa Ana Heights trail to the Orange County Fairgrounds stable facility, as well as special attention given to the trail as it crosses Newport Boulevard:

a. The OCFEC dedicate a recreation easement and/or enter into license agreement for regional riding and hiking trail purposes over the alignment of the Santa Ana Heights Trail (connection to the Equestrian Center, or designated proposed staging area per the MPRRHT), to the County of Orange.

b. OCFEC shall design and construct the portion of the regional trail from the Equestrian Center to the intersection of Newport Boulevard and Mesa Drive, per County regional trail standards. These standards include, but are not limited to, a 10-foot-wide usable trail surface of decomposed granite (DG), 3 feet of shy distance on each side, and horse-height traffic signal buttons at the intersection. HBP suggests the trail be routed along the east edge of the Equestrian Center and proposed Swap Meet area, within a landscaped setback with shade trees.

7. Because the Santa Ana Heights PAC has a strong interest in completing the regional trail, the County requests that subject NOP and subsequent environmental documents be sent to the PAC for its review. For information on the PAC, please contact Mr. Mark Esslinger of the County's Planning and Development Services Department, at (714) 834-5049.

Equestrian Center Resizing:

8. The NOP indicates the future proposed equestrian center to be reduced in size from 500, 900 square feet (11.5 acres), to 330, 000 square feet (7.57 acres). This represents a substantial reduction of 170, 940 square feet (3.92 acres) for the equestrian center. Insofar as this facility boards and trains horses in addition to accommodation of horse shows, the DEIR should provide the following:

a. An impact analysis of the loss of equestrian facilities acreage to recreational equestrian users, including but not limited to the following:

i. An evaluation of the number of existing horses accommodated and the number of horses to be forced to other quarters.

ii. Viable evaluation of alternative venues for equestrian users loosing facilities for horses.

2. Insofar as it appears the proposed project will negatively impact recreational equestrian users, HBP recommends the proposed project be redesigned so as not to reduce the size of the existing equestrian center

HISTORICAL

9. The proposed project description states that the Orange County fair has operated at this location for over 50 years. The DEIR should address potential impacts to any historical structures, buildings or heritage trees that may be removed or replaced as a result of this project.

10. The Orange County Historical Commission would appreciate receiving a copy of the DEIR and any related cultural resources or historic structure reports for their review.

WASTE MANAGEMENT

11. The project, to develop a Master Plan for the O.C. Fair and Exposition Center, which will require redevelopment of a portion of the Fairgrounds, proposes to remove and replace existing structures and construct new structures and additional parking areas. The O.C. Fair, a 17-day event, drew 800,000 people last summer. In addition, events and exhibitions occur each weekend, including the O.C. Marketplace, a swap meet that occupies a portion of the parking lot. These activities and the construction and demolition material that is to be generated by the construction planned will generate significant amounts of waste.

Notwithstanding the availability of Refuse Disposal Capacity in the County system, Orange County recommends that the project developer contact the City's recycling coordinator in Costa Mesa to ensure that the proposed project is in compliance with the city's waste reduction and recycling program. These programs implement state law, which requires that each city and county demonstrate a reduction of at least 50 percent in the amount of waste from that jurisdiction that had gone into landfills in the year 1990. Also, the state requires that this level of reduction be sustained in perpetuity. Waste haulers are expected to contribute by recycling residential and commercial waste they have collected, and project developers are expected to employ measures to reduce the amount of construction-generated waste by 50 percent or more.

In order to understand the solid waste capacity issue for Orange County, it is necessary to distinguish between refuse disposal capacity and flow rate or daily capacity. Refuse disposal capacity refers to the available air space capacity at one or more County landfills. Daily capacity refers to the maximum amount of daily permitted tonnage that may be disposed. The landfill permit establishes these capacities.

Refuse Disposal Capacity: The County of Orange owns and operates three active landfills. These are the Olinda Alpha Landfill near Brea, the Frank R. Bowerman Landfill near Irvine, and the Prima Deshecha Landfill in San Juan Capistrano. The Frank R. Bowerman Landfill is the closest facility to the project, and will likely be the solid waste facility most often receiving the waste from the subject project. Notwithstanding, the City of Costa Mesa is under contract to the County's Integrated Waste Management Department (IWMD) to commit all of its waste to the County landfill system (not to a particular facility) until the year 2007.

The California Integrated Waste Management Board requires that all counties have an approved Countywide Integrated Waste Management Plan (CIWMP). To be approved, the CIWMP must demonstrate sufficient solid waste disposal capacity for at least 15 years, or identify additional available capacity outside of the county's jurisdiction. Orange County's CIWMP, approved in 1996, contains future solid waste disposal demand based on the County population projections previously adopted by the Board of Supervisors. The Orange County landfill system has capacity in excess of 15 years. Consequently, it may be assumed that adequate capacity for the subject project is available for the foreseeable future.

Daily Capacity: In order to ensure that the maximum permitted daily tonnage at a particular site is not exceeded, refuse trucks may have to transport material to one of the other two facilities identified above. Accordingly, your document should address transport of refuse from this project to any of the three active landfills.

At this time, IWMD does not have information on solid waste generation rates in Orange County. Any questions about solid waste generation rates should be forwarded to the California Integrated Waste Management Board in Sacramento.

Thank you for the opportunity to respond to the NOP. Please send one complete set of the DEIR to me at the above address when it becomes available. If you have any questions, please contact Charlotte Harryman at (714) 834-2522.

Sincerely,

for Timothy Neely, Manager
Environmental Planning Services Division

ch

The Gas Company®

A Sempra Energy® utility

Southern California Gas Company
Technical Services Department
1919 S. State College Blvd., Bldg. A
Anaheim CA. 92806

SEP 16 2002

September 9, 2002

Orange County Fair and Exposition Center
88 Fair Drive
Costa Mesa, CA. 92626

Attention: Becky Bailey-Findley

Subject: N.O.P. of a Draft E.I.R. Orange County Fair and Exposition Center Master Plan

Thank you for providing the opportunity to respond to this E.I.R. (Environmental Impact Report) Document. We are pleased to inform you that Southern California Gas Company has facilities in the area where the aforementioned project is proposed. Gas service to the project can be provided from an existing gas main located in various locations. The service will be in accordance with the Company's policies and extension rules on file with the California Public Utilities Commission when the contractual arrangements are made.

This letter is not a contractual commitment to serve the proposed project but is only provided as an informational service. The availability of natural gas service is based upon conditions of gas supply and regulatory agencies. As a public utility, Southern California Gas Company is under the jurisdiction of the California Public Utilities Commission. Our ability to serve can also be affected by actions of federal regulatory agencies. Should these agencies take any action, which affect gas supply or the conditions under which service is available, gas service will be provided in accordance with the revised conditions.

This letter is also provided without considering any conditions or non-utility laws and regulations (such as environmental regulations), which could affect construction of a main and/or service line extension (i.e., if hazardous wastes were encountered in the process of installing the line). The regulations can only be determined around the time contractual arrangements are made and construction has begun.

Estimates of gas usage for residential and non-residential projects are developed on an individual basis and are obtained from the Commercial-Industrial/Residential Market Services Staff by calling (800) 427-2000 (Commercial/Industrial Customers) (800) 427-2200 (Residential Customers). We have developed several programs, which are available upon request to provide assistance in selecting the most energy efficient appliances or systems for a particular project. If you desire further information on any of our energy conservation programs, please contact this office for assistance.

Sincerely,

Carey Downs
Technical Supervisor
West Region-Anaheim

Cc: Nicole Dubois-LSA Associates
dja
eir02.doc

RESPONSES TO QUESTIONNAIRES

RESPONSE SHEET

SEP 17 2002

Orange County Sheriff's Department
North Operations Division
550 North Flower Street
Santa Ana, CA 92703

For your convenience, we have provided space on this questionnaire for your answers. If you choose to answer these questions in a letter form, please number your responses to correspond to the questions. Please fax your responses to (949) 553-8076. Mail originals to: LSA Associates, Inc., Attn: Nicole Dubois, 20 Executive Park, Suite 200, Irvine, CA 92614.

1. What are the locations, types, and capacity of your facilities that service the area, and how near capacity are they now operating?

   This Department does not have a permanent facility on the fairgrounds.

2. What level of service do you presently provide to the project area?

   We provide law enforcement services. We are contracted by the fairgrounds to provide law enforcement services 24/7. In addition, we deploy patrol personnel, over 900 shifts, during the 17-day annual Fair. We also deploy personnel through the year to the weekly marketplace and large events on the fairgrounds.

3. Are there any current plans for expansion of your services or facilities in the area? If yes, please briefly describe.

   SERVICES
   Due to the increased scheduling of major events at the fairgrounds, the request for patrol deputies assigned to major events have increased over the last 12 years. The request for more services may possibly again increase if the Pacific Amphitheater is re-opened.
   FACILITY
   The Department does not have a facility at the fairgounds. During the 17-day annual Fair, we operate from a Command Center Bus and Trailer parked on a lawn near Gate 5.

4. Will the project create a need to expand existing facilities or staff or to construct a new facility, or otherwise adversely impact the types of services you provide? Please explain.

   The expansion project may increase the number of large events that will require direct law enforcement services. With the Fair requiring over 900 shifts and the deployment of personnel for large events, a permanent facility for law enforcement should be considered. This facility could be used as a Command Center and Base of Operations.

5. What standard consumption or generation rates do you use in assessing service demands?

   N/A

6. Can you recommend any measures for mitigating project impacts that might be incorporated into the project?

   None

Prepared by: Lt. Dennis DeMaio

Title: Lieutenant

Date: September 6, 2002

Phone: (714) 647-4559

RESPONSE SHEET

Costa Mesa Fire Department
PO Box 1200
Costa Mesa, CA 92628-1200

SEP 2 3 2002

For your convenience, we have provided space on this questionnaire for your answers. If you choose to answer these questions in a letter form, please number your responses to correspond to the questions. Please fax your responses to (949) 553-8076. Mail originals to: LSA Associates, Inc., Attn: Nicole Dubois, 20 Executive Park, Suite 200, Irvine, CA 92614.

1. What are the locations, types, and capacity of your facilities that service the area, and how near capacity are they now operating?

1) FIVE STATIONS (6)

2) @PRIMARY STATION (VANGUARD/FAIR)
(B) BAKER/RANCHO (F) 3350 SAKIOKA
(C) ROYAL PALM/ADAMS
(D) 2300 PLACENTIA
(E) 1865 PARK

2. What level of service do you presently provide to the project area?

CURRENTLY WE PROVIDE FIRE/EMS PROTECTION TO THE FAIRGROUNDS

3. Are there any current plans for expansion of your services or facilities in the area? If yes, please briefly describe.

NO, THERE ARE NO CURRENT PLANS

4. Will the project create a need to expand existing facilities or staff or to construct a new facility, or otherwise adversely impact the types of services you provide? Please explain.

NO, THIS PROJECT DOES NOT EFFECT THE FIRE DEPARTMENT.

5. What standard consumption or generation rates do you use in assessing service demands?

NONE

6. Can you recommend any measures for mitigating project impacts that might be incorporated into the project?

(1) LIMIT PROJECT WORK ON WEEKENDS WHEN OC MARKET PLACE IS IN OPERATION. ALSO, DURING THE O.C. FAIR AS TRAFFIC FOR BOTH IS IN LARGE VOLUMES.

Prepared by: FRED SEGUIN

Title: FIRE CAPTAIN "MEDIC" C SHIFT

Date: 9/17/02

Phone: (714) 754-5005

Costa Mesa Sanitary District

... an Independent Special District

Board of Directors
Arlene Schafer
Greg Woodside
Art Perry
James Ferryman
Dan Worthington

September 25, 2002

SEP 30 2002

Ms. Becky Bailey-Findley
Chief Executive Officer
Orange County Fair and Exposition Center
88 Fair Drive
Costa Mesa, CA 92626

RE: Orange County Fairgrounds Master Plan

Dear Becky:

Thank you for the opportunity to comment on the proposed master plan for the Fairgrounds. In addition to providing comments on the master plan, this letter will recap the status of various items that relate to sewer service in and around the Fairgrounds.

Existing Sewer Service to the Fairgrounds

In 1990, the Fairgrounds, the Costa Mesa Sanitary District, and the Orange County Sanitation District (then known as County Sanitation Districts of Orange County) entered into a three party agreement whereby the two main sewer lines on Fairgrounds property were transferred from the Orange County Sanitation District (OCSD) to the Fairgrounds. The two sewers were constructed as part of the airbase and because they acted essentially as private on-site sewers the transfer was made. Attached is an exhibit that shows these two sewers. When these sewers leave the Fairgrounds property they tie into public sewers.

There are various other on-site private sewer lines that tie into these two main lines, however, no records exist with either OCSD or CMSD as to the location of these lines. Field personnel from the Fairgrounds may know of their location.

Current Improvement Project for Off-site Public Sewers

As of this date, the westerly public sewer system serving the Fairgrounds is being improved. The improvement consists of a new sewer in Arlington Drive, rehabilitation of the existing sewer through Davis School and Costa Mesa High School, and a new sewer on Costa Mesa High School property flowing to Fairview Road. The sewer improvement is a joint effort between OCSD and the CMSD and upon completion, the system will be transferred to the Costa Mesa Sanitary District in accordance with the concept of having local sewers owned by the local sewer agency. Upon completion, the standard CMSD yearly sewer fees will be due from the Fairgrounds and the fees are based on the square footage of all buildings connected to the system.

Phone
(714) 754-5043

Fax
(714) 432-1436

Mailing Address
P. O. Box 1200
Costa Mesa, CA
92628-1200

Street Address
77 Fair Drive
Costa Mesa, CA
92626-6520

Printed on Recycled Paper

Impact of the Proposed Fairgrounds Master Plan

The two main private sewers leaving the fairgrounds property tie into CMSD sewers and theses CMSD sewers will be receiving flows from the projected master plan development. Based on the layout, size and use of the buildings as shown in the May 2002 Notice of Preparation provided to this office, there are no anticipated negative impacts from the future sewer flows. When the sewer now under construction in Arlington Drive was designed, considerations were given for anticipated maximum and peak flows from the Fairgrounds property. The easterly CMSD sewer also appears adequate to handle the master plan flows, however, there is an unknown crisscross of the on-site sewers so the actual number of present and future master plan connections to the easterly sewer is unknown.

It is requested the Fairgrounds provide a map of the on-site sewers and the present and future buildings that will be served by each line. In general, new sewer connections should be directed to the westerly sewer system.

Existing CMSD Sewers on Fairgrounds Property

In 1995, the CMSD initiated a construction project to upgrade its pressure sewer line force main that traversed the southeast corner of the Fairgrounds property. In cooperation with the City of Costa Mesa and the Fairgrounds, the line was relocated under the bicycle trail from the intersection of Fair Drive and Newport Blvd to the main Fairgrounds entrance and a new concrete bicycle trail constructed over top of the line.

In conjunction with the construction, three easement documents were prepared. They are an easement from the Fairgrounds to the CMSD for the new pressure sewer line, an easement from the Fairgrounds to the City for the bicycle trail for the entire bicycle trail along Fair Drive from Newport Blvd. to Fairview Road, and an easement from the Fairgrounds to the City for the right turn lane from Fair Drive into the Fairgrounds main entrance. This easement was never completed after the. construction of the right turn lane was completed in 1986.

Prior to preparation of the three easement documents, discussions were held with Rick Pickering of the Fairgrounds and Gerald Anderson from the State's Sacramento office. The documents were first sent to Mr. Anderson on May 14, 1996, however, no review or comments were returned. The Sanitary District followed up the submittal with many phone calls and the City made phone calls and sent additional copies of the easement documents for comments. Because the Sacramento office has never followed through with any type of response, the documents remain unrecorded.

It is suggested that assistance from the local Fairgrounds administrative office be provided to complete the review and recording process for the easements. Without the recording, there may be some Fairgrounds liabilities because the responsibility for the bicycle trail, sidewalk, and right turn lane have not been transferred to the City.

Maintenance of On-site Sewer Lines

As a courtesy to the Fairgrounds, CMSD field crews performed an annual cleaning of some of the on-site sewer mains prior to the yearly fair. After the transfer from OCSD to the Fairgrounds for the two sewer mains, OCSD provided five years of maintenance. Subsequently, at the request of Rick Pickering, after the construction of the Sanitary District's new pressure sewer line, the CMSD provided five more years of cleaning.

If not already in place, it is suggested the Fairgrounds make arrangements for sewer maintenance services for its sewer system. Maintenance should include yearly cleaning and a periodic televising of the pipeline interior. A video of the pipeline interior is an excellent tool for sewer maintenance as it will disclose the structural condition of the line. Maintenance of sewer lines is very important to insure a long life expectancy.

No Rainwater Allowed in Sewer System

Lastly, near the equestrian area, the Fairgrounds recently connected a series of surface water drains that flow to the sewer system. This is a direct violation of the requirement that surface water runoff, in any quantity, is prohibited from entering the sewer system. During discovery of these drains, it was also discovered that animal wash down areas have sewer drains that are exposed to rainwater and surface water runoff. All of the connections to the sewer system that are subject to accepting rainwater or surface water runoff must be immediately removed. The beginning of the rainy season is designated as October 15 and all these connections must be removed by this date.

It is important to note that whether or not the Fairgrounds is State property, any connection to the sewer system requires a permit from the Costa Mesa Sanitary District. With respect to rainwater and surface water runoff, the treatment plant owner, the Orange County Sanitation District, is spending $10 million to identify the sources of illegal connections because the treatment plants are under severe strain during the winter months as they are experiencing 450 million gallons per day of illegal surface water runoff entering the sewer system.

As you make plans to terminate these connections to the sewer system, this office provides free assistance in designing and planning alternative drainage methods.

Thank you for the opportunity to provide these comments. If you have any questions, please call me at (949) 631-1731.

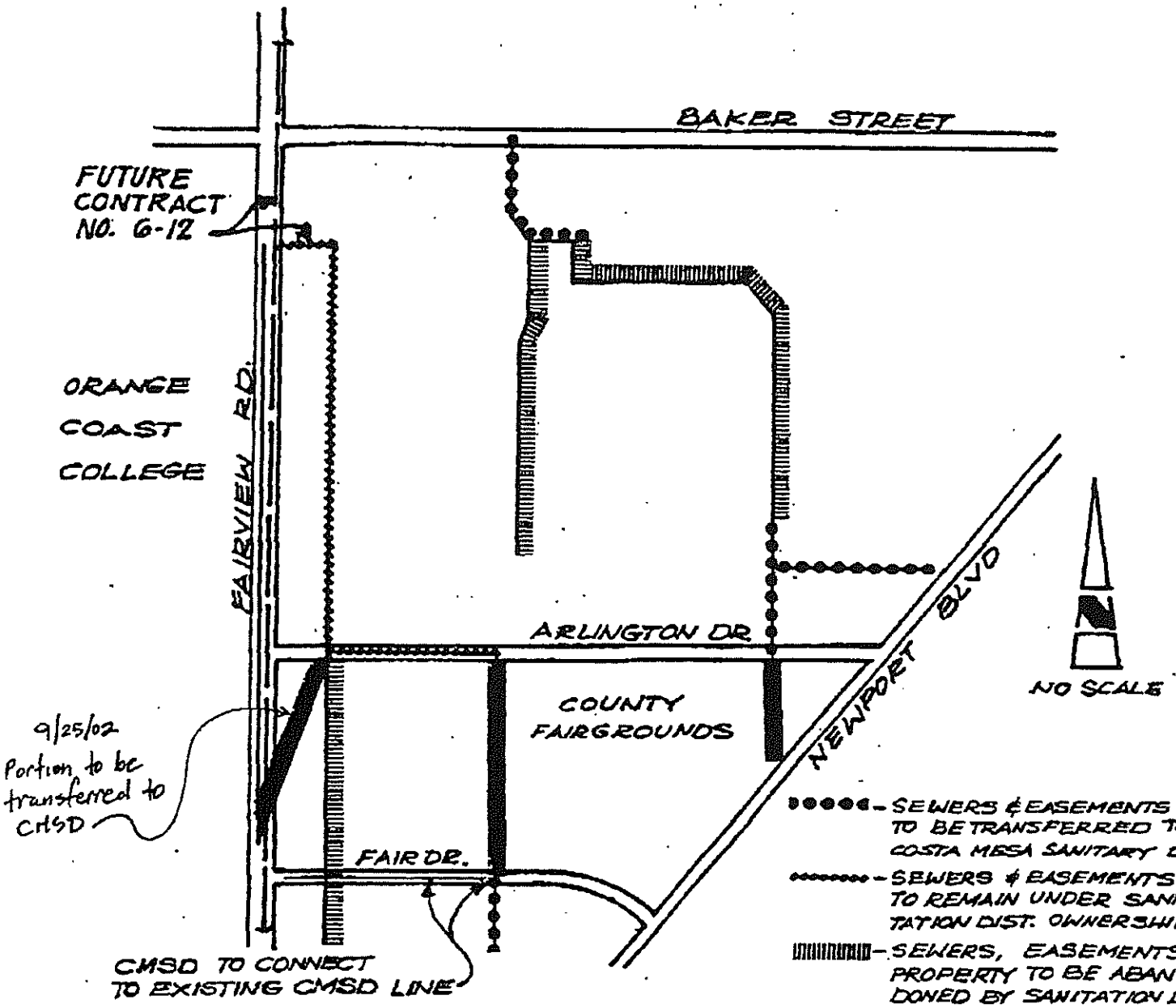
Sincerely,

RBH

Robin B. Hamers
Manager/District Engineer

cc: Board
Staff
William J. Morris, Director of Public Services, City of Costa Mesa
Blake Anderson, General Manager, OCSD
Nicole Dubois, Environmental Planner, LSA Associates, Inc.

EXHIBIT "A"



AGREEMENT BETWEEN COUNTY SANITATION DISTRICT No. 6 OF ORANGE COUNTY, COSTA MESA SANITARY DISTRICT AND 32nd AGRICULTURAL DISTRICT.

10-25-88

Mesa Consolidated
Water District

SEP 2002

September 26, 2002

BOARD OF DIRECTORS

JAMES F. ATKINSON
President
Division IV

R. MICHAEL HEALEY
First Vice President
Division V

FRED BOCKMILLER
Vice President
Division I

TRUDY OHLIG-HALL
Vice President
Division III

PAUL SHOENBERGER
Vice President
Division II

DIANA M. LEACH
General Manager

COLEEN SCARMINACH
District Secretary

MARGARET M. W. RUTLEDGE
Treasurer / Auditor

BOWIE, ARNESON
WILES & GIANNONE
Attorney

Mesa Consolidated Water District's mission: Dedicated to Satisfying our Community's Water Needs

Ms. Nicole Dubois, Environmental Planner
LSA Associates, Inc.
20 Executive Park, Suite 200
Irvine, California 92614-4731

Subject: Orange County Fair and Exposition Center Master Plan

Dear Ms. Freeman:

This letter is to provide a response to your questions relating to Mesa Consolidated Water District (Mesa) services to the project area requested with your August 29, 2002 letter. The following are your questions with Mesa's responses.

1. What are the locations, types, and capacity of your facilities that service the area, and how near capacity are they now operating?

Mesa provides water service to the area using wells with varying level of water treatment, imported water connections, reservoirs and distribution system (pipelines). Mesa's current well pumping capacity is approximately 27 million gallons per day (MGD). Mesa's imported water connection capacity is approximately 67 MGD. Mesa's reservoir storage capacity is 28 million gallons with pumping capacity from the reservoirs of approximately 34 MGD. The area has 18-inch distribution system pipelines on the north, east and west sides and an 8-inch distribution system pipeline and a 36-inch transmission pipeline on the south side. Mesa's projected demand for the maximum demand day in 2010 is 34 MGD. Mesa's supply capacity is over double the projected demands. The Orange County Water District, Municipal Water District of Orange County and Metropolitan Water District of Southern California have indicated that sufficient water will be available to support growth in Orange County and Southern California. The distribution system pipelines around the area are projected to operate at less than half capacity in 2010. The locations of the facilities are shown on the attached map.

2. What level of service do you presently provide to the project area?

The average demand for the area over the past 10 years has been approximately 114 acre-feet per year or 0.10 MGD. Mesa also provides fire service to the area.

3. Are there any current plans for expansion of your services or facilities in the area?

No.

P.O. Box 5008 • 1965 Placentia Avenue (92627) • Costa Mesa, California 92628-5008
Telephone (949) 631-1200 FAX (949) 574-1036

4. Will the project create a need to expand existing facilities or staff or to construct a new facility, or otherwise adversely impact the types of services you provide? Please explain.

No. Mesa's water supply and delivery system was designed and constructed to meet the current and projected future needs within the Mesa service area.

5. What standard consumption or generation rates do you use in assessing service demands?

For purposes of water distribution system planning, land use types and water demand factors were used in determining the capacity of the distribution system. The project area is zoned institutional and recreational. The water demand factor for this land use is 1,765 gallons per day per acre. The average historical demand was used for the project area in the water distribution system planning as use of acreage and the water demand factor resulted in an estimated water demand several times the historical water use.

For assessing service demands (sizing meters) for individual customers Mesa uses fixture counts and converts them to peak water flow based on the uniform plumbing code. For larger landscaped areas the peak water flow calculated by the landscape professional on the landscape plans are typically used to size the meter. Actual flow rates are verified after a year by flow measurement to insure the proper size of meter was installed.

6. Can you recommend any measures for mitigating project impacts that might be incorporated into the project?

Mesa recommends the use of water efficient devices and landscaping and the use of recycled water where possible.

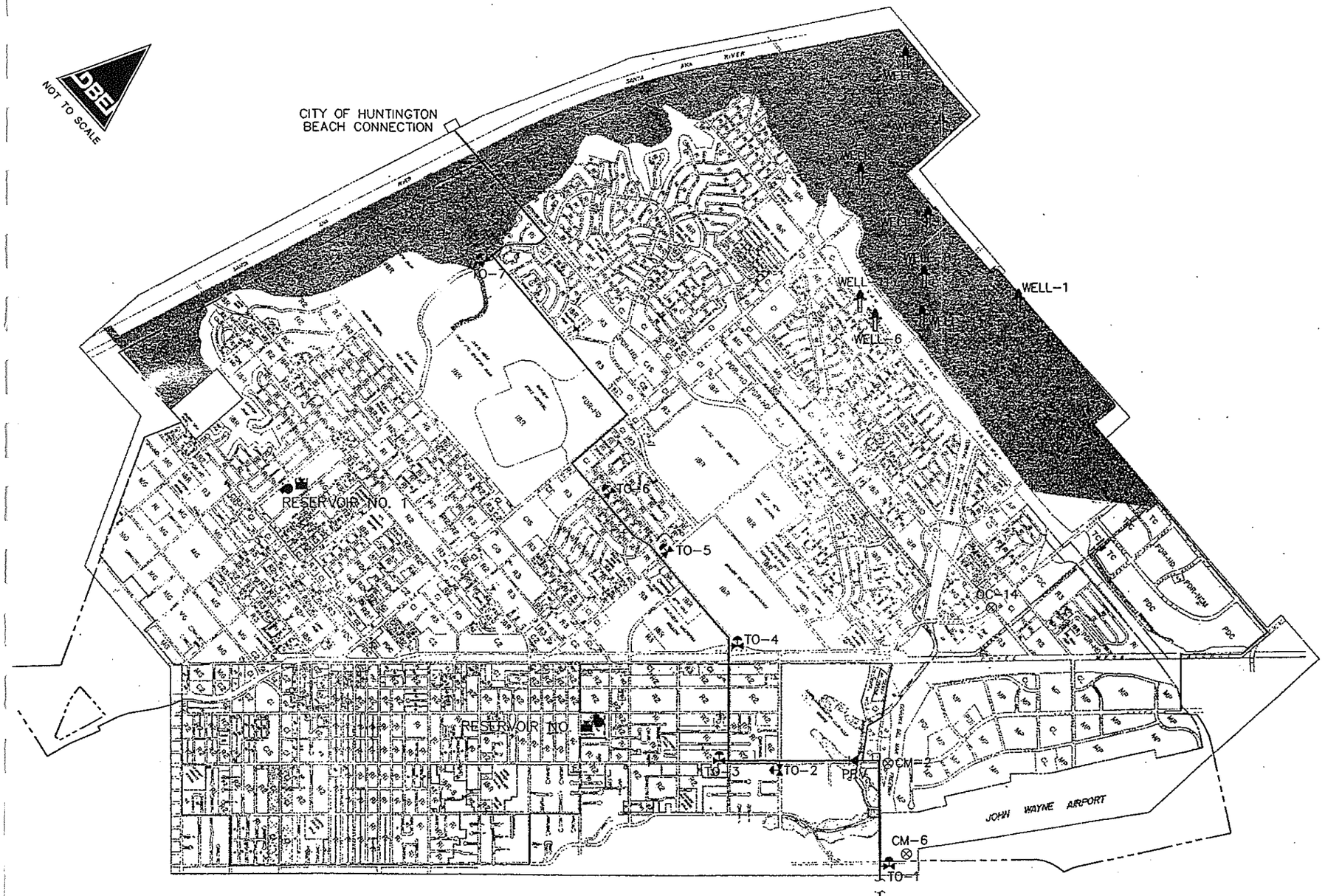
Mr. Robert R. McVicker, P.E. , District Engineer prepared this information. If you have any questions or require additional information please contact Mr. McVicker at (949) 631-1291 or by e-mail at BobM@mesawater.org.

Sincerely,

Diana M. Leach
General Manager

C: Bob McVicker, District Engineer

NOT TO SCALE



LEGEND

- Mesa Service Area Boundary
- OC-44 Transmission Main
- Turnout From OC-44 Transmission Main
- Pressure Regulating Valve
- Import Water Connection
- Groundwater Well
- Booster Pumping Station
- Reservoir

OCTA

RECEIVED
BY LSA, INC.
OCT 22 2002

BOARD OF DIRECTORS

Todd Spitzer
Chairman

Tim Keenan
Vice-Chairman

Arthur C. Brown
Director

Shirley McCracken
Director

Miguel A. Pulido
Director

James W. Silva
Director

Charles V. Smith
Director

Michael Ward
Director

Thomas W. Wilson
Director

Gregory T. Winterbottom
Director

Susan Withrow
Director

Denis R. Bilodeau
Alternate

Cynthia P. Coad
Alternate

Bev Perry
Alternate

Cindy Quon
Governor's
Ex-Officio Member

October 21, 2002

Ms. Nicole Dubois
LSA Associates, Inc.
20 Executive Park, Suite 200
Irvine, CA 92614

Dear Ms. Dubois,

Orange County Transportation Authority (OCTA) received a questionnaire regarding the Orange County Fair and Exposition Center Master Plan on August 29, 2002. OCTA apologizes for the delayed response. Please accept the attached to be incorporated into the environmental analysis for the proposed project.

Please contact me at (714) 560-5749 or by e-mail at cwright@octa.net with any questions or concerns.

Sincerely,

Christopher Wright
Associate Transportation Analyst

Attachment:
Response to Orange County Fair and Exposition Center Questionnaire

Orange County Fair and Exposition Center Master Plan - NOP Questionnaire
LSA Associates, INC.

1. What are the locations, types, and capacity of your facilities that service the area, and how near capacity are they now operating?

   The following is a list of routes that service the project area:

Route	Street
47	Fairview Road
55	Fairview Road
173	Fairview Road/Fair Drive
178	Fairview Road/Fair Drive

   Existing bus stops within the project area include:

Stop Location	Routes
Fairview & Merrimac	47, 55, 173, 178
Fairview & Fair	47, 55, 173, 178
Fair & Entrance to OC Fairgrounds	173, 178

   Bus stop locations have been plotted on the map.

2. What level of service do you presently provide to the project area?

   The level of service provided to the project area is as follows:

	Frequency of service (in minutes)	
Route	*Peak (6am-9am)(3pm-6pm)*	*Off Peak*
47	15	20
55	20	20
173	45	45
178	30	60

3. Are there any current plans for expansion of your services or facilities in the area?

   Yes, frequency of bus service is expected to increase by 20% by 2005.

4. Will the project create a need to expand existing facilities or staff or to construct a new facility, or otherwise adversely impact the type of services you provide? Please explain.

   No.

5. What standard ridership or generation rates do you use in assessing service demands?

   New services are expected to generate a minimum of 10 passengers per hour of service within one year of implementation. Assessing the demand for additional service on exiting routes is based on passenger loads.

6. Can you recommend any measures for mitigating project impacts that might be incorporated into the project?

   It is recommended that transit amenities such as bus turnouts, benches and shelters be incorporated into the project. Specifically, one "Farside" type turnout should be placed at northbound Fairview Farside Fair.

APPENDIX B

PHOTOMETRIC STUDY

REEDCORP ENGINEERING
CONSULTING ELECTRICAL ENGINEERS

2061 Business Center Drive
Suite 110
Irvine, CA 92612
Phone: (949) 752-1278
Fax: (949) 752-1287
E-Mail Address: EE@Reedcorp.net

September 16, 2002

SEP 2002

Mr. Frank L. Haselton
LSA Associates, Inc.
20 Executive Park, Suite 200
Irvine, California 92614-4731

RE: Orange County Fairgrounds

Dear Frank:

We visited the site the evening of 08/12/02 and took footcandle readings of a portion of the existing parking lot that had seven (7) 80 foot poles with six (6) 1000 watt metal halide lamps per pole, in order to compare new computer model to existing conditions.

The computer model indicates five (5) new 80 foot light standards with six 1000 watt metal halide fixtures/lamps matching existing. The model indicates that the new parking area light levels will closely match the existing lighting light levels. There is other existing lighting that will also contribute to the parking which is not indicated. That would be at entries, along walkways next to parking and existing buildings. The computer model has light levels that consider an approximate 30% light loss factor (lamp lumen deprecation, dirt, etc. over time). Therefore, the initial footcandle levels will be about 30% more footcandles than shown.

In summary, the new parking lot light standards will contribute in general, the same light levels as the existing at similar locations.

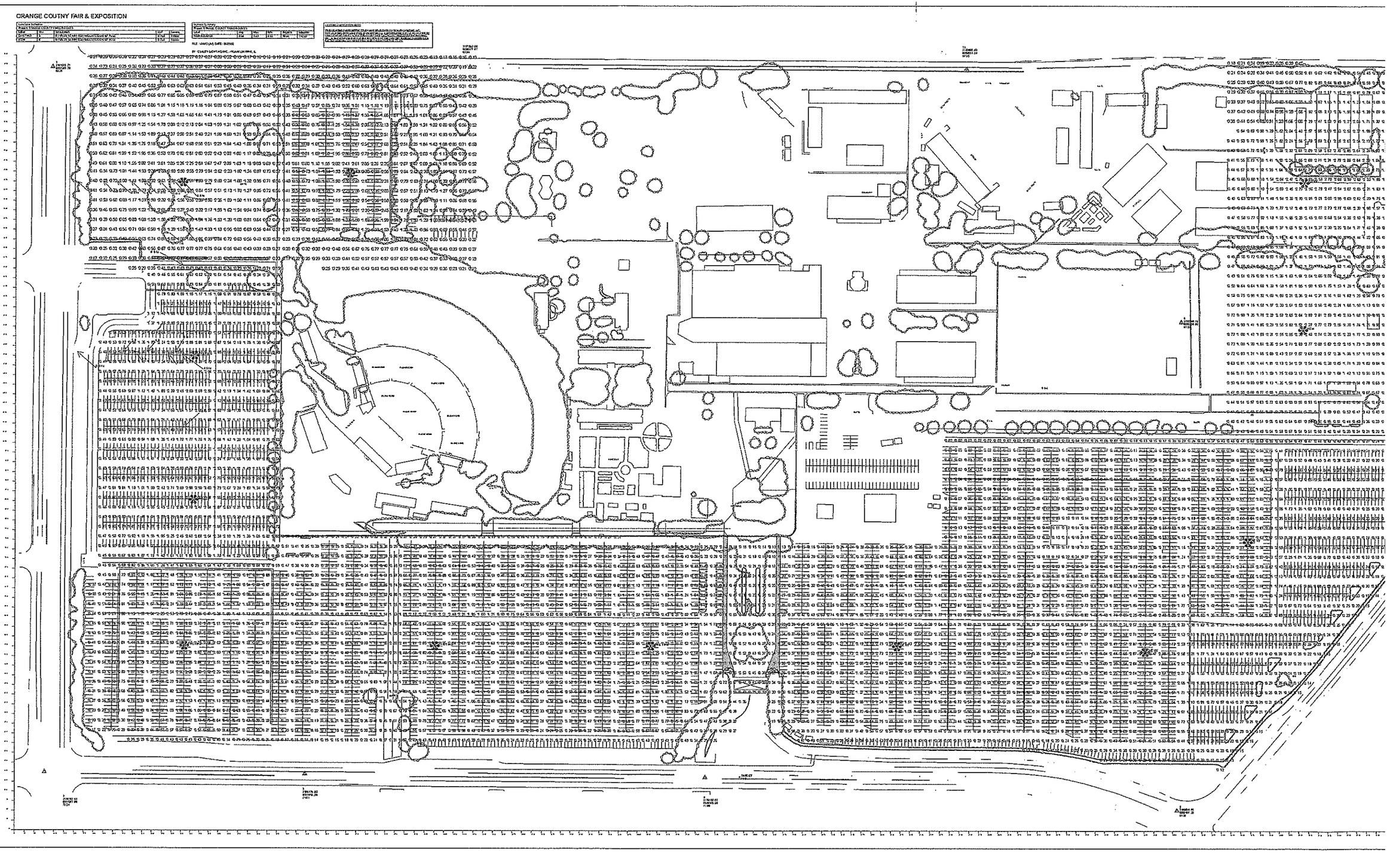
Sincerely,
Reedcorp Engineering, Inc.

Ronald W. Reed
Principal

RWR/sl

/Project Docs/Folder 1872-Ltr LSA-Site Visit

ORANGE COUTNY FAIR & EXPOSITION



APPENDIX C

GEOTECHNICAL STUDY

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVENUE, SUITE 514, TUSTIN, CALIFORNIA 92780
TELEPHONE: (714) 730-2122, FAX: (714) 730-5191

CALIFORNIA CONSTRUCTION AUTHORITY
88 Fair Drive
Costa Mesa, California 92626

June 27, 2002
Work Order 500588

Attention: Jess Cummings

Subject: **GEOTECHNICAL STUDY**
Pacific Amphitheater Berm
Orange County Fairgrounds
Costa Mesa, California

Mr. Cummings:

Pursuant to your request, Pacific Soils Engineering, Inc. (PSE), has conducted a preliminary geotechnical study of the soils comprising the berm at the Pacific Amphitheatre in the Orange County Fairgrounds in general conformance with our proposal dated March 18, 2002. The Fairgrounds are located on the northeast corner of Fair Drive and Fairview Road, and the subject berm separates the amphitheater from other improvements such as the farm and operations buildings.

1.0 INTRODUCTION

1.1 Background and Purpose

The berm was constructed circa 1983 of onsite and import materials. PSE understands the berm is to be removed and the materials exported offsite. The purpose of this report is to provide information regarding the soils comprising the berm that California Construction Authority intends to provide to potential importers of the soil.

1.2 Scope of Study

A geotechnical field investigation and study was to provide a basis for compiling the presented geotechnical design parameters. The scope of PSE's study included the following tasks:

- Reviewing readily available geotechnical data pertinent to the site.
- Excavating, logging, and sampling of four bucket auger borings to depths of about 50 feet below the existing ground surface.
- Performing laboratory testing to evaluate relevant engineering properties of the on-site subsurface materials.
- Evaluate the data collected.
- Prepare and submit six (6) copies of a geotechnical report containing this firm's findings, conclusions and recommendations.

It should be noted that this study focused on the evaluation and analysis of the geotechnical conditions of the subject site. Investigation or assessment of the potential presence of toxic or hazardous substances is beyond the scope of our services.

1.3 Report Structure

The main text of this report is divided into the following sections: Introduction, Project Description, Subsurface Conditions, Engineering Analyses, Conclusions and Recommendations. Included with this report are the following appendices:

Appendix A - Field Investigation including Boring Logs

Appendix B - Laboratory Testing including data

Accompanying this report is a facsimile copy of a site plan with approximate boring locations added by PSE.

2.0 PROJECT DESCRIPTION

2.1 Site Location and Existing Conditions

The berm is part of the Pacific Amphitheatre at the Orange County Fairgrounds. The Fairgrounds are located on the northeast corner of Fair Drive and Fairview Road, and the berm separates the amphitheater from other improvements such as the farm and operations buildings. The top of the berm is paved with approximately two to three inches of asphalt. Two structures, formerly used as

concession stands are present at either end of the berm. Concrete steps provide pedestrian access to near the top of the berm. Access for the drill rig was via a road comprised of paving stones. The side of the berm facing the amphitheatre is planted with grass, the side facing the farm has mature trees and ground cover.

2.2 Proposed Construction

The proposed construction consists of removal and export of the earthen berm.

3.0 SUBSURFACE CONDITIONS

Presented herein is a description of the materials encountered in our borings.

3.1 Fill

Fill materials were encountered to depths of about 46 feet in all the borings. The fill consisted of sandy and silty clays, clayey silts and sands and some poorly graded sands. The fill materials were generally dry at the surface and damp to moist below. Below the upper disturbed and weathered soils the fill soils were firm to stiff and medium dense. It should be noted that the berm was constructed of fill generated onsite as well as import soils.

3.2 Native Soils

Native soils were encountered at depths varying from 45 to 46½ feet and consist of damp to moist and stiff silty clays and clayey silts.

3.3 Groundwater

Groundwater was not encountered to the maximum depth explored of 50 feet.

4.0 ENGINEERING ANALYSIS

4.1 Materials Properties

4.1.1 Excavation Characteristics

The fill materials are considered to be easily removed and recompacted using conventional grading equipment.

4.1.2 Expansion Potential

The expansion potential of the berm materials, varied from "very low" to "high" when tested in accordance with Standard 18-2 of the 1997 UBC and classified in accordance with Table 18-I-B of the 1997 UBC. Testing for expansion potential should be performed during and at the completion of grading.

4.1.3 Soluble Sulfate Test Results

Results of soluble sulfate tests performed on representative samples of the site soils are presented on Table B-1 in Appendix B. The majority of the on-site soils are classified as having a "negligible" soluble sulfate effect on concrete when classified in accordance with Table 19-A-4 of the 1997 UBC. One sample had a soluble sulfate content 0.102 percent. Soils containing soluble sulfate of 0.10 to 0.20 percent are classified as having a "moderate" sulfate exposure.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The fill materials may be reused as fill. Specific recommendations regarding the placement of fill materials or recommended design should be provided by the geotechnical consultant of the project receiving the fill.

6.0 CLOSURE

6.1 Limitations

The conclusions and recommendations presented in this report are based on the data developed during the subject investigation. The materials immediately adjacent to or beneath those observed in the exploratory excavation may have different characteristics and no representations are made as to the quality or extent of materials not observed.

This report is based on the project as described and the information obtained from the boring at the approximate location indicated on the plans. The findings are

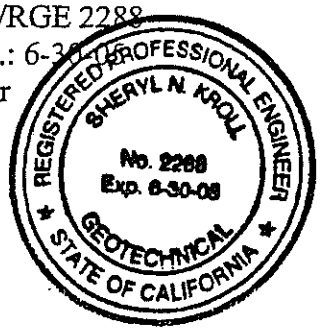
based on the results of the field, laboratory, and office investigations combined with an interpolation and extrapolation of conditions between and beyond the boring location. The results reflect an interpretation of the direct evidence obtained. Services performed by Pacific Soils Engineering, Inc., have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation, either expresses or implied, and no warranty or guarantee is included or intended.

Pacific Soils Engineering, Inc., has no responsibility for construction means, methods, techniques, sequences, or procedures, or for safety precautions or programs in connection with the construction, for the acts or omissions of the CONTRACTOR, or any other person performing any of the construction, or for the failure of any of them to carry out the construction in accordance with the final design drawings and specifications.

We wish to thank you for providing Pacific Soils Engineering, Inc., the opportunity to be of service to you and your organization. Should you have any questions, please do not hesitate to contact us at (714) 730-2122.

Respectfully submitted,
PACIFIC SOILS ENGINEERING, INC.

SHERYL N. KROLL/RGE 2288
RCE 44033/Reg. Exp.: 6-30-05
Geotechnical Engineer

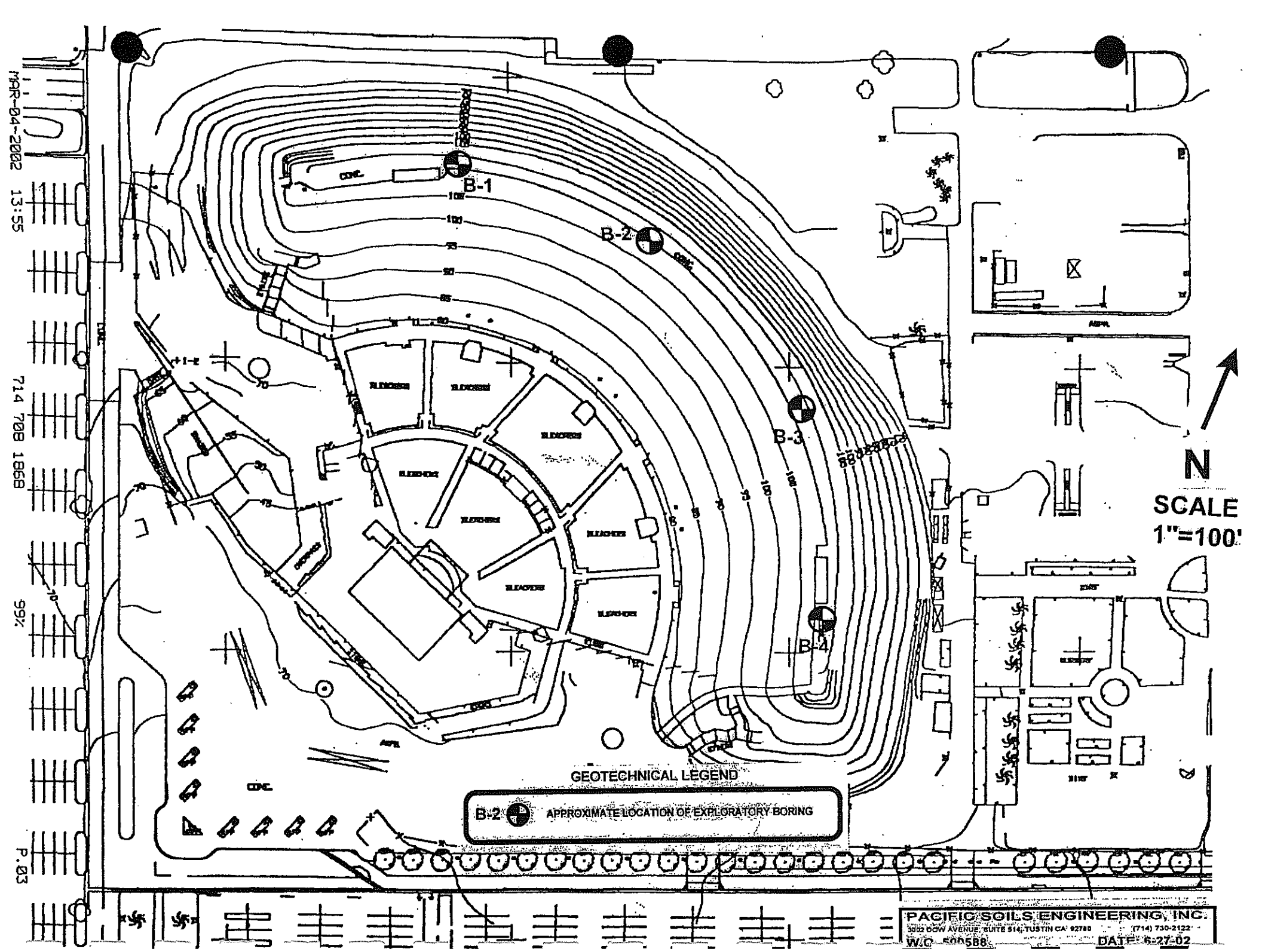


Reviewed by:

AZZAM J. ALWASH, Ph.D./RGE 21
RCE 42518/Reg. Exp.: 3-31-04
Manager of Geotechnical Services

Distribution: (6) Addressee

SNK:AJA:RD/500588, June 28, 2002



MAR-04-2002 13:55
714 708 1868
99%
P.03

APPENDIX A

Field Investigation

APPENDIX A

Field Investigation

A truck mounted bucket auger drill rig was utilized to excavate four (4) borings within the subject project to depths of approximately 50 feet, below existing grades. The approximate locations of the exploratory borings are shown on the accompanying sketch and the Geotechnical Boring Logs are attached.

Representative bulk soil samples were obtained at significant lithologic changes. The samples were transported to PSE's laboratory for testing. Laboratory testing procedures and test results are presented in Appendix B of this report.

TERMS FOR THE DESCRIPTION OF SOIL

MAJOR DIVISIONS			GROUP SYMBOLS	GROUP NAMES
Coarse-grained Soils More than 50% retained on No. 200 sieve	GRAVELS More than 50 % of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines	GW	Well-graded gravel
			GP	Poorly graded gravel
		Gravels with more than 12% fines	GM	Silty gravel
			GC	Clayey gravel
	SANDS 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines	SW	Well-graded sand
			SP	Poorly graded sand
		Sands with more than 12% fines	SM	Silty sand
			SC	Clayey sand
Fine-grained Soils 50% or more passes the No. 200 sieve	SILTS and CLAYS Liquid Limit less than 50	inorganic	CL	Lean clay
			ML	Silt
		organic	OL	Organic clay or silt
	SILTS and CLAYS Liquid Limit 50 or more	inorganic	CH	Fat clay
			MH	Elastic silt
		organic	OH	Organic clay or silt
	Highly Organic Soils		PT	Peat

CONSISTENCY CLASSIFICATION

COARSE-GRAINED SOILS

	Blows/foot (SPT)
Very Loose	<4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	>50

FINE-GRAINED SOILS

	Criteria
Very Soft	Thumb penetrates soil > 1 in.
Soft	Thumb penetrates soil 1 in.
Firm	Thumb penetrates soil 1/4 in.
Stiff	Readily indented with thumbnail
Hard	Thumbnail will not indent soil

SOIL MOISTURE

Dry - dry to touch
Moist - damp, but no visible water
Wet - Visible free water

SIZE PROPORTIONS

Trace - < 5 %
Few - 5 to 10 %
Some - 15 to 25 %

LABORATORY TESTS

DS	Direct Shear
DSR	Direct Shear (Remolded)
CON	Consolidation
SA	Sieve Analysis
MAX	Maximum Density
RV	Resistance Value
EI	Expansion Index
SE	Sand Equivalent
AL	Atterberg Limits
CHEM	Chemical Analysis
HY	Hydrometer Analysis

GEOTECHNICAL BORING LOG

PROJECT NO.	500588	PROJECT NAME	OC Fair Berm		
DATE STARTED	5/30/02	GROUND ELEV.		BORING DESIG.	B-1
DATE FINISHED	5/30/02	GW DEPTH (FT)		LOGGED BY	snk
DRILLER	Al Roy Drilling	DRIVE WT.		NOTE	
TYPE OF DRILL RIG	18" bucket	DROP			

DEPTH (Feet)	SAMPLE TYPE	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	OTHER TESTS
		CL	2" Asphalt **FILL:** fine to medium SANDY CLAY, light brown, dry, firm to stiff, with some coarse SAND and fine to coarse GRAVEL, trace rootlets	
5		CL	SILTY CLAY, olive brown and black brown, damp, medium stiff, trace white diatomaceous soil	
		CL	SANDY CLAY, dark brown, damp, medium stiff, with orange brown, SILTY SAND, some asphalt chunks	
10	B			MAX HY CHEM
15		ML	SANDY CLAYEY SILT, olive brown, damp, medium dense, trace roots	
		CL	SILTY CLAY, gray brown, damp to moist, firm to stiff	
20		CL	SILTY CLAY, gray brown, damp, firm to stiff, with some concrete	
		ML	SANDY CLAYEY SILT, some GRAVEL, light gray, moist, medium dense	
25		SM	SILTY SAND, orange brown, damp to moist, medium dense	
		SC	CLAYEY SAND, brown, moist, medium dense	
		CL	SANDY CLAY, olive brown, moist, firm to stiff, trace asphalt pieces	
30	B			MAX HY CHEM
		CL	SILTY CLAY, brown, moist, firm to stiff	
35		ML	CLAYEY SILT, gray brown, damp to moist, medium dense	
			some black SILTY CLAY chunks	

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE
B: BEDDING
S: SHEAR
J: JOINT

PACIFIC SOILS ENGINEERING, INC.

PLATE A-1

GEOTECHNICAL BORING LOG

PROJECT NO.	500588	PROJECT NAME	OC Fair Berm		
DATE STARTED	5/30/02	GROUND ELEV.		BORING DESIG.	B-1
DATE FINISHED	5/30/02	GW DEPTH (FT)		LOGGED BY	snk
DRILLER	Al Roy Drilling	DRIVE WT.		NOTE	
TYPE OF DRILL RIG	18" bucket	DROP			

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						CL	SILTY CLAY, light brown and dark brown, stiff				
						CL	SILTY CLAY, black brown, moist, stiff				
						CL	SILTY CLAY, black brown, moist, stiff, trace root hairs, organic smell				
45											
						CL	**NATIVE:**				
						CL	SILTY CLAY, brown, damp, stiff				
							SANDY CLAY, brown, damp, stiff, some pockets of tan silt				
50							TOTAL DEPTH 50 FEET NO GROUND WATER ENCOUNTERED NO CAVING				

SAMPLE TYPES:
[R] RING (DRIVE) SAMPLE
[S] SPT (SPLIT SPOON) SAMPLE
[B] BULK SAMPLE [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE
B: BEDDING
S: SHEAR
J: JOINT

PACIFIC SOILS ENGINEERING, INC.

PLATE A-1

GEOTECHNICAL BORING LOG

PROJECT NO.	500588	PROJECT NAME	OC Fair Berm		
DATE STARTED	5/30/02	GROUND ELEV.		BORING DESIG.	B-2
DATE FINISHED	5/30/02	GW DEPTH (FT)		LOGGED BY	snk
DRILLER	Al Roy Drilling	DRIVE WT.		NOTE	
TYPE OF DRILL RIG	18" bucket	DROP			

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						CL	2" Asphalt SANDY CLAY, some fine to coarse GRAVEL, light brown, dry to damp, firm				
5							some white diatomaceous				
						CL	SILTY CLAY, brown, dry, stiff				
10						SP	fine to coarse SAND, orange brown, dry to damp, medium dense				
						CL	SILTY CLAY, dark gray, damp to moist, firm to stiff, some cobble size				
15						CL	SANDY CLAY, yellow gray, damp to moist, firm to stiff, some roots				
						CL	SILTY CLAY, black brown, moist, firm to stiff				
20		B				SC	CLAYEY SAND, orange brown, moist, medium dense, with some roots				MAX HY CHEM
							trace sea shells				
25						CL	SANDY CLAY, light olive brown, moist, firm to stiff, slightly plastic				
							some pieces of bark				
30						CL	SILTY CLAY, brown, moist, stiff, plastic				
						ML	CLAYEY SILT, gray brown, moist, stiff				
35						CL/ML	SILTY CLAY/CLAYEY SILT, black brown, moist, stiff				
		B				CL	SILTY CLAY, black, moist, stiff, organic smell				MAX

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE
B: BEDDING
S: SHEAR
J: JOINT

PACIFIC SOILS ENGINEERING, INC.

PLATE A-2

GEOTECHNICAL BORING LOG

PROJECT NO.	500588	PROJECT NAME	OC Fair Berm		
DATE STARTED	5/30/02	GROUND ELEV.		BORING DESIG.	B-2
DATE FINISHED	5/30/02	GW DEPTH (FT)		LOGGED BY	snk
DRILLER	Al Roy Drilling	DRIVE WT.		NOTE	
TYPE OF DRILL RIG	18" bucket	DROP			

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						CL	SILTY CLAY, olive brown to brown, moist, stiff				HY CHEM
						CL	SILTY CLAY, black brown, moist, stiff, roots				
45						ML	**NATIVE:** CLAYEY SILT, light brown, some white powdery, damp to moist, stiff				
50							TOTAL DEPTH 50 FEET NO GROUND WATER ENCOUNTERED NO CAVING				

SAMPLE TYPES:
- [R] RING (DRIVE) SAMPLE
- [S] SPT (SPLIT SPOON) SAMPLE
- [B] BULK SAMPLE
- [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE
B: BEDDING
S: SHEAR
J: JOINT

PACIFIC SOILS ENGINEERING, INC.

GEOTECHNICAL BORING LOG

PROJECT NO.	500588	PROJECT NAME	OC Fair Berm		
DATE STARTED	5/30/02	GROUND ELEV.		BORING DESIG.	B-3
DATE FINISHED	5/30/02	GW DEPTH (FT)		LOGGED BY	snk
DRILLER	Al Roy Drilling	DRIVE WT.		NOTE	
TYPE OF DRILL RIG	18" bucket	DROP			

DEPTH (Feet)	SAMPLE TYPE	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	OTHER TESTS
		ML	2" Asphalt FILL: SANDY SILT, with some CLAY, light brown, dry, medium dense	
5	B			MAX HY CHEM
		SP	fine to coarse SAND, orange brown, damp to moist, medium dense, slightly micaceous, with some SANDY CLAY clods, dark brown, moist, stiff	
10		SP	fine to coarse SAND with CLAY, gray, damp to moist, medium dense, intermixed with black SILTY CLAY, moist, stiff	
		CL	SANDY SILTY CLAY, brown to gray brown, moist to stiff occasional asphalt chunks	
15		SP	fine to coarse SAND, orange brown, moist, medium dense	
20		ML	SANDY SILT, with clay clods, gray brown, moist, medium dense	
		CL	SANDY CLAY, light brown, moist, firm to stiff	
25		SC	CLAYEY SAND, gray brown, moist, medium dense, occasional sea shells	
30		CL	SANDY CLAY, orange brown, moist, stiff, slightly plastic, trace roots	
	B	ML	CLAYEY SILT, gray brown, moist, firm to stiff, slightly micaceous	MAX HY CHEM
35			becomes brown	
		CL	SILTY CLAY, dark gray brown, moist, stiff, trace mica	

MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE
B: BEDDING
S: SHEAR
J: JOINT

PACIFIC SOILS ENGINEERING, INC.

PLATE A-3

GEOTECHNICAL BORING LOG

PROJECT NO.	500588	PROJECT NAME	OC Fair Berm		
DATE STARTED	5/30/02	GROUND ELEV.		BORING DESIG.	B-3
DATE FINISHED	5/30/02	GW DEPTH (FT)		LOGGED BY	snk
DRILLER	Al Roy Drilling	DRIVE WT.		NOTE	
TYPE OF DRILL RIG	18" bucket	DROP			

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						CL	SILTY CLAY, trace SAND, black brown, moist, stiff, plastic				
						CL	SILTY CLAY, black, moist, firm to stiff, organic smell, roots, plastic				
45						CL	SILTY CLAY, brown, moist, firm to stiff				
						ML	**NATIVE** CLAYEY SILT, light brown, damp, stiff				
50							TOTAL DEPTH 50 FEET NO GROUND WATER ENCOUNTERED NO CAVING				

SAMPLE TYPES:
- [R] RING (DRIVE) SAMPLE
- [S] SPT (SPLIT SPOON) SAMPLE
- [B] BULK SAMPLE
- [T] TUBE SAMPLE

- GROUNDWATER
- SEEPAGE
- B: BEDDING
- S: SHEAR
- J: JOINT

PACIFIC SOILS ENGINEERING, INC.

PLATE A-3

GEOTECHNICAL BORING LOG

PROJECT NO.	500588	PROJECT NAME	OC Fair Berm		
DATE STARTED	5/30/02	GROUND ELEV.		BORING DESIG.	B-4
DATE FINISHED	5/30/02	GW DEPTH (FT)		LOGGED BY	snk
DRILLER	Al Roy	DRIVE WT.		NOTE	
TYPE OF DRILL RIG	18" bucket	DROP			

DEPTH (Feet)	SAMPLE TYPE	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	OTHER TESTS
0		SC/CL	3" Asphalt CLAYEY SAND/SANDY CLAY, light brown, dry, loose to medium dense/firm, roots	
		CL	SILTY CLAY, brown, damp, firm, with asphalt pieces	
10	B	CL	SANDY CLAY, dark gray, damp to moist, firm to stiff, occasional roots	MAX HY CHEM
		CL	SILTY CLAY, trace SAND, black, damp to moist, firm to stiff, trace asphalt pieces	
15		CL	SILTY CLAY, gray brown, damp, stiff	
		SC	CLAYEY SAND, light gray brown, damp to moist, medium dense	
20		SP	SAND with CLAY clods, brown, damp, medium dense	
25		CL	SANDY CLAY with SILT, gray brown, damp to moist, firm to stiff, slight mica	
30		CL	SILTY CLAY, brown, moist, firm to stiff, slightly micaceous	
		ML/CL	CLAYEY SILT/SILTY CLAY, gray brown, moist, firm to stiff, slightly plastic	
35	B	CL	SILTY CLAY, gray, moist, firm to stiff, micaceous	MAX HY CHEM
		CL	SILTY CLAY, black brown, moist, firm to stiff, plastic	

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE
B: BEDDING
S: SHEAR
J: JOINT

PACIFIC SOILS ENGINEERING, INC.

PLATE A-4

GEOTECHNICAL BORING LOG

PROJECT NO.	500588	PROJECT NAME	OC Fair Berm	BORING DESIG.	B-4
DATE STARTED	5/30/02	GROUND ELEV.		LOGGED BY	snk
DATE FINISHED	5/30/02	GW DEPTH (FT)		NOTE	
DRILLER	Al Roy	DRIVE WT.			
TYPE OF DRILL RIG	18" bucket	DROP			

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						CL	SILTY CLAY, black, damp, slight organic smell, rootlets				
45						CL	NATIVE: SILTY CLAY, brown, damp, stiff, white staining				
50							TOTAL DEPTH 50 FEET NO GROUND WATER ENCOUNTERED NO CAVING				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE
B: BEDDING
S: SHEAR
J: JOINT

PACIFIC SOILS ENGINEERING, INC.

PLATE A-4

APPENDIX B

Laboratory Data

APPENDIX B

Laboratory Testing

The results of laboratory testing performed during this study are enclosed within this Appendix. Table B-1 presents a summary of laboratory test results.

The following laboratory tests were performed on representative samples in accordance with the applicable latest standards or methods from the ASTM, Uniform Building Code (UBC) and California Department of Transportation.

Classification

Soils were classified with respect to the Unified Soil Classification System (USCS) in accordance with ASTM D-2487 and D-2488.

Maximum Density/Optimum Moisture

The maximum dry density and optimum moisture content of a selected representative bulk samples were evaluated in accordance with ASTM D-1557-91/Method A. The results of these tests are summarized in Table B-1.

Particle Size Analysis

Modified hydrometer portion ASTM D 2442-72 were conducted to aid in classification of the soils. The results of the particle size analysis are presented in Table B-1.

Expansion Index Tests

An expansion index tests was performed to evaluate the expansion potential of typical on-site soils. Testing was carried out according to UBC Method 18-2. The results are presented in Table B-1.

Soluble Sulfate Content

Sulfate content of selected samples was evaluated by KYH Co., Analytical Laboratory. The results of their study are presented in Table B-1 and attached to this Appendix.

TABLE B-1

Summary of Laboratory Test Data

Boring/Pit No.	Depth	Soil Description	Group Symbol - Unified Soil Classification System	Maximum Dry Density		Grain Size Analysis				Expansion Index, UBC 18-2	Soluble Sulfate Content* (% wt)
				Maximum Density (pcf)	Optimum Moisture (%)	% + No. 4 Screen	% Sand	%Silt (0.074 to 0.005mm)	% Clay (-0.005 mm)		
B-1	12	Sandy Clay	CL	127	9.5	12	49	16	23	65	0.075
B-1	30	Sandy Clay	CL	122.5	11.5	1	40	28	31	82	0.074
B-2	21	Clayey Sand	SC	117	13.0	4	79	7	10	1	0.102
B-2	39	Silty Clay	CL	119	12.0	2	17	40	41	92	0.008
B-3	4	Sandy Silt	ML	125.5	10.0	0	39	33	28	68	0.002
B-3	33	Clayey Silt	ML	116	13.0	0	20	52	28	66	0.019
B-4	11	Sandy Clay	CL	126	10.0	4	42	23	31	56	0.007
B-4	36	Silty Clay	CL	117	14.0	0	26	31	43	96	0.063

* Sulfate Content tests by KYH Co. Analytical Laboratory, Santa Ana, California.

KYH Company Analytical Laboratory

3621 W. MacArthur Blvd., #118, Santa Ana, CA 92704 Tel: (714) 549-5824 Fax: (714) 549-8375

ANALYTICAL REPORT

Client Name:	Pacific Soils Engineering, Inc.	Report #:	223489R
Address:	10653 Progress Way Cypress, CA 90630	PSE W.O. No.	500588
Contact Person:	Mr. Keeney Van Horn	P.O. Number:	Verbal

Sample Analysis Report

Client ID	Lab ID	Requested Date	Analysis	Method	Result (% wt)	MDL (% wt)
B-1 (30')	15321	6-3-02	Sulfate Content	CalTrans 417	0.074	0.001
B-4 (11')	15322	6-3-02	Sulfate Content	CalTrans 417	0.007	0.001
B-3 (4')	15323	6-4-02	Sulfate Content	CalTrans 417	0.002	0.001

KYH Company Analytical Laboratory

3621 W. MacArthur Blvd., #118, Santa Ana, CA 92704 Tel: (714) 549-5824 Fax: (714) 549-8375

ANALYTICAL REPORT

Client Name:	Pacific Soils Engineering, Inc.	Report #:	223483R
Address:	10653 Progress Way Cypress, CA 90630	PSE W.O. No.	500588
Contact Person:	Mr. Keeney Van Horn	P.O. Number:	Verbal

Sample Analysis Report

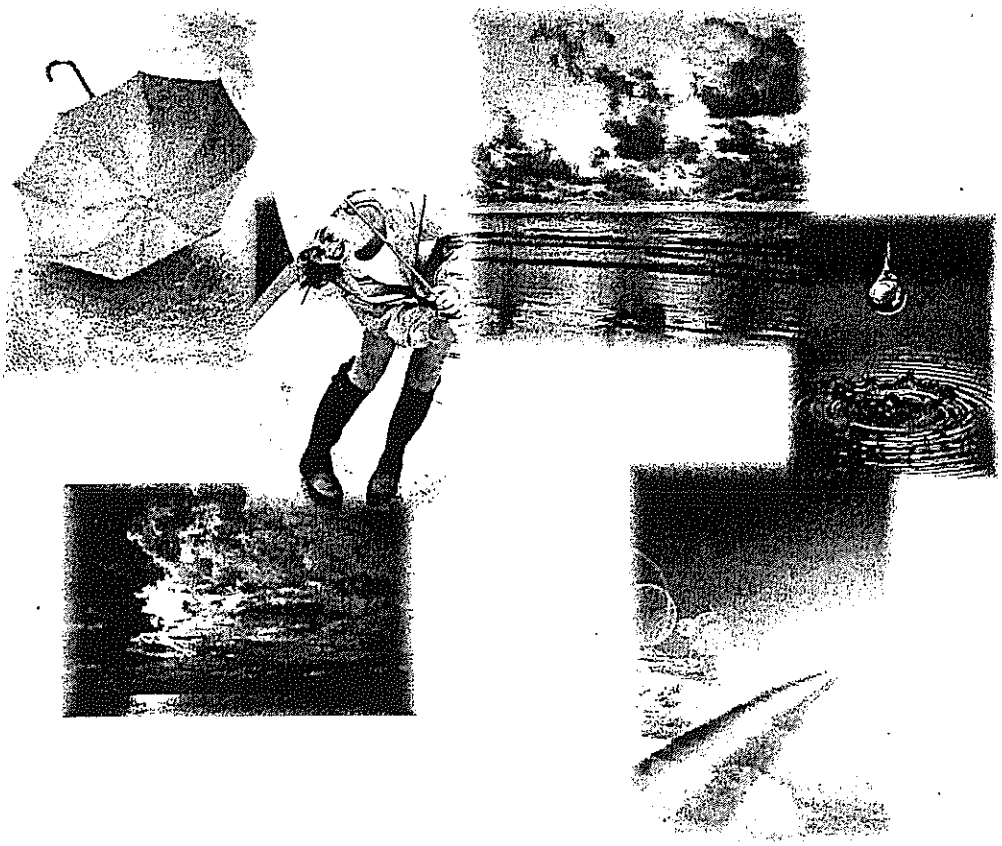
Client ID	Lab ID	Requested Date	Analysis	Method	Result (% wt)	MDL (% wt)
B-4 (36')	15311	6-2-02	Sulfate Content	CalTrans 417	0.063	0.001
B-3 (33')	15312	6-2-02	Sulfate Content	CalTrans 417	0.019	0.001
B-2 (39')	15313	6-2-02	Sulfate Content	CalTrans 417	0.008	0.001
B-2 (21')	15314	6-2-02	Sulfate Content	CalTrans 417	0.102	0.001
B-1 (12-13')	15315	6-2-02	Sulfate Content	CalTrans 417	0.075	0.001

APPENDIX D

HYDROLOGY REPORT

HYDROLOGY/HYDRAULIC REPORT FOR THE ORANGE COUNTY FAIR AND EXPOSITION CENTER

HYDROLOGY / HYDRAULIC REPORT



ORANGE COUNTY FAIR AND EXPOSITION CENTER

Costa Mesa, CA

Prepared for:

32 DISTRICT AGRICULTURE ASSOCIATION

88 Fair Drive
Costa Mesa, CA 92626

Project Manager:
James C. Lane II, P.E.

Date Prepared: August 2002
JN: 308.02

Prepared by:

FUSCOE ENGINEERING, INC.

16795 Von Karman Avenue, Suite 100
Irvine, CA 92606
(949) 474-1960
www.fuscoe.com

Prepared by:

FUSCOE ENGINEERING, INC.
16795 Von Karman Avenue, Suite 100
Irvine, California 92606
(949) 474-1960

Project Number:
309.02

Supervising Engineer:

James C. Lane II
RCE No. 28781

Date Prepared:

August, 2002

Table of Contents

I. Introduction 1

Geographic Setting 1
Purpose of This Report 1
References 1
Location Map – Topographic Setting 2

II. Existing Topographic & Hydrologic Conditions 3

Existing Topography 3
Existing Drainage Pattern & Storm Drain Facilities 3

III. Hydrology Study 3

Storm Frequency 3
Methodology 3

IV. Previous Reports 4

Previous Hydrology Reports 4

V. Existing Drainage Areas 4

VI. Proposed Drainage Areas & Storm Drain 7

VII. Arlington Avenue Alternatives 8

VIII. Results & Conclusions 8

IX. Appendices 9

Appendix A – Existing 10-Year Hydrology Calculations

Appendix B – Existing 25-Year Hydrology Calculations

Appendix C – Existing 100-Year Hydrology Calculations

Appendix D – Proposed 10-Year Hydrology Calculations

Appendix E – Proposed 25-Year Hydrology Calculations

Appendix F – Proposed 100-Year Hydrology Calculations

Appendix G - Earthern Ditch Sizing Analysis for Arlington Avenue

Appendix H – Existing Hydrology/Storm Drain Area Map
(In Pocket)

Appendix I – Proposed Hydrology/Storm Drain Area Map
(In Pocket)

I. Introduction

Geographic Setting

The Study area consists of 148 acres± and is located in the City of Costa Mesa, California. The location is between Fairview Avenue and Newport Boulevard (55 Freeway), and Fair Drive and Arlington Avenue. The present site comprises of approximately 73 acres of parking, 53 acres of fair and exposition area, 15 acres of equestrian center, and 7 acres of perimeter landscaping.

Purpose of This Report

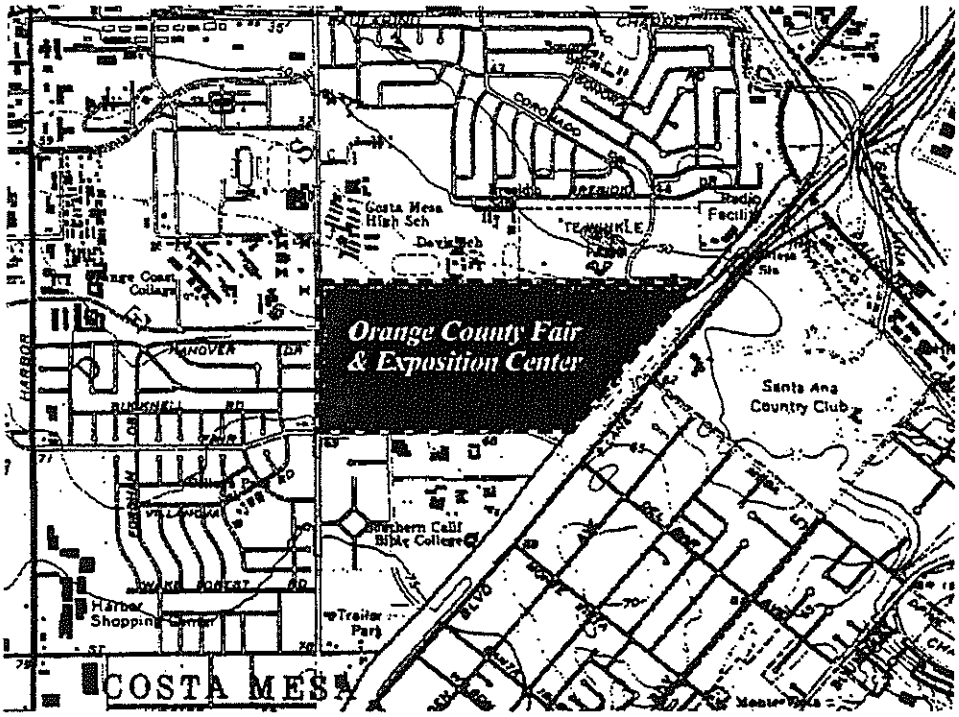
The purpose of this report is to accomplish the following objectives:

1. To determine the existing storm water discharges generated within local drainage areas within the project (see Appendix H).
2. To support the design of "local" storm drains, consisting of laterals and catch basins, as submitted with this report (see Appendicle "I").
3. To support the design of an "offsite" extended storm drain or drainage facility in Arlington Avenue.
4. To demonstrate that the "storm water" and "flood" protection goals as outlined in Addendum No. 1 to the O.C.E.M.A. Design Manual have been met (see Appendix A for "Storm Water Protection Goals").

References

- O.C.E.M.A. Hydrology Manual
- O.C.E.M.A. Design Manual

Location Map



II. Existing Topographic & Hydrologic Conditions

Existing Topography

The site is relatively flat sloping approximately 1% to the northeast or northwest.

Existing Drainage Pattern & Storm Drain Facilities

The existing drainage pattern is divided into three main areas. The western portion (approx. 33 acres) drains to the existing 66" RCP in Fairview Road via a onsite storm drain system or sheet flows. The northern portion (approx. 59 acres) drains in a northerly direction toward Arlington Drive and an existing earthen channel and 54" RCP. Of the 54 acres, the flow for approximately 19 acres drains via an onsite storm drain system and the remaining 35 acres sheet flows. The southern and eastern area (approx. 61 acres) drains in an easterly direction via three existing storm drain systems to a 54" RCP in Newport Boulevard.

III. Hydrology Study

Storm Frequency

This study is intended to determine "local" discharges for use in the design of lateral storm drains and catch basins. 25 & 100 year storm design criteria was used for all sump condition. The 10-year was also run to compare results with the hydrology done by Sikand Engineering in 1985.

Methodology

This study was prepared in conformance with the Orange County Hydrology Manual. A.E.S. Computer Software (Version 7.1) was utilized to compile the hydrologic data and to determine the peak discharges and approximate storm drain sizes.

Copies of the computer printouts are included in this report as Appendix B & C.

IV. Previous Reports

Previous Hydrology Reports

A previous hydrology was done by Sikand engineering in 1985 for the design of the existing 54" storm drain in Arlington Avenue. A Master Plan of Drainage was done for the City of Costa Mesa by Boyle Engineering Corporation in January, 1984. The City is presently having a new Master Plan of Drainage prepared, but it is not complete at this time.

V. Existing Drainage Areas

The site is divided into fourteen (14) existing drainage areas. The description for each is as follows:

Area "A"

Area "A covers the parking lots in the southeast corner of the site approximately 9.3 acres. The drainage area sheet flows in a northwesterly direction exiting the unused Princeton entrance onto Fairview Road.

Area "B"

Area "B" is a parking lot area just north of area A (approx. 6.2 acres). The existing storm drain consists of two catch basins connected by a 12" pipe then connect into the back of a catch basin in Fairview Road, where it then connects to the existing 66" storm drain.

Area "C"

Area "C" includes the amphitheater area and the adjacent parking lot (approx. 17.11 acres). The flow from the amphitheater area (approx. 6.5 acres) is pumped out and exits through a catch basin opening onto the parking drive aisle. It then proceeds down a concrete gutter, picking up sheet flow from the parking area. After approximately 300 feet it turns into a pair of concrete v-gutters. The flow is intercepted by a catch basin at the edge of the parking lot adjacent to Arlington Avenue. A storm drain pipe carries the flow into the back of a catch basin on Fairview Road, which connects to the 66" storm drain in Fairview.

Area "D"

Area "D" is the largest area (approx. 43.5 acres), which drains most of the parking lots that face Fair Drive. An existing storm drain and catch basins drain the north end of the west half of this area as it flows to the east. The storm drain then proceeds into the parking lot and collects water with a series of drop inlets. A large catch basin on the east end of the lot

VI. Proposed Drainage Areas & Storm Drain

Eight (8) local storm drain areas are proposed for this project as follows:

Area "A & B"

Areas "A & B" are unaffected for the most part by the proposed plan

Area "C"

The area has been reduced from approximately 17.1 acres to 14.4 acres due to the amphitheater area being regarded for the proposed park. The 25-year flow reduced from 52.5 cfs to 36.5 cfs. The existing 18" pvc should be replaced this a 36" RCP.

Area "D"

The area has been reduced from approximately 43.5 acres to 40 acres due to the proposed Exhibit and Administration building. The 25-year flow reduced from 92.2 cfs to 84.17 cfs. The proposed design includes a bio-swale along the entrance off Mesa Drive with a proposed 42" RCP, 48" RCP storm drain and five catch basins with a filter insert and a storm drain insert.

Area "E"

The area has been reduced from approximately 6.8 acres to 3.5 acres due to the proposed parking lot area. The 25-year flow reduced from 16.7 cfs to 9.1 cfs. The existing storm drain is sufficient to handle the flow. A bio-filtration is proposed by the existing catch basin.

Area "F"

The area has been reduced from approximately 10.4 acres to 8.4 acres due to the proposed parking area. The 25-year flow reduced from 17.9 cfs to 11.3 cfs and the existing storm drain system is sufficient. For water quality purposes, a 500-gallon septic tank, local sump area, a first flush treatment basin are proposed.

Area "G - N"

The existing Area G – N has been combined from the proposed as Area G (onsite) and are an H offsite. The existing Area G – M has increased from 54 acres to 65 acres due to the regarding of the amphitheater and the proposed parking lot. The existing Area N, which is Arlington Drive, becomes Area H and the acreage remains the same approximately 7.5 acres. The 25-year flow to the existing 54" RCP in Arlington Drive for Area G& N combined has increased by 24% from 100.4 cfs to 123.7 cfs.

The existing 54" RCP has been proposed to be extended approximately 2000 feet to the west with five new storm drain laterals for onsite flow interception. The proposed onsite storm drain system includes 12" PVC, 18" RCP, 24" RCP, 30" RCP, 36" RCP, eighteen (18) catch basins with filter inserts, several bio-swales, local SUSMP, and water quality basin in the park area and a low flow sewer division.

VII. Arlington Avenue Alternative

In lieu of constructing an underground storm drain system, cleaning out and widening the existing earthen ditch along the south side of the road is an interim alternative. The following design criteria would apply:

Q25	DEPTH	BASE
7.1	1.0'	2.0'
45.2	1.5'	6.0'
89.93	1.5'	14.0'
121.0	1.5'	20.0'

VIII. Results and Conclusions

The analysis of the existing versus the proposed Hydrology has indicated that the overall flow from the site has not changed. Although the drainage area for Areas C, D, E, & F have decreased and Area G (proposed) has increased, the cumulative flow from the site has decreased from 405 cfs to 394 cfs, approximately 2.5%. The existing 54 RCP in Arlington Drive was designed to handle a 10-year flow if 100.7 cfs with an area of 65.2 acres and it can handle the proposed 25-year flow of 123.7 cfs with an area of 72.3 acres.

Area A and B will remain the same. Area C will require a new lateral of 36' RCP to handle a 25-year flow. Area D will require a bio-swale, regarding of a portion of the parking lot and a new storm drain system. Area E and F's storm drain is sufficient. The areas will require water quality mitigations.

The drainage Area G has increased by 20% from 54 acres to 65 acres. The increase in flow will be handled by the proposed onsite storm drain system, which will connect to the extension of the existing 54" RCP in Arlington Drive. The proposed bio-swales, catch basin inserts, water quality basin, and low flow sewer division will handle the water quality mitigations.

picks up the remainder of the drainage. This then flows into an existing 54 " storm drain in Newport Boulevard which proceeds northerly.

Area "E"

Area "E" covers the parking lot north of the Fairgrounds Driveway entrance and the east part of the existing carnival area (approx. 6.8 acres). It sheet flows to an existing catch basin on the east side. It then proceeds into the existing 54" storm drain in Newport Boulevard.

Area "F"

Area "F" covers the staging and arena areas of the existing equestrian center (approx 10.4 acres). Water sheet flows and is carried in concrete v-gutters to a large catch basin. It then proceeds underground to an existing detention basin with a pressure gate outlet. When the water reaches a certain height the gate opens and the water flows out into the existing 54" storm drain in Newport Boulevard.

Area "G"

Area "G" covers the easterly portion of the stables in the equestrian center. The drainage in this area sheet flows out onto Arlington Avenue.

Area "H"

Area "H" covers the westerly portion of the stables in the equestrian center. The drainage in this area also sheet flows out onto Arlington Avenue.

Area "I"

Area "I" covers the barn area of Centennial Farm, the two large exhibit builgings, through the carnival area. This sheet flows with the help of a series of concrete gutters, a small 2-8" storm drain with slot drain inlets and drop inlets. This is sized for nuisance water and easily floods with any appreciable rainfall. Two 8" pipes then outlet onto Arlington Avenue.

Area "J"

Area "J" covers the Arena area. This area sheet flows out onto Arlington Avenue.

Area "K"

Area "K" covers the middle portion of the Exhibit area as well as the maintenance yard. The drainage in this area also sheet flows out onto Arlington Avenue.

Area "L"

Area "L" covers the back side of the Amphitheater and the east end of the parking lot adjacent to Arlington. The drainage in this area also sheet flows out onto Arlington Avenue.

Area "M"

Area "M" covers the westerly portion of Centennial Gardens, the west end of the Exhibit area, the Festival area, and Arlington Theater. The drainage in this area also sheet flows out onto Arlington Avenue via a sidewalk culvert.

Area "N"

Area "N" covers Arlington Avenue. Arlington Avenue is improved with curb and gutter on both sides for 800 feet on the west end near Fairview, and on the north side for 50 feet on the east end near Newport Blvd. In between it has a graded earthen ditch along the edge of the Fairgrounds property. This ditch is not maintained and has silted up reducing its capacity to that of nuisance water flows only. Any appreciable rainfall and the street floods.

The following is a table summarizing the acreage, 25-year flow and a 100-year flow:

AREA	ACREAGE	Q25cfs	Q100
A	9.31	21.95	28.45
B	6.16	16.30	21.12
C	17.11	52.53	68.39
D	43.46	92.22	120.33
E	6.81	16.69	21.66
F	10.39	17.89	23.56
G	2.0	4.47	5.78
H	2.94	5.76cfs	8.72
J	19.02	37.87	49.43
J	2.96	8.66	11.15
K	6.60	17.88	23.07
L	17.07	34.74	45.50
M	3.28	4.63	6.04
Total H-N (OFFSITE)	61.35	100.38	131.19

IX. Appendices

Appendix A – Existing 10-Year Hydrology Calculations

Appendix B – Existing 25-Year Hydrology Calculations

Appendix C – Existing 100-Year Hydrology Calculations

Appendix D – Proposed 10-Year Hydrology Calculations

Appendix E – Proposed 25-Year Hydrology Calculations

Appendix F – Proposed 100-Year Hydrology Calculations

Appendix G - Earthern Ditch Sizing Analysis for Arlington Avenue

Appendix H – Existing Hydrology/Storm Drain Area Map
(In Pocket)

Appendix I – Proposed Hydrology/Storm Drain Area Map
(In Pocket)

Appendix A

Existing 10-Year Hydrology Calculations

```
**************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 OCEMA HYDROLOGY CRITERION)
        (c) Copyright 1983-2000 Advanced Engineering Software (aes)
            Ver. 8.0  Release Date: 01/01/2000  License ID 1355

                          Analysis prepared by:

                        FUSCOE ENGINEERING, INC.
                      16795 VON KARMAN, SUITE 100
                           IRVINE, CA  92606
                    TEL: 949.474.1960    FAX: 949.474.5315

 ************************** DESCRIPTION OF STUDY **************************
* Orange County Fair Grounds                                              *
* Existing 10 Yr. Hydrology                                               *
* Area A thru Area N                                                      *
 *************************************************************************

  FILE NAME: 30902A.10
  TIME/DATE OF STUDY: 15:22 07/30/2002
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*


**************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     20.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =     76.18  DOWNSTREAM(FEET) =     73.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.825
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.141
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 D        1.95      0.20       0.10     75    7.83
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      5.48
  TOTAL AREA(ACRES) =      1.95   PEAK FLOW RATE(CFS) =      5.48

**************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     30.00 IS CODE =   9
```

```
 ----------------------------------------------------------------------------
   >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
 ============================================================================
   UPSTREAM NODE ELEVATION(FEET) =      73.00
   DOWNSTREAM NODE ELEVATION(FEET) =      70.76
   CHANNEL LENGTH THRU SUBAREA(FEET) =    630.00
   "V" GUTTER WIDTH(FEET) =    2.00    GUTTER HIKE(FEET) =  0.080
   PAVEMENT LIP(FEET) =  0.010    MANNING'S N = .0150
   PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
   MAXIMUM DEPTH(FEET) =    1.00
   *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.204
   SUBAREA LOSS RATE DATA(AMC  II):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   COMMERCIAL                  D        4.79      0.20       0.10    75
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     10.11
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =    1.56
   AVERAGE FLOW DEPTH(FEET) =    0.33    FLOOD WIDTH(FEET) =    50.52
   "V" GUTTER FLOW TRAVEL TIME(MIN.) =    6.72    Tc(MIN.) =  14.54
   SUBAREA AREA(ACRES) =     4.79        SUBAREA RUNOFF(CFS) =     9.41
   EFFECTIVE AREA(ACRES) =     6.74      AREA-AVERAGED Fm(INCH/HR) =    0.02
   AREA-AVERAGED Fp(INCH/HR) =    0.20   AREA-AVERAGED Ap =    0.10
   TOTAL AREA(ACRES) =     6.74          PEAK FLOW RATE(CFS) =       13.25

   END OF SUBAREA "V" GUTTER HYDRAULICS:
   DEPTH(FEET) =  0.36    FLOOD WIDTH(FEET) =    56.21
   FLOW VELOCITY(FEET/SEC.) =    1.66    DEPTH*VELOCITY(FT*FT/SEC) =    0.60
   LONGEST FLOWPATH FROM NODE      10.00 TO NODE      30.00 =    960.00 FEET.

 ****************************************************************************
   FLOW PROCESS FROM NODE      30.00 TO NODE      30.00 IS CODE =  81
 ----------------------------------------------------------------------------
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
 ============================================================================
   MAINLINE Tc(MIN) =  14.54
   *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.204
   SUBAREA LOSS RATE DATA(AMC  II):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   COMMERCIAL                  D        2.47      0.20       0.10    75
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
   SUBAREA AREA(ACRES) =     2.47        SUBAREA RUNOFF(CFS) =     4.85
   EFFECTIVE AREA(ACRES) =     9.21      AREA-AVERAGED Fm(INCH/HR) =  0.02
   AREA-AVERAGED Fp(INCH/HR) =  0.20     AREA-AVERAGED Ap =  0.10
   TOTAL AREA(ACRES) =     9.21          PEAK FLOW RATE(CFS) =       18.10

 ****************************************************************************
   FLOW PROCESS FROM NODE      30.00 TO NODE      40.00 IS CODE =   9
 ----------------------------------------------------------------------------
   >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
 ============================================================================
   UPSTREAM NODE ELEVATION(FEET) =      70.76
   DOWNSTREAM NODE ELEVATION(FEET) =      70.51
   CHANNEL LENGTH THRU SUBAREA(FEET) =     85.00
```

```
"V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
MAXIMUM DEPTH(FEET) =   1.00
*  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.132
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  D        0.10      0.20       0.10    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     18.20
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.67
AVERAGE FLOW DEPTH(FEET) =   0.48   FLOOD WIDTH(FEET) =   65.44
"V" GUTTER FLOW TRAVEL TIME(MIN.) =   0.85   Tc(MIN.) =  15.39
SUBAREA AREA(ACRES) =    0.10       SUBAREA RUNOFF(CFS) =    0.19
EFFECTIVE AREA(ACRES) =    9.31     AREA-AVERAGED Fm(INCH/HR) =   0.02
AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
TOTAL AREA(ACRES) =    9.31         PEAK FLOW RATE(CFS) =      18.10
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

END OF SUBAREA "V" GUTTER HYDRAULICS:
DEPTH(FEET) =  0.48   FLOOD WIDTH(FEET) =   65.11
FLOW VELOCITY(FEET/SEC.) =   1.68   DEPTH*VELOCITY(FT*FT/SEC) =   0.81
LONGEST FLOWPATH FROM NODE     10.00 TO NODE     40.00 =  1045.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     50.00 TO NODE     60.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
ELEVATION DATA: UPSTREAM(FEET) =     74.25  DOWNSTREAM(FEET) =     71.30

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.944
*  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.133
SUBAREA Tc AND LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
COMMERCIAL                  D        0.88      0.20       0.10    75    7.94
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA RUNOFF(CFS) =      2.47
TOTAL AREA(ACRES) =      0.88   PEAK FLOW RATE(CFS) =      2.47

****************************************************************************
FLOW PROCESS FROM NODE     60.00 TO NODE     70.00 IS CODE =   9
----------------------------------------------------------------------------
>>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
UPSTREAM NODE ELEVATION(FEET) =     71.30
DOWNSTREAM NODE ELEVATION(FEET) =     68.25
CHANNEL LENGTH THRU SUBAREA(FEET) =   260.00
"V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.080
PAVEMENT LIP(FEET) =  0.030   MANNING'S N = .0150
```

```
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.733
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.86      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.72
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.12
 AVERAGE FLOW DEPTH(FEET) =   0.24   FLOOD WIDTH(FEET) =   28.94
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.04   Tc(MIN.) =   9.98
 SUBAREA AREA(ACRES) =    1.86       SUBAREA RUNOFF(CFS) =    4.54
 EFFECTIVE AREA(ACRES) =    2.74     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    2.74         PEAK FLOW RATE(CFS) =       6.69

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.27   FLOOD WIDTH(FEET) =   33.46
 FLOW VELOCITY(FEET/SEC.) =   2.28   DEPTH*VELOCITY(FT*FT/SEC) =   0.61
 LONGEST FLOWPATH FROM NODE     50.00 TO NODE     70.00 =   590.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     70.00 TO NODE     80.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    64.25  DOWNSTREAM(FEET) =    62.50
 FLOW LENGTH(FEET) =   500.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.06
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      6.69
 PIPE TRAVEL TIME(MIN.) =   2.05    Tc(MIN.) =  12.04
 LONGEST FLOWPATH FROM NODE     50.00 TO NODE     80.00 =  1090.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     80.00 TO NODE     80.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  12.04
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.461
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        3.42      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    3.42       SUBAREA RUNOFF(CFS) =    7.51
 EFFECTIVE AREA(ACRES) =    6.16     AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    6.16         PEAK FLOW RATE(CFS) =      13.53

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

```
 FLOW PROCESS FROM NODE     80.00 TO NODE     90.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    62.50  DOWNSTREAM(FEET) =    62.20
 FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.09
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     13.53
 PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =  12.27
 LONGEST FLOWPATH FROM NODE     50.00 TO NODE     90.00 =  1160.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    114.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     72.00  DOWNSTREAM(FEET) =     67.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.300
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.287
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 D        0.48      0.20       0.10     75    7.30
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      1.41
 TOTAL AREA(ACRES) =      0.48   PEAK FLOW RATE(CFS) =      1.41

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =    110.00  DOWNSTREAM(FEET) =     45.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  4.060
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 D        6.47      0.20       0.10     75    5.00
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =  6.47   INITIAL SUBAREA RUNOFF(CFS) =   23.52

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN) =   7.30
```

```
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.287
 SUBAREA AREA(ACRES) =     6.47      SUBAREA RUNOFF(CFS) =    19.02
 EFFECTIVE AREA(ACRES) =     6.95    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     6.95        PEAK FLOW RATE(CFS) =       20.44

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     67.50
 DOWNSTREAM NODE ELEVATION(FEET) =     65.30
 CHANNEL LENGTH THRU SUBAREA(FEET) =   340.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.804
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        3.86      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     25.30
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.44
 AVERAGE FLOW DEPTH(FEET) =   0.47   FLOOD WIDTH(FEET) =   63.81
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.32   Tc(MIN.) =   9.62
 SUBAREA AREA(ACRES) =     3.86      SUBAREA RUNOFF(CFS) =     9.67
 EFFECTIVE AREA(ACRES) =   10.81     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =   10.81         PEAK FLOW RATE(CFS) =       27.08

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.48   FLOOD WIDTH(FEET) =   65.44
 FLOW VELOCITY(FEET/SEC.) =   2.48   DEPTH*VELOCITY(FT*FT/SEC) =   1.20
 LONGEST FLOWPATH FROM NODE    112.00 TO NODE    120.00 =   670.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     65.30
 DOWNSTREAM NODE ELEVATION(FEET) =     63.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   380.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.453
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        6.30      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     33.97
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.56
  AVERAGE FLOW DEPTH(FEET) =   0.52   FLOOD WIDTH(FEET) =   72.29
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.47   Tc(MIN.) =  12.10
  SUBAREA AREA(ACRES) =     6.30        SUBAREA RUNOFF(CFS) =   13.80
  EFFECTIVE AREA(ACRES) =   17.11       AREA-AVERAGED Fm(INCH/HR) =   0.02
  AREA-AVERAGED Fp(INCH/HR) =   0.20   AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =   17.11           PEAK FLOW RATE(CFS) =      37.47

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.53   FLOOD WIDTH(FEET) =   75.23
  FLOW VELOCITY(FEET/SEC.) =   2.61   DEPTH*VELOCITY(FT*FT/SEC) =   1.39
  LONGEST FLOWPATH FROM NODE    112.00 TO NODE    130.00 =  1050.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    140.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    60.00  DOWNSTREAM(FEET) =    58.00
  FLOW LENGTH(FEET) =   480.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.55
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     37.47
  PIPE TRAVEL TIME(MIN.) =   1.22    Tc(MIN.) =  13.32
  LONGEST FLOWPATH FROM NODE    112.00 TO NODE    140.00 =  1530.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    160.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =     75.90  DOWNSTREAM(FEET) =     73.90

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.586
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.007
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 D        0.52      0.20        0.10    75    8.59
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      1.40
  TOTAL AREA(ACRES) =      0.52   PEAK FLOW RATE(CFS) =      1.40

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    170.00 IS CODE =   9
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =     73.90
```

```
 DOWNSTREAM NODE ELEVATION(FEET) =      71.20
 CHANNEL LENGTH THRU SUBAREA(FEET) =   410.00
 "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.050
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.393
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        3.37      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.89
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.71
 AVERAGE FLOW DEPTH(FEET) =   0.20   FLOOD WIDTH(FEET) =   33.09
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.99   Tc(MIN.) =  12.57
 SUBAREA AREA(ACRES) =    3.37       SUBAREA RUNOFF(CFS) =    7.20
 EFFECTIVE AREA(ACRES) =    3.89     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    3.89         PEAK FLOW RATE(CFS) =       8.31

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.24   FLOOD WIDTH(FEET) =   40.80
 FLOW VELOCITY(FEET/SEC.) =   1.94   DEPTH*VELOCITY(FT*FT/SEC) =   0.46
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    170.00 =   740.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    170.00 TO NODE    180.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    67.20  DOWNSTREAM(FEET) =    65.60
 FLOW LENGTH(FEET) =   280.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.16
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      8.31
 PIPE TRAVEL TIME(MIN.) =   0.90    Tc(MIN.) =  13.48
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    180.00 =  1020.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    180.00 TO NODE    180.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  13.48
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.306
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.21      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    2.21       SUBAREA RUNOFF(CFS) =    4.55
 EFFECTIVE AREA(ACRES) =    6.10     AREA-AVERAGED Fm(INCH/HR) =  0.02
```

```
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     6.10       PEAK FLOW RATE(CFS) =      12.55

****************************************************************************
 FLOW PROCESS FROM NODE    180.00 TO NODE    190.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    65.60  DOWNSTREAM(FEET) =    62.10
 FLOW LENGTH(FEET) =   600.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.75
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     12.55
 PIPE TRAVEL TIME(MIN.) =   1.74    Tc(MIN.) =  15.21
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    190.00 =  1620.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    190.00 TO NODE    190.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  15.21
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.145
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D       14.20      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =   14.20      SUBAREA RUNOFF(CFS) =   27.15
 EFFECTIVE AREA(ACRES) =    20.30   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    20.30       PEAK FLOW RATE(CFS) =      38.82

****************************************************************************
 FLOW PROCESS FROM NODE    190.00 TO NODE    200.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    62.10  DOWNSTREAM(FEET) =    60.90
 FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  33.0 INCH PIPE IS  27.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.46
 ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     38.82
 PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =  15.66
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    200.00 =  1820.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    200.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  15.66
```

```
 * 10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.112
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        2.48      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     2.48      SUBAREA RUNOFF(CFS) =     4.67
 EFFECTIVE AREA(ACRES) =    22.78    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    22.78        PEAK FLOW RATE(CFS) =       42.90

****************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    60.90  DOWNSTREAM(FEET) =    59.80
 FLOW LENGTH(FEET) =   190.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  26.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.70
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     42.90
 PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =  16.07
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    210.00 =  2010.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  16.07
 * 10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.083
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        2.47      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     2.47      SUBAREA RUNOFF(CFS) =     4.59
 EFFECTIVE AREA(ACRES) =    25.25    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    25.25        PEAK FLOW RATE(CFS) =       46.88

****************************************************************************
 FLOW PROCESS FROM NODE    210.00 TO NODE    220.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    59.80  DOWNSTREAM(FEET) =    58.40
 FLOW LENGTH(FEET) =   240.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  28.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.79
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     46.88
```

```
 PIPE TRAVEL TIME(MIN.) =    0.51     Tc(MIN.) =  16.59
 LONGEST FLOWPATH FROM NODE     150.00 TO NODE     220.00 =  2250.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     220.00 TO NODE     220.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  16.59
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.046
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        6.68      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     6.68      SUBAREA RUNOFF(CFS) =    12.18
 EFFECTIVE AREA(ACRES) =    31.93    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    31.93        PEAK FLOW RATE(CFS) =       58.21

****************************************************************************
 FLOW PROCESS FROM NODE     220.00 TO NODE     230.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     58.40  DOWNSTREAM(FEET) =     55.10
 FLOW LENGTH(FEET) =    580.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  31.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =    8.12
 ESTIMATED PIPE DIAMETER(INCH) =  39.00     NUMBER OF PIPES =    1
 PIPE-FLOW(CFS) =      58.21
 PIPE TRAVEL TIME(MIN.) =    1.19     Tc(MIN.) =  17.78
 LONGEST FLOWPATH FROM NODE     150.00 TO NODE     230.00 =  2830.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     230.00 TO NODE     230.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.78
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.963
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D       11.53      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    11.53      SUBAREA RUNOFF(CFS) =    20.17
 EFFECTIVE AREA(ACRES) =    43.46    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    43.46        PEAK FLOW RATE(CFS) =       76.01

****************************************************************************
 FLOW PROCESS FROM NODE     230.00 TO NODE     240.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
ELEVATION DATA: UPSTREAM(FEET) =     55.10  DOWNSTREAM(FEET) =     54.00
FLOW LENGTH(FEET) =     65.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  13.22
ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     76.01
PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =  17.86
LONGEST FLOWPATH FROM NODE    150.00 TO NODE    240.00 =  2895.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    250.00 TO NODE    260.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
ELEVATION DATA: UPSTREAM(FEET) =     63.50  DOWNSTREAM(FEET) =     59.40

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.437
*  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.241
SUBAREA Tc AND LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
COMMERCIAL                 D        0.32      0.20       0.10     75    7.44
NATURAL GOOD COVER
"MEADOWS"                  D        0.87      0.20       1.00     78   22.88
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.76
SUBAREA RUNOFF(CFS) =      3.31
TOTAL AREA(ACRES) =      1.19   PEAK FLOW RATE(CFS) =      3.31

****************************************************************************
FLOW PROCESS FROM NODE    260.00 TO NODE    270.00 IS CODE =   9
----------------------------------------------------------------------------
>>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
UPSTREAM NODE ELEVATION(FEET) =     59.40
DOWNSTREAM NODE ELEVATION(FEET) =     56.86
CHANNEL LENGTH THRU SUBAREA(FEET) =   610.00
"V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
MAXIMUM DEPTH(FEET) =   1.00
*  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.286
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 D        5.62      0.20       0.10     75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      8.87
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.63
AVERAGE FLOW DEPTH(FEET) =   0.38   FLOOD WIDTH(FEET) =   45.87
```

```
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   6.25   Tc(MIN.) =  13.69
 SUBAREA AREA(ACRES) =     5.62       SUBAREA RUNOFF(CFS) =    11.46
 EFFECTIVE AREA(ACRES) =    6.81      AREA-AVERAGED Fm(INCH/HR) =    0.04
 AREA-AVERAGED Fp(INCH/HR) =   0.20   AREA-AVERAGED Ap =    0.21
 TOTAL AREA(ACRES) =     6.81         PEAK FLOW RATE(CFS) =       13.75

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.43   FLOOD WIDTH(FEET) =   54.68
 FLOW VELOCITY(FEET/SEC.) =   1.79   DEPTH*VELOCITY(FT*FT/SEC) =    0.77
 LONGEST FLOWPATH FROM NODE   250.00 TO NODE    270.00 =   940.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    270.00 TO NODE    280.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    52.86  DOWNSTREAM(FEET) =    50.00
 FLOW LENGTH(FEET) =    80.00  MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  11.64
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     13.75
 PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =  13.80
 LONGEST FLOWPATH FROM NODE    250.00 TO NODE    280.00 =  1020.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    300.00 TO NODE    310.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     59.00  DOWNSTREAM(FEET) =     58.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.862
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.757
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 D        0.79      0.20       0.10     75    9.86
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      1.95
 TOTAL AREA(ACRES) =      0.79   PEAK FLOW RATE(CFS) =      1.95

****************************************************************************
 FLOW PROCESS FROM NODE    310.00 TO NODE    320.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     58.00
 DOWNSTREAM NODE ELEVATION(FEET) =     53.80
 CHANNEL LENGTH THRU SUBAREA(FEET) =  1070.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
```

```
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.719
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.30      0.20       0.10    75
 NATURAL FAIR COVER
 "GRASS"                     D        3.50      0.20       1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.76
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      5.20
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.43
 AVERAGE FLOW DEPTH(FEET) =   0.34   FLOOD WIDTH(FEET) =   37.06
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =  12.45   Tc(MIN.) =  22.31
 SUBAREA AREA(ACRES) =    4.80       SUBAREA RUNOFF(CFS) =    6.77
 EFFECTIVE AREA(ACRES) =    5.59     AREA-AVERAGED Fm(INCH/HR) =   0.13
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.66
 TOTAL AREA(ACRES) =    5.59         PEAK FLOW RATE(CFS) =       7.98

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.38   FLOOD WIDTH(FEET) =   44.24
 FLOW VELOCITY(FEET/SEC.) =   1.57   DEPTH*VELOCITY(FT*FT/SEC) =   0.59
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    320.00 =  1400.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    320.00 TO NODE    330.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    50.80  DOWNSTREAM(FEET) =    50.00
 FLOW LENGTH(FEET) =   130.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.27
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      7.98
 PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =  22.72
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    330.00 =  1530.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    330.00 TO NODE    330.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  22.72
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.701
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 NATURAL FAIR COVER
 "GRASS"                     D        4.80      0.20       1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA AREA(ACRES) =    4.80       SUBAREA RUNOFF(CFS) =    6.48
 EFFECTIVE AREA(ACRES) =   10.39     AREA-AVERAGED Fm(INCH/HR) =  0.16
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.82
```

```
 TOTAL AREA(ACRES) =    10.39       PEAK FLOW RATE(CFS) =      14.38

****************************************************************************
 FLOW PROCESS FROM NODE    350.00 TO NODE    360.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     58.00  DOWNSTREAM(FEET) =     56.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.094
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.908
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        1.40      0.20       0.10    75    9.09
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      3.64
 TOTAL AREA(ACRES) =      1.40   PEAK FLOW RATE(CFS) =      3.64

****************************************************************************
 FLOW PROCESS FROM NODE    360.00 TO NODE    370.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     56.50
 DOWNSTREAM NODE ELEVATION(FEET) =     55.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   320.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0350
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.073
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.60      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.20
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.75
 AVERAGE FLOW DEPTH(FEET) =   0.39   FLOOD WIDTH(FEET) =   46.52
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   7.12   Tc(MIN.) =  16.21
 SUBAREA AREA(ACRES) =    0.60       SUBAREA RUNOFF(CFS) =    1.11
 EFFECTIVE AREA(ACRES) =    2.00     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    2.00         PEAK FLOW RATE(CFS) =       3.69

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.38   FLOOD WIDTH(FEET) =   44.24
 FLOW VELOCITY(FEET/SEC.) =   0.73   DEPTH*VELOCITY(FT*FT/SEC) =   0.27
 LONGEST FLOWPATH FROM NODE    350.00 TO NODE    370.00 =   650.00 FEET.

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

```
 FLOW PROCESS FROM NODE    510.00 TO NODE    520.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     73.00  DOWNSTREAM(FEET) =     70.80

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   19.563
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.856
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 NATURAL FAIR COVER
 "GRASS"                     D        0.47      0.20       1.00    84   19.56
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA RUNOFF(CFS) =      0.70
 TOTAL AREA(ACRES) =      0.47   PEAK FLOW RATE(CFS) =      0.70

****************************************************************************
 FLOW PROCESS FROM NODE    520.00 TO NODE    530.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     70.80
 DOWNSTREAM NODE ELEVATION(FEET) =     67.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   720.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.482
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 NATURAL FAIR COVER
 "GRASS"                     D        1.39      0.20       1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.49
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.27
 AVERAGE FLOW DEPTH(FEET) =   0.23   FLOOD WIDTH(FEET) =   20.42
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   9.45   Tc(MIN.) =  29.01
 SUBAREA AREA(ACRES) =    1.39      SUBAREA RUNOFF(CFS) =    1.60
 EFFECTIVE AREA(ACRES) =    1.86    AREA-AVERAGED Fm(INCH/HR) =   0.20
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   1.00
 TOTAL AREA(ACRES) =    1.86        PEAK FLOW RATE(CFS) =       2.15

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.25   FLOOD WIDTH(FEET) =   24.13
 FLOW VELOCITY(FEET/SEC.) =   1.35   DEPTH*VELOCITY(FT*FT/SEC) =   0.33
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    530.00 =  1050.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    530.00 TO NODE    540.00 IS CODE =   9
```

```
 ----------------------------------------------------------------------------
   >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
 ============================================================================
   UPSTREAM NODE ELEVATION(FEET) =      67.00
   DOWNSTREAM NODE ELEVATION(FEET) =      62.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   400.00
   "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
   PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
   PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
   MAXIMUM DEPTH(FEET) =   1.00
   *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.394
   SUBAREA LOSS RATE DATA(AMC  II):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   COMMERCIAL                  D        1.42      0.20        0.10    75
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.02
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.00
   AVERAGE FLOW DEPTH(FEET) =   0.24   FLOOD WIDTH(FEET) =   23.46
   "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.33   Tc(MIN.) =  32.34
   SUBAREA AREA(ACRES) =     1.42       SUBAREA RUNOFF(CFS) =     1.76
   EFFECTIVE AREA(ACRES) =     3.28     AREA-AVERAGED Fm(INCH/HR) =    0.12
   AREA-AVERAGED Fp(INCH/HR) =    0.20  AREA-AVERAGED Ap =    0.61
   TOTAL AREA(ACRES) =     3.28         PEAK FLOW RATE(CFS) =        3.75

   END OF SUBAREA "V" GUTTER HYDRAULICS:
   DEPTH(FEET) =  0.25   FLOOD WIDTH(FEET) =   25.82
   FLOW VELOCITY(FEET/SEC.) =   2.08   DEPTH*VELOCITY(FT*FT/SEC) =   0.53
   LONGEST FLOWPATH FROM NODE    510.00 TO NODE    540.00 =  1450.00 FEET.

 ****************************************************************************
   FLOW PROCESS FROM NODE    540.00 TO NODE    540.00 IS CODE =  81
 ----------------------------------------------------------------------------
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
 ============================================================================
   MAINLINE Tc(MIN) =  32.34
   *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.394
   SUBAREA LOSS RATE DATA(AMC  II):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   COMMERCIAL                  D        1.00      0.20        0.10    75
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
   SUBAREA AREA(ACRES) =     1.00       SUBAREA RUNOFF(CFS) =     1.24
   EFFECTIVE AREA(ACRES) =     4.28     AREA-AVERAGED Fm(INCH/HR) =  0.10
   AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.49
   TOTAL AREA(ACRES) =     4.28         PEAK FLOW RATE(CFS) =        4.99

 ****************************************************************************
   FLOW PROCESS FROM NODE    540.00 TO NODE    500.00 IS CODE =  51
 ----------------------------------------------------------------------------
   >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA (NEW ELEMENT)<<<<<
 ============================================================================
   ELEVATION DATA: UPSTREAM(FEET) =      62.00  DOWNSTREAM(FEET) =      58.50
   CHANNEL LENGTH THRU SUBAREA(FEET) =  1050.00   CHANNEL SLOPE =  0.0033
```

```
 CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   2.00
 CHANNEL FLOW THRU SUBAREA(CFS) =      4.99
 FLOW VELOCITY(FEET/SEC) =   1.62   FLOW DEPTH(FEET) =   0.84
 TRAVEL TIME(MIN.) =  10.77   Tc(MIN.) =  43.11
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2500.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  43.11
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.186
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.98      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.98      SUBAREA RUNOFF(CFS) =    1.03
 EFFECTIVE AREA(ACRES) =     5.26   AREA-AVERAGED Fm(INCH/HR) =  0.08
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.42
 TOTAL AREA(ACRES) =     5.26       PEAK FLOW RATE(CFS) =       5.22

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    470.00 TO NODE    480.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     73.00  DOWNSTREAM(FEET) =     70.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.917
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.138
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.51      0.20       0.10    75    7.92
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      1.43
 TOTAL AREA(ACRES) =      0.51   PEAK FLOW RATE(CFS) =      1.43

****************************************************************************
 FLOW PROCESS FROM NODE    480.00 TO NODE    490.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
```

```
 UPSTREAM NODE ELEVATION(FEET) =     70.00
 DOWNSTREAM NODE ELEVATION(FEET) =     64.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   720.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.151
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.07      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.38
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.67
 AVERAGE FLOW DEPTH(FEET) =   0.26   FLOOD WIDTH(FEET) =   27.51
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   7.20   Tc(MIN.) =  15.12
 SUBAREA AREA(ACRES) =    2.07       SUBAREA RUNOFF(CFS) =    3.97
 EFFECTIVE AREA(ACRES) =    2.58     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    2.58         PEAK FLOW RATE(CFS) =       4.95

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.29   FLOOD WIDTH(FEET) =   32.24
 FLOW VELOCITY(FEET/SEC.) =   1.81   DEPTH*VELOCITY(FT*FT/SEC) =   0.52
 LONGEST FLOWPATH FROM NODE    470.00 TO NODE    490.00 =  1050.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    490.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  15.12
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.151
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.21      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    2.21       SUBAREA RUNOFF(CFS) =    4.24
 EFFECTIVE AREA(ACRES) =    4.79     AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    4.79         PEAK FLOW RATE(CFS) =       9.19

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    490.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  15.12
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.151
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.33      0.20       0.10    75
```

```
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     2.33      SUBAREA RUNOFF(CFS) =     4.47
 EFFECTIVE AREA(ACRES) =     7.12    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     7.12        PEAK FLOW RATE(CFS) =      13.66

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    500.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     64.50
 DOWNSTREAM NODE ELEVATION(FEET) =     58.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   530.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.942
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        2.60      0.20        0.10    75
 NATURAL FAIR COVER
 "GRASS"                    D        7.35      0.20        1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.76
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     21.61
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.92
 AVERAGE FLOW DEPTH(FEET) =   0.39   FLOOD WIDTH(FEET) =   53.87
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.02   Tc(MIN.) =  18.14
 SUBAREA AREA(ACRES) =     9.95      SUBAREA RUNOFF(CFS) =   16.02
 EFFECTIVE AREA(ACRES) =   17.07     AREA-AVERAGED Fm(INCH/HR) =   0.10
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.49
 TOTAL AREA(ACRES) =   17.07         PEAK FLOW RATE(CFS) =      28.33

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.42   FLOOD WIDTH(FEET) =   59.95
 FLOW VELOCITY(FEET/SEC.) =   3.11   DEPTH*VELOCITY(FT*FT/SEC) =   1.32
 LONGEST FLOWPATH FROM NODE    470.00 TO NODE    500.00 =  1580.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
     1      28.33  18.14     1.942   0.20( 0.10)  0.49     17.1      470.00
 LONGEST FLOWPATH FROM NODE    470.00 TO NODE    500.00 =  1580.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
```

```
    1       5.22  43.11    1.186  0.20( 0.08) 0.42      5.3      510.00
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2500.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1      32.03  18.14     1.942   0.20( 0.10) 0.48     19.3      470.00
    2      21.95  43.11     1.186   0.20( 0.09) 0.47     22.3      510.00
   TOTAL AREA(ACRES) =      22.33

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       32.03  Tc(MIN.) =   18.141
 EFFECTIVE AREA(ACRES) =     19.28  AREA-AVERAGED Fm(INCH/HR) =  0.10
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.48
 TOTAL AREA(ACRES) =     22.33
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2500.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     58.50  DOWNSTREAM(FEET) =     58.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   270.00   CHANNEL SLOPE =  0.0019
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   3.00
 CHANNEL FLOW THRU SUBAREA(CFS) =     32.03
 FLOW VELOCITY(FEET/SEC) =   2.09   FLOW DEPTH(FEET) =   2.12
 TRAVEL TIME(MIN.) =   2.15   Tc(MIN.) =  20.29
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2770.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    460.00 TO NODE    460.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  20.29
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.816
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.25      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.25      SUBAREA RUNOFF(CFS) =     0.40
 EFFECTIVE AREA(ACRES) =    19.53   AREA-AVERAGED Fm(INCH/HR) =  0.09
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.47
 TOTAL AREA(ACRES) =    22.58       PEAK FLOW RATE(CFS) =       32.03
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    460.00 TO NODE    460.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    440.00 TO NODE    450.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     65.40  DOWNSTREAM(FEET) =     62.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.971
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.128
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 D        1.60      0.20       0.10     75    7.97
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      4.48
 TOTAL AREA(ACRES) =      1.60   PEAK FLOW RATE(CFS) =      4.48

****************************************************************************
 FLOW PROCESS FROM NODE    450.00 TO NODE    460.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     62.50
 DOWNSTREAM NODE ELEVATION(FEET) =     58.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   490.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.522
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        5.00      0.20       0.10     75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     10.00
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.27
 AVERAGE FLOW DEPTH(FEET) =   0.33   FLOOD WIDTH(FEET) =   41.36
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.60   Tc(MIN.) =  11.57
 SUBAREA AREA(ACRES) =    5.00       SUBAREA RUNOFF(CFS) =   11.26
 EFFECTIVE AREA(ACRES) =    6.60     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    6.60         PEAK FLOW RATE(CFS) =      14.86

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.37   FLOOD WIDTH(FEET) =   48.46
 FLOW VELOCITY(FEET/SEC.) =   2.47   DEPTH*VELOCITY(FT*FT/SEC) =   0.91
 LONGEST FLOWPATH FROM NODE    440.00 TO NODE    460.00 =   820.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    460.00 TO NODE    460.00 IS CODE =  11
----------------------------------------------------------------------------
```

```
   >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
 ============================================================================

   ** MAIN STREAM CONFLUENCE DATA **
    STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
    NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
       1      14.86  11.57     2.522   0.20( 0.02) 0.10      6.6      440.00
   LONGEST FLOWPATH FROM NODE    440.00 TO NODE    460.00 =   820.00 FEET.

   ** MEMORY BANK #  2 CONFLUENCE DATA **
    STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
    NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
       1      32.03  20.29     1.816   0.20( 0.09) 0.47     19.5      470.00
       2      21.95  45.48     1.153   0.20( 0.09) 0.47     22.6      510.00
   LONGEST FLOWPATH FROM NODE    510.00 TO NODE    460.00 =  2770.00 FEET.

   ** PEAK FLOW RATE TABLE **
    STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
    NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
       1      40.63  11.57     2.522   0.20( 0.07) 0.34     17.7      440.00
       2      42.70  20.29     1.816   0.20( 0.08) 0.38     26.1      470.00
       3      28.68  45.48     1.153   0.20( 0.08) 0.38     29.2      510.00
     TOTAL AREA(ACRES) =      29.18

   COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
   PEAK FLOW RATE(CFS) =       42.70  Tc(MIN.) =   20.291
   EFFECTIVE AREA(ACRES) =     26.13  AREA-AVERAGED Fm(INCH/HR) =  0.08
   AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.38
   TOTAL AREA(ACRES) =     29.18
   LONGEST FLOWPATH FROM NODE    510.00 TO NODE    460.00 =  2770.00 FEET.

****************************************************************************
   FLOW PROCESS FROM NODE    460.00 TO NODE    430.00 IS CODE =  51
----------------------------------------------------------------------------
   >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
   ELEVATION DATA: UPSTREAM(FEET) =     58.00  DOWNSTREAM(FEET) =     56.70
   CHANNEL LENGTH THRU SUBAREA(FEET) =   465.00   CHANNEL SLOPE =  0.0028
   CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
   MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   3.00
   CHANNEL FLOW THRU SUBAREA(CFS) =     42.70
   FLOW VELOCITY(FEET/SEC) =   2.63   FLOW DEPTH(FEET) =   2.19
   TRAVEL TIME(MIN.) =   2.94   Tc(MIN.) =  23.23
   LONGEST FLOWPATH FROM NODE    510.00 TO NODE    430.00 =  3235.00 FEET.

****************************************************************************
   FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =  81
----------------------------------------------------------------------------
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   MAINLINE Tc(MIN) =  23.23
   *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.681
   SUBAREA LOSS RATE DATA(AMC  II):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   COMMERCIAL                  D        0.32      0.20       0.10    75
```

```
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     0.32      SUBAREA RUNOFF(CFS) =     0.48
 EFFECTIVE AREA(ACRES) =    26.45    AREA-AVERAGED Fm(INCH/HR) =  0.08
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.38
 TOTAL AREA(ACRES) =    29.50        PEAK FLOW RATE(CFS) =       42.70
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    410.00 TO NODE    420.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     60.00  DOWNSTREAM(FEET) =     57.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.211
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.081
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS  Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 D        0.62      0.20       0.10     75    8.21
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      1.71
 TOTAL AREA(ACRES) =      0.62   PEAK FLOW RATE(CFS) =      1.71

****************************************************************************
 FLOW PROCESS FROM NODE    420.00 TO NODE    430.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     57.50
 DOWNSTREAM NODE ELEVATION(FEET) =     56.70
 CHANNEL LENGTH THRU SUBAREA(FEET) =   150.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.765
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        1.64      0.20       0.10     75
 NATURAL FAIR COVER
 "GRASS"                    D        0.70      0.20       1.00     84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.37
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.50
```

```
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =    1.55
 AVERAGE FLOW DEPTH(FEET) =   0.29   FLOOD WIDTH(FEET) =   33.25
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.61   Tc(MIN.) =   9.82
 SUBAREA AREA(ACRES) =    2.34       SUBAREA RUNOFF(CFS) =    5.67
 EFFECTIVE AREA(ACRES) =    2.96     AREA-AVERAGED Fm(INCH/HR) =   0.06
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.31
 TOTAL AREA(ACRES) =    2.96         PEAK FLOW RATE(CFS) =       7.20

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.33   FLOOD WIDTH(FEET) =   40.35
 FLOW VELOCITY(FEET/SEC.) =   1.71   DEPTH*VELOCITY(FT*FT/SEC) =   0.56
 LONGEST FLOWPATH FROM NODE    410.00 TO NODE    430.00 =   480.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)     NODE
     1       7.20   9.82    2.765  0.20( 0.06) 0.31      3.0      410.00
 LONGEST FLOWPATH FROM NODE    410.00 TO NODE    430.00 =   480.00 FEET.

 ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)     NODE
     1      40.63  14.56    2.202  0.20( 0.07) 0.33     18.1      440.00
     2      42.70  23.23    1.681  0.20( 0.08) 0.38     26.5      470.00
     3      28.68  48.75    1.108  0.20( 0.08) 0.38     29.5      510.00
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    430.00 =  3235.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)     NODE
     1      41.83   9.82    2.765  0.20( 0.07) 0.33     15.1      410.00
     2      46.33  14.56    2.202  0.20( 0.07) 0.33     21.0      440.00
     3      47.01  23.23    1.681  0.20( 0.07) 0.37     29.4      470.00
     4      31.46  48.75    1.108  0.20( 0.07) 0.37     32.5      510.00
   TOTAL AREA(ACRES) =      32.46

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       47.01  Tc(MIN.) =   23.234
 EFFECTIVE AREA(ACRES) =     29.41  AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.37
 TOTAL AREA(ACRES) =     32.46
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    430.00 =  3235.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    430.00 TO NODE    660.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     56.70  DOWNSTREAM(FEET) =     56.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0035
```

```
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   3.00
 CHANNEL FLOW THRU SUBAREA(CFS) =     47.01
 FLOW VELOCITY(FEET/SEC) =   2.93   FLOW DEPTH(FEET) =   2.18
 TRAVEL TIME(MIN.) =   1.14   Tc(MIN.) =  24.37
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    660.00 =  3435.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    660.00 TO NODE    660.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  24.37
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.635
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        0.19      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.19      SUBAREA RUNOFF(CFS) =    0.28
 EFFECTIVE AREA(ACRES) =    29.60   AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.37
 TOTAL AREA(ACRES) =    32.65      PEAK FLOW RATE(CFS) =      47.01
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    660.00 TO NODE    660.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    660.00 TO NODE    660.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    600.00 TO NODE    610.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =    70.20  DOWNSTREAM(FEET) =    66.90

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.767
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.168
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 D        0.56      0.20       0.10    75    7.77
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      1.59
```

```
 TOTAL AREA(ACRES) =      0.56   PEAK FLOW RATE(CFS) =      1.59

****************************************************************************
 FLOW PROCESS FROM NODE    610.00 TO NODE    620.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     66.90
 DOWNSTREAM NODE ELEVATION(FEET) =     63.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   750.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.131
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        5.06      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      6.13
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.64
 AVERAGE FLOW DEPTH(FEET) =   0.31   FLOOD WIDTH(FEET) =   37.99
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   7.63   Tc(MIN.) =  15.40
 SUBAREA AREA(ACRES) =    5.06       SUBAREA RUNOFF(CFS) =    9.62
 EFFECTIVE AREA(ACRES) =    5.62     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    5.62         PEAK FLOW RATE(CFS) =      10.68

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.36   FLOOD WIDTH(FEET) =   47.78
 FLOW VELOCITY(FEET/SEC.) =   1.83   DEPTH*VELOCITY(FT*FT/SEC) =   0.67
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    620.00 =  1080.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    620.00 TO NODE    630.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    61.00  DOWNSTREAM(FEET) =    59.40
 FLOW LENGTH(FEET) =   560.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.15
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     10.68
 PIPE TRAVEL TIME(MIN.) =   2.25    Tc(MIN.) =  17.65
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    630.00 =  1640.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    630.00 TO NODE    630.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.65
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.971
```

```
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.94      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     1.94      SUBAREA RUNOFF(CFS) =     3.41
 EFFECTIVE AREA(ACRES) =    7.56     AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =      7.56       PEAK FLOW RATE(CFS) =       13.28

****************************************************************************
 FLOW PROCESS FROM NODE     630.00 TO NODE     640.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     59.40  DOWNSTREAM(FEET) =     55.00
 FLOW LENGTH(FEET) =   380.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.51
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     13.28
 PIPE TRAVEL TIME(MIN.) =   0.84    Tc(MIN.) =  18.49
 LONGEST FLOWPATH FROM NODE     600.00 TO NODE     640.00 =  2020.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     640.00 TO NODE     640.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  18.49
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.921
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        3.71      0.20       0.10    75
 NATURAL FAIR COVER
 "GRASS"                     D        6.24      0.20       1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.66
 SUBAREA AREA(ACRES) =     9.95      SUBAREA RUNOFF(CFS) =    16.01
 EFFECTIVE AREA(ACRES) =    17.51    AREA-AVERAGED Fm(INCH/HR) =  0.08
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.42
 TOTAL AREA(ACRES) =   17.51        PEAK FLOW RATE(CFS) =       28.94

****************************************************************************
 FLOW PROCESS FROM NODE     640.00 TO NODE     650.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     55.00  DOWNSTREAM(FEET) =     54.00
 FLOW LENGTH(FEET) =   240.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  33.0 INCH PIPE IS  24.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.16
 ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
```

```
 PIPE-FLOW(CFS) =     28.94
 PIPE TRAVEL TIME(MIN.) =   0.65    Tc(MIN.) =  19.14
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    650.00 =  2260.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    650.00 TO NODE    650.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  19.14
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.882
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.51      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    1.51      SUBAREA RUNOFF(CFS) =    2.53
 EFFECTIVE AREA(ACRES) =  19.02     AREA-AVERAGED Fm(INCH/HR) =  0.08
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.40
 TOTAL AREA(ACRES) =    19.02       PEAK FLOW RATE(CFS) =      30.86

****************************************************************************
 FLOW PROCESS FROM NODE    650.00 TO NODE    660.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    54.00  DOWNSTREAM(FEET) =    53.00
 FLOW LENGTH(FEET) =   240.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  33.0 INCH PIPE IS  25.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.21
 ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     30.86
 PIPE TRAVEL TIME(MIN.) =   0.64    Tc(MIN.) =  19.78
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    660.00 =  2500.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    660.00 TO NODE    660.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1      30.86   19.78     1.843   0.20( 0.08) 0.40     19.0      600.00
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    660.00 =  2500.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1      41.83   10.99     2.599   0.20( 0.06) 0.32     15.3      410.00
    2      46.33   15.70     2.110   0.20( 0.07) 0.33     21.2      440.00
    3      47.01   24.37     1.635   0.20( 0.07) 0.37     29.6      470.00
    4      31.46   50.01     1.090   0.20( 0.07) 0.37     32.6      510.00
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    660.00 =  3435.00 FEET.
```

```
** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1      66.32  10.99     2.599   0.20( 0.07) 0.35     25.9      410.00
    2      74.52  15.70     2.110   0.20( 0.07) 0.36     36.3      440.00
    3      77.51  19.78     1.843   0.20( 0.07) 0.37     44.2      600.00
    4      74.23  24.37     1.635   0.20( 0.08) 0.38     48.6      470.00
    5      49.15  50.01     1.090   0.20( 0.08) 0.38     51.7      510.00
  TOTAL AREA(ACRES) =      51.67

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       77.51  Tc(MIN.) =   19.785
 EFFECTIVE AREA(ACRES) =     44.18  AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.35
 TOTAL AREA(ACRES) =     51.67
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    660.00 =  3435.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    660.00 TO NODE    402.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     53.00  DOWNSTREAM(FEET) =     51.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   530.00   CHANNEL SLOPE =  0.0038
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   3.00
 CHANNEL FLOW THRU SUBAREA(CFS) =     77.51
 FLOW VELOCITY(FEET/SEC) =   3.42   FLOW DEPTH(FEET) =   2.70
 TRAVEL TIME(MIN.) =   2.58   Tc(MIN.) =  22.37
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    402.00 =  3965.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  22.37
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.716
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.49      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.49      SUBAREA RUNOFF(CFS) =     0.75
 EFFECTIVE AREA(ACRES) =    44.67   AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.36
 TOTAL AREA(ACRES) =    52.16       PEAK FLOW RATE(CFS) =       77.51
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    380.00 TO NODE    390.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     59.80  DOWNSTREAM(FEET) =     59.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.313
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.689
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.83      0.20       0.10    75   10.31
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      1.99
 TOTAL AREA(ACRES) =      0.83   PEAK FLOW RATE(CFS) =      1.99

****************************************************************************
 FLOW PROCESS FROM NODE    390.00 TO NODE    400.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     59.00
 DOWNSTREAM NODE ELEVATION(FEET) =     55.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   520.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.143
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.11      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.99
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.76
 AVERAGE FLOW DEPTH(FEET) =   0.27   FLOOD WIDTH(FEET) =   29.20
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   4.92   Tc(MIN.) =  15.24
 SUBAREA AREA(ACRES) =    2.11   SUBAREA RUNOFF(CFS) =    4.03
 EFFECTIVE AREA(ACRES) =    2.94   AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    2.94   PEAK FLOW RATE(CFS) =      5.62

 END OF SUBAREA "V" GUTTER HYDRAULICS:
```

```
 DEPTH(FEET) =  0.29   FLOOD WIDTH(FEET) =   33.93
 FLOW VELOCITY(FEET/SEC.) =   1.86   DEPTH*VELOCITY(FT*FT/SEC) =   0.55
 LONGEST FLOWPATH FROM NODE    380.00 TO NODE    400.00 =   850.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    400.00 TO NODE    402.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     51.50  DOWNSTREAM(FEET) =     51.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =    20.00   CHANNEL SLOPE =  0.0250
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   4.00
 CHANNEL FLOW THRU SUBAREA(CFS) =      5.62
 FLOW VELOCITY(FEET/SEC) =   3.29   FLOW DEPTH(FEET) =   0.44
 TRAVEL TIME(MIN.) =   0.10   Tc(MIN.) =  15.34
 LONGEST FLOWPATH FROM NODE    380.00 TO NODE    402.00 =   870.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS) (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
     1       5.62  15.34     2.136  0.20( 0.02) 0.10      2.9      380.00
 LONGEST FLOWPATH FROM NODE    380.00 TO NODE    402.00 =   870.00 FEET.

 ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS) (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
     1      66.32  13.68     2.287  0.20( 0.07) 0.35     26.4      410.00
     2      74.52  18.31     1.931  0.20( 0.07) 0.35     36.8      440.00
     3      77.51  22.37     1.716  0.20( 0.07) 0.36     44.7      600.00
     4      74.23  26.98     1.547  0.20( 0.08) 0.38     49.1      470.00
     5      49.15  52.91     1.058  0.20( 0.08) 0.38     52.2      510.00
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    402.00 =  3965.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS) (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
     1      71.69  13.68     2.287  0.20( 0.07) 0.33     29.0      410.00
     2      74.87  15.34     2.136  0.20( 0.07) 0.33     33.1      380.00
     3      79.59  18.31     1.931  0.20( 0.07) 0.33     39.7      440.00
     4      82.01  22.37     1.716  0.20( 0.07) 0.35     47.6      600.00
     5      78.28  26.98     1.547  0.20( 0.07) 0.36     52.1      470.00
     6      51.90  52.91     1.058  0.20( 0.07) 0.36     55.1      510.00
   TOTAL AREA(ACRES) =      55.10

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       82.01  Tc(MIN.) =   22.366
 EFFECTIVE AREA(ACRES) =     47.61  AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.35
 TOTAL AREA(ACRES) =     55.10
```

```
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    402.00 =  3965.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    402.00 TO NODE    404.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     51.00  DOWNSTREAM(FEET) =     50.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   270.00   CHANNEL SLOPE =  0.0037
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   4.00
 CHANNEL FLOW THRU SUBAREA(CFS) =     82.01
 FLOW VELOCITY(FEET/SEC) =   3.45   FLOW DEPTH(FEET) =   2.78
 TRAVEL TIME(MIN.) =   1.31   Tc(MIN.) =  23.67
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    404.00 =  4235.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  23.67
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.663
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.19      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.19      SUBAREA RUNOFF(CFS) =    0.28
 EFFECTIVE AREA(ACRES) =    47.80   AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.35
 TOTAL AREA(ACRES) =    55.29       PEAK FLOW RATE(CFS) =      82.01
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    404.00 TO NODE    406.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    45.86  DOWNSTREAM(FEET) =    45.50
 FLOW LENGTH(FEET) =    89.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  54.0 INCH PIPE IS  33.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.05
 GIVEN PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     82.01
 PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =  23.86
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    406.00 =  4324.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    406.00 TO NODE    406.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  23.86
```

```
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.656
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.44      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     2.44      SUBAREA RUNOFF(CFS) =     3.59
 EFFECTIVE AREA(ACRES) =    50.24    AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.34
 TOTAL AREA(ACRES) =    57.73        PEAK FLOW RATE(CFS) =       82.01
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    406.00 TO NODE    408.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    45.50  DOWNSTREAM(FEET) =    44.00
 FLOW LENGTH(FEET) =   840.50   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.16
 GIVEN PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     82.01
 PIPE TRAVEL TIME(MIN.) =   2.72    Tc(MIN.) =  26.57
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    408.00 =  5164.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    408.00 TO NODE    408.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  26.57
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.560
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        3.62      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     3.62      SUBAREA RUNOFF(CFS) =     5.02
 EFFECTIVE AREA(ACRES) =    53.86    AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.32
 TOTAL AREA(ACRES) =    61.35        PEAK FLOW RATE(CFS) =       82.01
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =      61.35  TC(MIN.) =      26.57
 EFFECTIVE AREA(ACRES) =      53.86  AREA-AVERAGED Fm(INCH/HR)=  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.32
 PEAK FLOW RATE(CFS)    =      82.01

 ** PEAK FLOW RATE TABLE **
  STREAM     Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER   (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
     1     71.69  17.72     1.967   0.20( 0.06) 0.29     35.3      410.00
```

2	74.87	19.35	1.869	0.20(0.06)	0.29	39.3	380.00
3	79.59	22.61	1.706	0.20(0.06)	0.30	46.0	440.00
4	82.01	26.57	1.560	0.20(0.06)	0.32	53.9	600.00
5	78.28	30.97	1.427	0.20(0.07)	0.33	58.3	470.00
6	52.07	57.23	1.010	0.20(0.07)	0.34	61.3	510.00

END OF RATIONAL METHOD ANALYSIS

1

Southern California Welands Recovery Project
2002-2003 Work Plan Summary

TIER 1 PROJECTS (See page A3 for explanation of Tiers 1 and 2)

No.	Project Name	Local Lead	County	Type of Project	Estimated Total Cost	Estimated WRP Contribution
16.*	Caulerpa Taxifolia Eradication Program	Agua Hedionda Lagoon Foundation	San Diego	Restoration	$6,000,000	$1,000,000
19.*	San Luis Rey River Arundo Removal	Mission Resource Conservation District	San Diego	Restoration	$6,420,600	$642,000
32.	Hellman Ranch Acquisition (Los Cerritos)	Wildlife Conservation Board	Orange	Acquisition	Confidential	See Description
43.*	Topanga Lagoon Restoration Technical Assessments	RCD of the Santa Monica Mountains	Los Angeles	Planning	$309,762	$76,762
44.	Malibu Lagoon Habitat Enhancement Program	California Department of Parks and Recreation	Los Angeles	Planning	$575,000	$650,000
41.*	Ballona Wetlands Area C Assessment and Conceptual Restoration Study	To be determined	Los Angeles	Planning	$100,000	$100,000
51.	Ormond Beach Wetlands Acquisition	Coastal Conservancy	Ventura	Acquisition	$20,000,000	$5,000,000
52.	Ormond Beach Wetlands Restoration Plan	Coastal Conservancy	Ventura	Planning	$325,000	$200,000
57.*	Carpinteria Creek Restoration Project	Community Environmental Council	Santa Barbara	Restoration	$412,900	$300,000
				Subtotal Tier 1 Projects	**$34,143,262**	**$7,968,762**

TIER 2 PROJECTS

No.	Project Name	Local Lead	County	Type of Project	Estimated Total Cost	Estimated WRP Contribution
5.	Otay Mesa Vernal Pools Acquisition	County of San Diego	San Diego	Acquisition	$4,500,000	$500,000
7.	Rose Creek Enhancement Plan	To be determined	San Diego	Planning	$60,000	$60,000
11.*	Escondido Creek Watershed Restoration Action Strategy	San Elijo Lagoon Conservancy	San Diego	Planning	$328,900	$250,000
12.	Escondido Creek Restoration - Bumann Site	Escondido Creek Conservancy	San Diego	Restoration	$235,510	$220,770
13.	ESD Park Riparian Restoration (Cottonwood Creek)	City of Encinitas	San Diego	Restoration	$272,500	$136,250
14.*	Batiquitos Lagoon Saxony Property Acquisition	City of Encinitas	San Diego	Acquisition	$1,200,000	$200,000
15.*	Batiquitos Lagoon Exotics Removal and Revegetation	Batiquitos Lagoon Foundation	San Diego	Planning	$160,000	$150,000
18.	Buena Vista Creek Acquisition, Sherman Parcel	County of San Diego	San Diego	Acquisition	$4,400,000	$750,000

* = New project on Work Plan.
Use the project number to locate the project description in Attachment C.

Southern California Welands Recovery Project
2002-2003 Work Plan Summary

No.	Project Name	Local Lead	County	Type of Project	Estimated Total Cost	Estimated WRP Contribution
20.	Wood Canyon Stream Stabilization and Restoration	County of Orange	Orange	Restoration	$1,500,000	$300,000
21.	Aliso Creek Dairy Fork Biofiltration Basin	County of Orange	Orange	Restoration	$430,000	$215,000
23.*	Serrano Creek Exotics Removal	County of Orange	Orange	Restoration	$227,650	$58,000
26.*	Big Canyon Creek Restoration Project	Community Conservancy International	Orange	Planning	$250,000	$100,000
27.	Talbert Marsh Tidal Channel Enhancement Design	Huntington Beach Wetlands Conservancy	Orange	Planning	$80,000	$50,000
28.	Huntington Beach Acquisitions	Huntington Beach Wetlands Conservancy	Orange	Acquisition	$5,000,000	$2,000,000
29.	Bolsa Chica Wetlands Restoration	Steering committee of 8 federal and state agencies.	Orange	Restoration	$90,000,000	$20,000,000
30.*	East Garden Grove Wintersburg Channel Treatment Wetland	City of Huntington Beach	Orange	Planning	$390,000	$80,000
31.	Coyote Creek Watershed Plan	County of Orange	Orange	Planning	$2,000,000	$130,000
33.	Bryant Acquisition (Los Cerritos)	Trust for Public Land	Los Angeles	Acquisition	Confidential	$1,000,000
34.	Bixby Ranch Company Acquisition (Los Cerritos)	Trust for Public Land	Los Angeles	Acquisition	Confidential	$14,000,000
35.	Los Cerritos Wetlands Conceptual Restoration Plan	Coastal Conservancy	Los Angeles	Planning	$500,000	$500,000
36.	Colorado Lagoon Restoration Project	City of Long Beach	Los Angeles	Planning	$200,000	$200,000
37.	Lower Los Angeles and San Gabriel Rivers Habitat Needs Assessment	Coastal Conservancy	Los Angeles	Planning	$100,000	$100,000
38.*	DeForest Wetlands Restoration Preliminary Plan	City of Long Beach	Los Angeles	Restoration	$300,000	$300,000
39.	Lower Los Angeles River Acquisitions	City of Long Beach	Los Angeles	Acquisition	$20,000,000	$2,000,000
40.	Big Tujunga Wash Revegetation and Restoration	California Environmental Project	Los Angeles	Restoration	$153,680	$83,000
42.*	Ballona Wetlands Acquisition	Trust for Public Land	Los Angeles	Acquisition	Not Available	$25,000,000
45.*	Cross Creek Road Fish Passage	Malibu Coastal Land Conservancy	Los Angeles	Restoration	$620,000	$310,000
46.	Upper Malibu Creek Feasibility Study (Rindge Dam)	California Department of Parks and Recreation	Los Angeles	Planning	$2,000,000	$500,000
47.*	Cold Creek Riparian Acquisitions, Part 2	Mountains Restoration Trust	Los Angeles	Acquisition	$2,592,670	$1,192,670
48.*	La Sierra Riparian Acquisition	Mountains Restoration Trust	Los Angeles	Acquisition	$1,674,595	See Description
50.	Lower Conejo Creek Acquisition	To be determined	Ventura	Acquisition	$1,500,000	$750,000
54.	Santa Clara River Parkway Acquisitions, Part 2	The Nature Conservancy	Ventura	Acquisition	$15,000,000	$2,000,000

* = New project on Work Plan.
Use the project number to locate the project description in Attachment C.

Southern California Welands Recovery Project
2002-2003 Work Plan Summary

No.	Project Name	Lead Agency	County	Type of Project	Estimated Total Cost	Estimated WRP Contribution
55.	Ventura River Arundo Removal Project	County of Ventura Flood Control District	Ventura	Restoration	$355,700	$159,500
59.*	Carpinteria Salt Marsh, Basin 1 Implementation	Land Trust of Santa Barbara County	Santa Barbara	Restoration	$1,229,000	$525,000
61.*	Mission Creek Museum Area Restoration Plan	Community Environmental Council	Santa Barbara	Planning	$120,000	$110,000
63.	Goleta Slough Tidal Restoration Study	Santa Barbara Municipal Airport	Santa Barbara	Restoration	$400,000	$200,000
64.	UCSB Campus Lagoon Enhancements	University of California, Santa Barbara	Santa Barbara	Restoration	$232,870	$150,000
67.	WRP Small Grants Program 02-03	Environment Now	Regional	Restoration	$250,000	$25,000
68.	WRP Technical Assistance and Program Administration		Regional	Planning	$400,000	$400,000
				Subtotal Tier 2 Projects	**$158,663,075**	**$74,705,190**
				Total Tier 1 and 2 Projects	**$192,806,337**	**$82,673,952**
				Project Specific Line Items (Upper Newport Bay, Bolsa Chica (requested), Los Cerritos, Ballona)		**($57,000,000)**
				Current Funding Need		**$25,673,952**

Note on Tiers 1 and 2
Project on the WRP Work Plan are divided into two tiers. Tier 1 projects must be both a high priority for the WRP and ready for implementation in the short-run. Tier 2 includes projects that need further development and/or are of lower priority. Available funding will be budged for Tier 1 projects first.

* = New project on Work Plan.
Use the project number to locate the project description in Attachment C.

Southern California Wetlands Recovery Project

Attachment B

2002-2003 Work Plan, Tier 1 and 2
Estimated Costs and Projected Funding Sources*

Projects (listed south to north)	Estimated Cost**	SCC-WRP	Other State	Federal	Local	Private
1. Otay Mesa Vernal Pools Acquisition (5)	$4,500,000	$500,000				
2. Rose Creek Enhancement Plan (7)	$60,000	$60,000				
3. Escondido Creek Watershed Restoration Action Strategy (11)	$328,900	$250,000			$30,000	
4. Escondido Creek Restoration - Bumann Site (12)	$235,510	$220,770				$14,740
5. ESD Park Riparian Restoration (Cottonwood Creek) (13)	$272,500	$136,250			$136,250	
6. Batiquitos Lagoon Saxony Property Acquisition (14)	$1,200,000	$200,000		$880,000	$120,000	
7. Batiquitos Lagoon Exotics Removal and Revegetation (15)	$160,000	$150,000				$10,000
8. Caulerpa Taxifolia Eradication Program (16)	$6,000,000	$1,000,000				
9. Buena Vista Creek Acquisition, Sherman Parcel (18)	$4,400,000	$750,000	$200,000			
10. San Luis Rey River Arundo Removal (19)	$6,420,600	$642,000	$1,559,100	$3,694,966	$49,400	$14,134
11. Wood Canyon Stream Stabilization and Restoration (20)	$1,500,000	$300,000				
12. Aliso Creek Dairy Fork Biofiltration Basin (21)	$430,000	$215,000			$215,000	
13. Serrano Creek Exotics Removal (23)	$227,650	$58,000	$109,850		$60,000	
14. Big Canyon Creek Restoration Project (26)	$250,000	$100,000	$37,000		$96,700	$17,000
15. Talbert Marsh Tidal Channel Enhancement Design (27)	$80,000	$50,000				
16. Huntington Beach Acquisitions (28)	$5,000,000	$2,000,000				
17. Bolsa Chica Wetlands Restoration (29)	$90,000,000	$20,000,000		$11,000,000	$53,000,000	
18. East Garden Grove Wintersburg Channel Treatment Wetland (3	$390,000	$80,000	$310,000			
19. Coyote Creek Watershed Plan (31)	$2,000,000	$130,000		$1,000,000		
20. Hellman Ranch Acquisition (Los Cerritos) (32)	Confidential					
21. Bryant Acquisition (Los Cerritos) (33)	Confidential	$1,000,000				
22. Bixby Ranch Company Acquisition (Los Cerritos) (34)	Confidential	$14,000,000				
23. Los Cerritos Wetlands Conceptual Restoration Plan (35)	$500,000	$500,000				
24. Colorado Lagoon Restoration Project (36)	$200,000	$200,000				
25. Lower Los Angeles and San Gabriel Rivers Habitat Needs Asses	$100,000	$100,000				
26. DeForest Wetlands Restoration Preliminary Plan (38)	$300,000	$300,000				
27. Lower Los Angeles River Acquisitions (39)	$20,000,000	$2,000,000				
28. Big Tujunga Wash Revegetation and Restoration (40)	$153,680	$83,000		$14,200		$56,480

* For some projects, the total of the funding sources may not equal the estimated cost. This indicates that complete funding has not been identified for these projects.

**Total costs are estimates and may change significantly as projects are developed and project descriptions refined.

(#) Use numbers in paratheses to locate project descriptions in Attachment D.

Continued on next page.

Last Revised: May 16, 2002

Projects (listed south to north)	Estimated Cost**	SCC-WRP	Other State	Federal	Local	Private
29. Ballona Wetlands Area C Assessment and Conceptual Restorati	$100,000	$100,000				
30. Ballona Wetlands Acquisition (42)	Not Available	$25,000,000				
31. Topanga Lagoon Restoration Technical Assessments (43)	$309,762	$76,762	$233,000			
32. Malibu Lagoon Habitat Enhancement Program (44)	$575,000	$650,000	$105,000		$1,085,000	
33. Cross Creek Road Fish Passage (45)	$620,000	$310,000				$150,000
34. Upper Malibu Creek Feasibility Study (Rindge Dam) (46)	$2,000,000	$500,000	$735,000	$750,000	$100,000	
35. Cold Creek Riparian Acquisitions, Part 2 (47)	$2,592,670	$1,192,670	$600,000			$800,000
36. La Sierra Riparian Acquisition (48)	$1,674,595		$300,000		$10,000	$550,000
37. Lower Conejo Creek Acquisition (50)	$1,500,000	$750,000	$600,000			
38. Ormond Beach Wetlands Acquisition (51)	$20,000,000	$5,000,000				
39. Ormond Beach Wetlands Restoration Plan (52)	$325,000	$200,000		$125,000		
40. Santa Clara River Parkway Acquisitions, Part 2 (54)	$15,000,000	$2,000,000	$4,000,000			
41. Ventura River Arundo Removal Project (55)	$355,700	$159,500	$63,500	$69,200	$63,500	
42. Carpinteria Creek Restoration Project (57)	$412,900	$300,000	$15,000		$23,800	$27,000
43. Carpinteria Salt Marsh, Basin 1 Implementation (59)	$1,229,000	$525,000		$500,000	$75,000	$155,000
44. Mission Creek Museum Area Restoration Plan (61)	$120,000	$110,000			$7,800	$2,200
45. Goleta Slough Tidal Restoration Study (63)	$400,000	$200,000			$200,000	
46. UCSB Campus Lagoon Enhancements (64)	$232,870	$150,000				
47. WRP Small Grants Program 02-03 (67)	$250,000	$25,000				$250,000
48. WRP Technical Assistance and Program Administration (68)	$400,000	$400,000				
TOTAL	**$192,806,337**	**$82,673,952^**	**$8,867,450**	**$18,033,366**	**$55,272,450**	**$2,046,554**
Total estimated cost with confidential acquisition costs included:	**$275,000,000**					

* For some projects, the total of the funding sources may not equal the estimated cost. This indicates that complete funding has not been identified for these projects.
**Total costs are estimates and may change significantly as projects are developed and project descriptions refined.
(#) Use numbers in paratheses to locate project descriptions in Attachment D.
^ Includes approximately $57 million in line item appropriations for specific projects.

Last Revised: May 16, 2002

Appendix B

Existing 25-Year Hydrology Calculations

```
**************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 OCEMA HYDROLOGY CRITERION)
       (c) Copyright 1983-2000 Advanced Engineering Software (aes)
           Ver. 8.0  Release Date: 01/01/2000  License ID 1355

                        Analysis prepared by:

                      FUSCOE ENGINEERING, INC.
                     16795 VON KARMAN, SUITE 100
                          IRVINE, CA  92606
                   TEL: 949.474.1960    FAX: 949.474.5315

 ************************** DESCRIPTION OF STUDY **************************
* Orange County Fair Grounds                                              *
* Existing 25 Yr. Hydrology                                               *
* Area A thru Area N                                                      *
 **************************************************************************

  FILE NAME: 30902A.25
  TIME/DATE OF STUDY: 15:15 07/30/2002
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*


**************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     20.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =     76.18  DOWNSTREAM(FEET) =     73.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.825
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.744
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)   (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 D        1.95      0.20        0.10     75    7.83
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      6.53
  TOTAL AREA(ACRES) =      1.95   PEAK FLOW RATE(CFS) =      6.53

**************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     30.00 IS CODE =   9
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =      73.00
  DOWNSTREAM NODE ELEVATION(FEET) =      70.76
  CHANNEL LENGTH THRU SUBAREA(FEET) =    630.00
  "V" GUTTER WIDTH(FEET) =    2.00   GUTTER HIKE(FEET) =  0.080
  PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =    1.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.668
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 D        4.79      0.20       0.10     75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     12.16
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =    1.62
  AVERAGE FLOW DEPTH(FEET) =    0.35   FLOOD WIDTH(FEET) =    54.43
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =    6.48   Tc(MIN.) =  14.30
  SUBAREA AREA(ACRES) =     4.79       SUBAREA RUNOFF(CFS) =    11.42
  EFFECTIVE AREA(ACRES) =     6.74     AREA-AVERAGED Fm(INCH/HR) =    0.02
  AREA-AVERAGED Fp(INCH/HR) =    0.20  AREA-AVERAGED Ap =    0.10
  TOTAL AREA(ACRES) =     6.74         PEAK FLOW RATE(CFS) =       16.06

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.38   FLOOD WIDTH(FEET) =    60.47
  FLOW VELOCITY(FEET/SEC.) =    1.74   DEPTH*VELOCITY(FT*FT/SEC) =    0.67
  LONGEST FLOWPATH FROM NODE      10.00 TO NODE      30.00 =    960.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      30.00 TO NODE      30.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  14.30
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.668
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 D        2.47      0.20       0.10     75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     2.47       SUBAREA RUNOFF(CFS) =     5.89
  EFFECTIVE AREA(ACRES) =     9.21     AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     9.21         PEAK FLOW RATE(CFS) =       21.95

****************************************************************************
  FLOW PROCESS FROM NODE      30.00 TO NODE      40.00 IS CODE =   9
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =      70.76
  DOWNSTREAM NODE ELEVATION(FEET) =      70.51
  CHANNEL LENGTH THRU SUBAREA(FEET) =     85.00
```

```
"V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
MAXIMUM DEPTH(FEET) =   1.00
*  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.581
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 D        0.10      0.20       0.10    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     22.07
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.76
AVERAGE FLOW DEPTH(FEET) =   0.51   FLOOD WIDTH(FEET) =   70.33
"V" GUTTER FLOW TRAVEL TIME(MIN.) =   0.81   Tc(MIN.) =  15.11
SUBAREA AREA(ACRES) =    0.10       SUBAREA RUNOFF(CFS) =    0.23
EFFECTIVE AREA(ACRES) =    9.31     AREA-AVERAGED Fm(INCH/HR) =   0.02
AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
TOTAL AREA(ACRES) =    9.31        PEAK FLOW RATE(CFS) =      21.95
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

END OF SUBAREA "V" GUTTER HYDRAULICS:
DEPTH(FEET) =  0.51   FLOOD WIDTH(FEET) =   70.33
FLOW VELOCITY(FEET/SEC.) =   1.75   DEPTH*VELOCITY(FT*FT/SEC) =   0.89
LONGEST FLOWPATH FROM NODE     10.00 TO NODE     40.00 =  1045.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     50.00 TO NODE     60.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     74.25  DOWNSTREAM(FEET) =     71.30

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.944
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.729
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 D        0.88      0.20       0.10    75    7.94
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      2.94
 TOTAL AREA(ACRES) =      0.88   PEAK FLOW RATE(CFS) =      2.94

****************************************************************************
 FLOW PROCESS FROM NODE     60.00 TO NODE     70.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     71.30
 DOWNSTREAM NODE ELEVATION(FEET) =     68.25
 CHANNEL LENGTH THRU SUBAREA(FEET) =   260.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.080
 PAVEMENT LIP(FEET) =  0.030   MANNING'S N = .0150
```

```
PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
MAXIMUM DEPTH(FEET) =   1.00
*  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.275
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 D        1.86      0.20       0.10    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      5.64
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.18
AVERAGE FLOW DEPTH(FEET) =   0.26   FLOOD WIDTH(FEET) =   31.38
"V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.99   Tc(MIN.) =   9.93
SUBAREA AREA(ACRES) =    1.86       SUBAREA RUNOFF(CFS) =    5.45
EFFECTIVE AREA(ACRES) =    2.74     AREA-AVERAGED Fm(INCH/HR) =   0.02
AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
TOTAL AREA(ACRES) =    2.74         PEAK FLOW RATE(CFS) =       8.03

END OF SUBAREA "V" GUTTER HYDRAULICS:
DEPTH(FEET) =  0.28   FLOOD WIDTH(FEET) =   36.24
FLOW VELOCITY(FEET/SEC.) =   2.35   DEPTH*VELOCITY(FT*FT/SEC) =   0.66
LONGEST FLOWPATH FROM NODE     50.00 TO NODE     70.00 =   590.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     70.00 TO NODE     80.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    64.25  DOWNSTREAM(FEET) =    62.50
 FLOW LENGTH(FEET) =   500.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.19
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      8.03
 PIPE TRAVEL TIME(MIN.) =   1.99    Tc(MIN.) =  11.92
 LONGEST FLOWPATH FROM NODE     50.00 TO NODE     80.00 =  1090.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     80.00 TO NODE     80.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  11.92
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.960
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        3.42      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    3.42       SUBAREA RUNOFF(CFS) =    9.05
 EFFECTIVE AREA(ACRES) =    6.16     AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    6.16         PEAK FLOW RATE(CFS) =      16.30

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

```
 FLOW PROCESS FROM NODE     80.00 TO NODE     90.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    62.50  DOWNSTREAM(FEET) =    62.20
 FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  19.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.43
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     16.30
 PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =  12.14
 LONGEST FLOWPATH FROM NODE     50.00 TO NODE     90.00 =  1160.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    114.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     72.00  DOWNSTREAM(FEET) =     67.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.300
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.909
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.48      0.20       0.10    75    7.30
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      1.68
 TOTAL AREA(ACRES) =      0.48   PEAK FLOW RATE(CFS) =      1.68

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =    110.00  DOWNSTREAM(FEET) =     45.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.820
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        6.47      0.20       0.10    75    5.00
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     6.47   INITIAL SUBAREA RUNOFF(CFS) =   27.95

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN) =   7.30
```

```
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.909
 SUBAREA AREA(ACRES) =     6.47      SUBAREA RUNOFF(CFS) =    22.65
 EFFECTIVE AREA(ACRES) =     6.95    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =      6.95       PEAK FLOW RATE(CFS) =      24.33

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     67.50
 DOWNSTREAM NODE ELEVATION(FEET) =     65.30
 CHANNEL LENGTH THRU SUBAREA(FEET) =   340.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.367
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        3.86      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     30.17
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.54
 AVERAGE FLOW DEPTH(FEET) =   0.50   FLOOD WIDTH(FEET) =   68.38
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.23   Tc(MIN.) =   9.53
 SUBAREA AREA(ACRES) =    3.86       SUBAREA RUNOFF(CFS) =   11.63
 EFFECTIVE AREA(ACRES) =   10.81     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =   10.81         PEAK FLOW RATE(CFS) =      32.56

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.51   FLOOD WIDTH(FEET) =   70.33
 FLOW VELOCITY(FEET/SEC.) =   2.59   DEPTH*VELOCITY(FT*FT/SEC) =   1.31
 LONGEST FLOWPATH FROM NODE    112.00 TO NODE    120.00 =   670.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     65.30
 DOWNSTREAM NODE ELEVATION(FEET) =     63.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   380.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.962
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        6.30      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
```

```
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     40.89
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.67
 AVERAGE FLOW DEPTH(FEET) =   0.54   FLOOD WIDTH(FEET) =   77.83
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.38   Tc(MIN.) =  11.91
 SUBAREA AREA(ACRES) =    6.30       SUBAREA RUNOFF(CFS) =   16.68
 EFFECTIVE AREA(ACRES) =   17.11     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =   17.11         PEAK FLOW RATE(CFS) =      45.31

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.56   FLOOD WIDTH(FEET) =   80.77
 FLOW VELOCITY(FEET/SEC.) =   2.75   DEPTH*VELOCITY(FT*FT/SEC) =   1.53
 LONGEST FLOWPATH FROM NODE    112.00 TO NODE    130.00 =  1050.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    130.00 TO NODE    140.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    60.00  DOWNSTREAM(FEET) =    58.00
 FLOW LENGTH(FEET) =   480.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  28.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.89
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     45.31
 PIPE TRAVEL TIME(MIN.) =   1.16    Tc(MIN.) =  13.07
 LONGEST FLOWPATH FROM NODE    112.00 TO NODE    140.00 =  1530.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    150.00 TO NODE    160.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     75.90  DOWNSTREAM(FEET) =     73.90

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.586
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.582
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.52      0.20        0.10    75    8.59
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      1.67
 TOTAL AREA(ACRES) =      0.52   PEAK FLOW RATE(CFS) =      1.67

****************************************************************************
 FLOW PROCESS FROM NODE    160.00 TO NODE    170.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     73.90
```

```
 DOWNSTREAM NODE ELEVATION(FEET) =      71.20
 CHANNEL LENGTH THRU SUBAREA(FEET) =   410.00
 "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.050
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.883
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        3.37      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      5.88
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.79
 AVERAGE FLOW DEPTH(FEET) =   0.21   FLOOD WIDTH(FEET) =   35.66
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.83   Tc(MIN.) =  12.41
 SUBAREA AREA(ACRES) =    3.37       SUBAREA RUNOFF(CFS) =    8.68
 EFFECTIVE AREA(ACRES) =    3.89     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    3.89         PEAK FLOW RATE(CFS) =      10.03

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.26   FLOOD WIDTH(FEET) =   44.11
 FLOW VELOCITY(FEET/SEC.) =   2.01   DEPTH*VELOCITY(FT*FT/SEC) =   0.51
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    170.00 =   740.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    170.00 TO NODE    180.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    67.20  DOWNSTREAM(FEET) =    65.60
 FLOW LENGTH(FEET) =   280.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.33
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     10.03
 PIPE TRAVEL TIME(MIN.) =   0.88    Tc(MIN.) =  13.29
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    180.00 =  1020.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    180.00 TO NODE    180.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  13.29
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.782
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.21      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    2.21       SUBAREA RUNOFF(CFS) =    5.49
 EFFECTIVE AREA(ACRES) =    6.10     AREA-AVERAGED Fm(INCH/HR) =  0.02
```

```
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     6.10       PEAK FLOW RATE(CFS) =      15.16

****************************************************************************
 FLOW PROCESS FROM NODE    180.00 TO NODE    190.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    65.60  DOWNSTREAM(FEET) =    62.10
 FLOW LENGTH(FEET) =   600.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.92
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     15.16
 PIPE TRAVEL TIME(MIN.) =   1.69    Tc(MIN.) =  14.98
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    190.00 =  1620.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    190.00 TO NODE    190.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  14.98
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.593
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D       14.20      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =   14.20      SUBAREA RUNOFF(CFS) =   32.88
 EFFECTIVE AREA(ACRES) =    20.30   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    20.30       PEAK FLOW RATE(CFS) =      47.00

****************************************************************************
 FLOW PROCESS FROM NODE    190.00 TO NODE    200.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    62.10  DOWNSTREAM(FEET) =    60.90
 FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  28.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.89
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     47.00
 PIPE TRAVEL TIME(MIN.) =   0.42    Tc(MIN.) =  15.40
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    200.00 =  1820.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    200.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  15.40
```

```
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.555
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.48      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     2.48      SUBAREA RUNOFF(CFS) =     5.66
 EFFECTIVE AREA(ACRES) =    22.78    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    22.78        PEAK FLOW RATE(CFS) =       51.97

****************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    60.90  DOWNSTREAM(FEET) =    59.80
 FLOW LENGTH(FEET) =   190.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  28.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.10
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     51.97
 PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =  15.79
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    210.00 =  2010.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  15.79
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.520
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.47      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     2.47      SUBAREA RUNOFF(CFS) =     5.56
 EFFECTIVE AREA(ACRES) =    25.25    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    25.25        PEAK FLOW RATE(CFS) =       56.82

****************************************************************************
 FLOW PROCESS FROM NODE    210.00 TO NODE    220.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    59.80  DOWNSTREAM(FEET) =    58.40
 FLOW LENGTH(FEET) =   240.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  30.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.21
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     56.82
```

```
 PIPE TRAVEL TIME(MIN.) =    0.49     Tc(MIN.) =  16.28
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    220.00 =  2250.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    220.00 TO NODE    220.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  16.28
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.478
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        6.68      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    6.68      SUBAREA RUNOFF(CFS) =   14.77
 EFFECTIVE AREA(ACRES) =   31.93    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    31.93       PEAK FLOW RATE(CFS) =      70.62

****************************************************************************
 FLOW PROCESS FROM NODE    220.00 TO NODE    230.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    58.40  DOWNSTREAM(FEET) =    55.10
 FLOW LENGTH(FEET) =   580.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  33.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.53
 ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     70.62
 PIPE TRAVEL TIME(MIN.) =   1.13    Tc(MIN.) =  17.41
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    230.00 =  2830.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.41
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.378
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D       11.53      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =   11.53      SUBAREA RUNOFF(CFS) =   24.47
 EFFECTIVE AREA(ACRES) =   43.46    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    43.46       PEAK FLOW RATE(CFS) =      92.22

****************************************************************************
 FLOW PROCESS FROM NODE    230.00 TO NODE    240.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     55.10  DOWNSTREAM(FEET) =     54.00
  FLOW LENGTH(FEET) =     65.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  29.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.91
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      92.22
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =  17.49
  LONGEST FLOWPATH FROM NODE    150.00 TO NODE    240.00 =  2895.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    260.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =     63.50  DOWNSTREAM(FEET) =     59.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.437
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.855
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 D        0.32      0.20       0.10    75    7.44
  NATURAL GOOD COVER
  "MEADOWS"                  D        0.87      0.20       1.00    78   22.88
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.76
  SUBAREA RUNOFF(CFS) =      3.97
  TOTAL AREA(ACRES) =      1.19   PEAK FLOW RATE(CFS) =      3.97

****************************************************************************
  FLOW PROCESS FROM NODE    260.00 TO NODE    270.00 IS CODE =   9
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =     59.40
  DOWNSTREAM NODE ELEVATION(FEET) =     56.86
  CHANNEL LENGTH THRU SUBAREA(FEET) =   610.00
  "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
  PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   1.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.766
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 D        5.62      0.20       0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     10.70
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.70
  AVERAGE FLOW DEPTH(FEET) =   0.40   FLOOD WIDTH(FEET) =   49.46
```

```
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   5.99   Tc(MIN.) =  13.43
 SUBAREA AREA(ACRES) =    5.62       SUBAREA RUNOFF(CFS) =   13.89
 EFFECTIVE AREA(ACRES) =    6.81     AREA-AVERAGED Fm(INCH/HR) =   0.04
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.21
 TOTAL AREA(ACRES) =    6.81         PEAK FLOW RATE(CFS) =      16.69

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.45   FLOOD WIDTH(FEET) =   58.92
 FLOW VELOCITY(FEET/SEC.) =   1.88   DEPTH*VELOCITY(FT*FT/SEC) =   0.85
 LONGEST FLOWPATH FROM NODE    250.00 TO NODE    270.00 =   940.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    270.00 TO NODE    280.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    52.86  DOWNSTREAM(FEET) =    50.00
 FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  12.04
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     16.69
 PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =  13.54
 LONGEST FLOWPATH FROM NODE    250.00 TO NODE    280.00 =  1020.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    300.00 TO NODE    310.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     59.00  DOWNSTREAM(FEET) =     58.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   9.862
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.291
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 D        0.79      0.20        0.10    75    9.86
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      2.33
 TOTAL AREA(ACRES) =      0.79   PEAK FLOW RATE(CFS) =      2.33

****************************************************************************
 FLOW PROCESS FROM NODE    310.00 TO NODE    320.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     58.00
 DOWNSTREAM NODE ELEVATION(FEET) =     53.80
 CHANNEL LENGTH THRU SUBAREA(FEET) =  1070.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
```

```
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.099
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        1.30      0.20       0.10    75
 NATURAL FAIR COVER
 "GRASS"                    D        3.50      0.20       1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.76
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      6.37
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.49
 AVERAGE FLOW DEPTH(FEET) =   0.36   FLOOD WIDTH(FEET) =   40.33
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =  11.93   Tc(MIN.) =  21.80
 SUBAREA AREA(ACRES) =    4.80       SUBAREA RUNOFF(CFS) =    8.42
 EFFECTIVE AREA(ACRES) =    5.59     AREA-AVERAGED Fm(INCH/HR) =   0.13
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.66
 TOTAL AREA(ACRES) =    5.59         PEAK FLOW RATE(CFS) =       9.89

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.40   FLOOD WIDTH(FEET) =   48.48
 FLOW VELOCITY(FEET/SEC.) =   1.63   DEPTH*VELOCITY(FT*FT/SEC) =   0.65
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    320.00 =  1400.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    320.00 TO NODE    330.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    50.80  DOWNSTREAM(FEET) =    50.00
 FLOW LENGTH(FEET) =   130.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.49
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      9.89
 PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =  22.19
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    330.00 =  1530.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    330.00 TO NODE    330.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  22.19
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.077
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 NATURAL FAIR COVER
 "GRASS"                    D        4.80      0.20       1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA AREA(ACRES) =    4.80       SUBAREA RUNOFF(CFS) =    8.11
 EFFECTIVE AREA(ACRES) =   10.39     AREA-AVERAGED Fm(INCH/HR) =  0.16
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.82
```

```
 TOTAL AREA(ACRES) =    10.39       PEAK FLOW RATE(CFS) =      17.89

****************************************************************************
 FLOW PROCESS FROM NODE    350.00 TO NODE    360.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     58.00  DOWNSTREAM(FEET) =     56.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.094
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.467
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        1.40      0.20       0.10    75    9.09
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      4.34
 TOTAL AREA(ACRES) =      1.40   PEAK FLOW RATE(CFS) =      4.34

****************************************************************************
 FLOW PROCESS FROM NODE    360.00 TO NODE    370.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     56.50
 DOWNSTREAM NODE ELEVATION(FEET) =     55.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   320.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0350
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.505
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.60      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      5.02
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.78
 AVERAGE FLOW DEPTH(FEET) =   0.41   FLOOD WIDTH(FEET) =   50.11
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   6.87   Tc(MIN.) =  15.97
 SUBAREA AREA(ACRES) =    0.60     SUBAREA RUNOFF(CFS) =    1.34
 EFFECTIVE AREA(ACRES) =    2.00     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    2.00         PEAK FLOW RATE(CFS) =       4.47

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.39   FLOOD WIDTH(FEET) =   47.83
 FLOW VELOCITY(FEET/SEC.) =   0.76   DEPTH*VELOCITY(FT*FT/SEC) =   0.30
 LONGEST FLOWPATH FROM NODE    350.00 TO NODE    370.00 =   650.00 FEET.

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

```
 FLOW PROCESS FROM NODE     510.00 TO NODE     520.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     73.00  DOWNSTREAM(FEET) =     70.80

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   19.563
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.230
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 NATURAL FAIR COVER
 "GRASS"                     D        0.47      0.20       1.00    84   19.56
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA RUNOFF(CFS) =      0.86
 TOTAL AREA(ACRES) =      0.47   PEAK FLOW RATE(CFS) =      0.86

****************************************************************************
 FLOW PROCESS FROM NODE     520.00 TO NODE     530.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     70.80
 DOWNSTREAM NODE ELEVATION(FEET) =     67.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   720.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.790
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 NATURAL FAIR COVER
 "GRASS"                     D        1.39      0.20       1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.84
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.29
 AVERAGE FLOW DEPTH(FEET) =   0.24   FLOOD WIDTH(FEET) =   22.78
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   9.32   Tc(MIN.) =  28.88
 SUBAREA AREA(ACRES) =    1.39      SUBAREA RUNOFF(CFS) =    1.99
 EFFECTIVE AREA(ACRES) =    1.86    AREA-AVERAGED Fm(INCH/HR) =   0.20
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   1.00
 TOTAL AREA(ACRES) =    1.86        PEAK FLOW RATE(CFS) =       2.66

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.26   FLOOD WIDTH(FEET) =   26.83
 FLOW VELOCITY(FEET/SEC.) =   1.38   DEPTH*VELOCITY(FT*FT/SEC) =   0.36
 LONGEST FLOWPATH FROM NODE     510.00 TO NODE     530.00 =  1050.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     530.00 TO NODE     540.00 IS CODE =   9
```

```
------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
========================================================================
 UPSTREAM NODE ELEVATION(FEET) =     67.00
 DOWNSTREAM NODE ELEVATION(FEET) =     62.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   400.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.689
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.42      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.73
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.12
 AVERAGE FLOW DEPTH(FEET) =   0.25   FLOOD WIDTH(FEET) =   25.48
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.15   Tc(MIN.) =  32.03
 SUBAREA AREA(ACRES) =    1.42       SUBAREA RUNOFF(CFS) =    2.13
 EFFECTIVE AREA(ACRES) =    3.28     AREA-AVERAGED Fm(INCH/HR) =   0.12
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.61
 TOTAL AREA(ACRES) =    3.28         PEAK FLOW RATE(CFS) =       4.63

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.27   FLOOD WIDTH(FEET) =   28.19
 FLOW VELOCITY(FEET/SEC.) =   2.18   DEPTH*VELOCITY(FT*FT/SEC) =   0.58
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    540.00 =  1450.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    540.00 TO NODE    540.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  32.03
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.689
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.00      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    1.00       SUBAREA RUNOFF(CFS) =    1.50
 EFFECTIVE AREA(ACRES) =    4.28     AREA-AVERAGED Fm(INCH/HR) =  0.10
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.49
 TOTAL AREA(ACRES) =    4.28         PEAK FLOW RATE(CFS) =       6.13

****************************************************************************
 FLOW PROCESS FROM NODE    540.00 TO NODE    500.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (NEW ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     62.00  DOWNSTREAM(FEET) =     58.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =  1050.00   CHANNEL SLOPE =  0.0033
```

```
 CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   2.00
 CHANNEL FLOW THRU SUBAREA(CFS) =      6.13
 FLOW VELOCITY(FEET/SEC) =   1.71   FLOW DEPTH(FEET) =   0.93
 TRAVEL TIME(MIN.) =  10.22   Tc(MIN.) =  42.25
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2500.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  42.25
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.450
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.98      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.98      SUBAREA RUNOFF(CFS) =    1.26
 EFFECTIVE AREA(ACRES) =    5.26    AREA-AVERAGED Fm(INCH/HR) =  0.08
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.42
 TOTAL AREA(ACRES) =     5.26       PEAK FLOW RATE(CFS) =       6.47

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    470.00 TO NODE    480.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     73.00  DOWNSTREAM(FEET) =     70.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.917
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.735
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.51      0.20        0.10    75    7.92
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      1.71
 TOTAL AREA(ACRES) =      0.51   PEAK FLOW RATE(CFS) =      1.71

****************************************************************************
 FLOW PROCESS FROM NODE    480.00 TO NODE    490.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
```

```
 UPSTREAM NODE ELEVATION(FEET) =     70.00
 DOWNSTREAM NODE ELEVATION(FEET) =     64.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   720.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.618
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.07      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.07
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.76
 AVERAGE FLOW DEPTH(FEET) =   0.27   FLOOD WIDTH(FEET) =   29.54
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   6.83   Tc(MIN.) =  14.75
 SUBAREA AREA(ACRES) =    2.07      SUBAREA RUNOFF(CFS) =    4.84
 EFFECTIVE AREA(ACRES) =    2.58    AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    2.58        PEAK FLOW RATE(CFS) =       6.03

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.30   FLOOD WIDTH(FEET) =   34.94
 FLOW VELOCITY(FEET/SEC.) =   1.89   DEPTH*VELOCITY(FT*FT/SEC) =   0.57
 LONGEST FLOWPATH FROM NODE    470.00 TO NODE    490.00 =  1050.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    490.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  14.75
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.618
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.21      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    2.21      SUBAREA RUNOFF(CFS) =    5.17
 EFFECTIVE AREA(ACRES) =    4.79    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    4.79        PEAK FLOW RATE(CFS) =      11.20

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    490.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  14.75
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.618
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.33      0.20        0.10    75
```

```
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     2.33      SUBAREA RUNOFF(CFS) =     5.45
 EFFECTIVE AREA(ACRES) =     7.12    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     7.12       PEAK FLOW RATE(CFS) =      16.65

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    500.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     64.50
 DOWNSTREAM NODE ELEVATION(FEET) =     58.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   530.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.359
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                D        2.60      0.20        0.10    75
 NATURAL FAIR COVER
 "GRASS"                   D        7.35      0.20        1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.76
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     26.46
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.03
 AVERAGE FLOW DEPTH(FEET) =   0.42   FLOOD WIDTH(FEET) =   58.60
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.91   Tc(MIN.) =  17.66
 SUBAREA AREA(ACRES) =     9.95      SUBAREA RUNOFF(CFS) =   19.76
 EFFECTIVE AREA(ACRES) =   17.07     AREA-AVERAGED Fm(INCH/HR) =   0.10
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.49
 TOTAL AREA(ACRES) =   17.07         PEAK FLOW RATE(CFS) =      34.74

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.45   FLOOD WIDTH(FEET) =   65.02
 FLOW VELOCITY(FEET/SEC.) =   3.25   DEPTH*VELOCITY(FT*FT/SEC) =   1.46
 LONGEST FLOWPATH FROM NODE    470.00 TO NODE    500.00 =  1580.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
    1      34.74  17.66     2.359   0.20( 0.10)  0.49     17.1      470.00
 LONGEST FLOWPATH FROM NODE    470.00 TO NODE    500.00 =  1580.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
```

```
     1      6.47  42.25    1.450  0.20( 0.08) 0.42      5.3      510.00
  LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2500.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
   NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1     39.25  17.66    2.359  0.20( 0.10) 0.48     19.3      470.00
      2     27.24  42.25    1.450  0.20( 0.09) 0.47     22.3      510.00
    TOTAL AREA(ACRES) =     22.33

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       39.25  Tc(MIN.) =   17.660
  EFFECTIVE AREA(ACRES) =     19.27  AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.48
  TOTAL AREA(ACRES) =     22.33
  LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2500.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     58.50  DOWNSTREAM(FEET) =     58.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   270.00   CHANNEL SLOPE =  0.0019
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   3.00
  CHANNEL FLOW THRU SUBAREA(CFS) =     39.25
  FLOW VELOCITY(FEET/SEC) =   2.21   FLOW DEPTH(FEET) =   2.32
  TRAVEL TIME(MIN.) =   2.04   Tc(MIN.) =  19.70
  LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2770.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    460.00 TO NODE    460.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  19.70
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.221
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 D        0.25      0.20       0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.25      SUBAREA RUNOFF(CFS) =    0.50
  EFFECTIVE AREA(ACRES) =    19.52   AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.47
  TOTAL AREA(ACRES) =    22.58      PEAK FLOW RATE(CFS) =      39.25
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    460.00 TO NODE    460.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    440.00 TO NODE    450.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     65.40  DOWNSTREAM(FEET) =     62.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.971
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.723
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        1.60      0.20        0.10    75    7.97
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      5.33
 TOTAL AREA(ACRES) =      1.60   PEAK FLOW RATE(CFS) =      5.33

****************************************************************************
 FLOW PROCESS FROM NODE    450.00 TO NODE    460.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     62.50
 DOWNSTREAM NODE ELEVATION(FEET) =     58.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   490.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.031
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        5.00      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     11.99
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.33
 AVERAGE FLOW DEPTH(FEET) =   0.35   FLOOD WIDTH(FEET) =   44.74
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.50   Tc(MIN.) =  11.47
 SUBAREA AREA(ACRES) =    5.00      SUBAREA RUNOFF(CFS) =   13.55
 EFFECTIVE AREA(ACRES) =    6.60    AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    6.60        PEAK FLOW RATE(CFS) =      17.88

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.39   FLOOD WIDTH(FEET) =   52.18
 FLOW VELOCITY(FEET/SEC.) =   2.58   DEPTH*VELOCITY(FT*FT/SEC) =   0.99
 LONGEST FLOWPATH FROM NODE    440.00 TO NODE    460.00 =   820.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    460.00 TO NODE    460.00 IS CODE =  11
----------------------------------------------------------------------------
```

```
>>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
================================================================================

** MAIN STREAM CONFLUENCE DATA **
 STREAM     Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER   (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)         (ACRES)     NODE
    1     17.88  11.47     3.031   0.20( 0.02) 0.10      6.6      440.00
LONGEST FLOWPATH FROM NODE    440.00 TO NODE    460.00 =   820.00 FEET.

** MEMORY BANK #  2 CONFLUENCE DATA **
 STREAM     Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER   (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)         (ACRES)     NODE
    1     39.25  19.70     2.221   0.20( 0.09) 0.47     19.5      470.00
    2     27.24  44.48     1.409   0.20( 0.09) 0.47     22.6      510.00
LONGEST FLOWPATH FROM NODE    510.00 TO NODE    460.00 =  2770.00 FEET.

** PEAK FLOW RATE TABLE **
 STREAM     Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER   (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)         (ACRES)     NODE
    1     49.45  11.47     3.031   0.20( 0.07) 0.34     18.0      440.00
    2     52.32  19.70     2.221   0.20( 0.08) 0.38     26.1      470.00
    3     35.49  44.48     1.409   0.20( 0.08) 0.38     29.2      510.00
  TOTAL AREA(ACRES) =     29.18

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      52.32  Tc(MIN.) =   19.698
EFFECTIVE AREA(ACRES) =    26.12  AREA-AVERAGED Fm(INCH/HR) =  0.08
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.38
TOTAL AREA(ACRES) =     29.18
LONGEST FLOWPATH FROM NODE    510.00 TO NODE    460.00 =  2770.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    460.00 TO NODE    430.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =     58.00  DOWNSTREAM(FEET) =     56.70
CHANNEL LENGTH THRU SUBAREA(FEET) =   465.00   CHANNEL SLOPE =  0.0028
CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   3.00
CHANNEL FLOW THRU SUBAREA(CFS) =     52.32
FLOW VELOCITY(FEET/SEC) =   2.77   FLOW DEPTH(FEET) =   2.41
TRAVEL TIME(MIN.) =   2.80   Tc(MIN.) =  22.50
LONGEST FLOWPATH FROM NODE    510.00 TO NODE    430.00 =  3235.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  22.50
*  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.060
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 D        0.32      0.20       0.10     75
```

```
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     0.32      SUBAREA RUNOFF(CFS) =     0.59
  EFFECTIVE AREA(ACRES) =    26.44    AREA-AVERAGED Fm(INCH/HR) =  0.08
  AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.38
  TOTAL AREA(ACRES) =    29.50        PEAK FLOW RATE(CFS) =      52.32
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    420.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =     60.00  DOWNSTREAM(FEET) =     57.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.211
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.668
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  D        0.62      0.20        0.10    75    8.21
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      2.04
  TOTAL AREA(ACRES) =      0.62   PEAK FLOW RATE(CFS) =      2.04

****************************************************************************
  FLOW PROCESS FROM NODE    420.00 TO NODE    430.00 IS CODE =   9
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =     57.50
  DOWNSTREAM NODE ELEVATION(FEET) =     56.70
  CHANNEL LENGTH THRU SUBAREA(FEET) =   150.00
  "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
  PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   1.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.313
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        1.64      0.20        0.10    75
  NATURAL FAIR COVER
  "GRASS"                     D        0.70      0.20        1.00    84
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.37
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      5.40
```

```
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.60
 AVERAGE FLOW DEPTH(FEET) =   0.30   FLOOD WIDTH(FEET) =   35.96
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.56   Tc(MIN.) =   9.77
 SUBAREA AREA(ACRES) =    2.34       SUBAREA RUNOFF(CFS) =    6.82
 EFFECTIVE AREA(ACRES) =    2.96     AREA-AVERAGED Fm(INCH/HR) =   0.06
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.31
 TOTAL AREA(ACRES) =    2.96         PEAK FLOW RATE(CFS) =       8.66

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.34   FLOOD WIDTH(FEET) =   43.73
 FLOW VELOCITY(FEET/SEC.) =   1.76   DEPTH*VELOCITY(FT*FT/SEC) =   0.61
 LONGEST FLOWPATH FROM NODE    410.00 TO NODE    430.00 =   480.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1       8.66   9.77    3.313   0.20( 0.06) 0.31      3.0      410.00
 LONGEST FLOWPATH FROM NODE    410.00 TO NODE    430.00 =   480.00 FEET.

 ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1      49.45  14.31    2.667   0.20( 0.07) 0.33     18.3      440.00
     2      52.32  22.50    2.060   0.20( 0.08) 0.38     26.4      470.00
     3      35.49  47.58    1.354   0.20( 0.08) 0.38     29.5      510.00
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    430.00 =  3235.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1      50.79   9.77    3.313   0.20( 0.07) 0.33     15.4      410.00
     2      56.39  14.31    2.667   0.20( 0.07) 0.33     21.2      440.00
     3      57.64  22.50    2.060   0.20( 0.07) 0.37     29.4      470.00
     4      38.93  47.58    1.354   0.20( 0.07) 0.37     32.5      510.00
   TOTAL AREA(ACRES) =     32.46

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      57.64  Tc(MIN.) =   22.497
 EFFECTIVE AREA(ACRES) =    29.40  AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.37
 TOTAL AREA(ACRES) =     32.46
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    430.00 =  3235.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    430.00 TO NODE    660.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     56.70  DOWNSTREAM(FEET) =     56.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0035
```

```
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   3.00
 CHANNEL FLOW THRU SUBAREA(CFS) =     57.64
 FLOW VELOCITY(FEET/SEC) =   3.08   FLOW DEPTH(FEET) =   2.40
 TRAVEL TIME(MIN.) =   1.08   Tc(MIN.) =  23.58
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    660.00 =  3435.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    660.00 TO NODE    660.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  23.58
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.008
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.19      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.19      SUBAREA RUNOFF(CFS) =    0.34
 EFFECTIVE AREA(ACRES) =    29.59   AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.37
 TOTAL AREA(ACRES) =    32.65      PEAK FLOW RATE(CFS) =      57.64
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    660.00 TO NODE    660.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    660.00 TO NODE    660.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    600.00 TO NODE    610.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     70.20  DOWNSTREAM(FEET) =     66.90

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.767
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.769
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.56      0.20       0.10    75    7.77
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      1.89
```

```
 TOTAL AREA(ACRES) =      0.56   PEAK FLOW RATE(CFS) =      1.89

****************************************************************************
 FLOW PROCESS FROM NODE    610.00 TO NODE    620.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     66.90
 DOWNSTREAM NODE ELEVATION(FEET) =     63.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   750.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.581
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)   (DECIMAL)  CN
 COMMERCIAL                  D        5.06      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      7.40
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.70
 AVERAGE FLOW DEPTH(FEET) =   0.33   FLOOD WIDTH(FEET) =   41.03
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   7.34   Tc(MIN.) =  15.10
 SUBAREA AREA(ACRES) =    5.06       SUBAREA RUNOFF(CFS) =   11.66
 EFFECTIVE AREA(ACRES) =    5.62     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    5.62         PEAK FLOW RATE(CFS) =      12.95

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.38   FLOOD WIDTH(FEET) =   51.50
 FLOW VELOCITY(FEET/SEC.) =   1.91   DEPTH*VELOCITY(FT*FT/SEC) =   0.73
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    620.00 =  1080.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    620.00 TO NODE    630.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    61.00  DOWNSTREAM(FEET) =    59.40
 FLOW LENGTH(FEET) =   560.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.41
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     12.95
 PIPE TRAVEL TIME(MIN.) =   2.12   Tc(MIN.) =  17.22
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    630.00 =  1640.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    630.00 TO NODE    630.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.22
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.395
```

```
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.94      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     1.94      SUBAREA RUNOFF(CFS) =     4.15
 EFFECTIVE AREA(ACRES) =     7.56    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     7.56        PEAK FLOW RATE(CFS) =       16.16

****************************************************************************
 FLOW PROCESS FROM NODE    630.00 TO NODE    640.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    59.40  DOWNSTREAM(FEET) =    55.00
 FLOW LENGTH(FEET) =   380.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  17.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.66
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     16.16
 PIPE TRAVEL TIME(MIN.) =   0.83    Tc(MIN.) =  18.05
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    640.00 =  2020.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    640.00 TO NODE    640.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  18.05
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.333
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        3.71      0.20       0.10    75
 NATURAL FAIR COVER
 "GRASS"                     D        6.24      0.20       1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.66
 SUBAREA AREA(ACRES) =     9.95      SUBAREA RUNOFF(CFS) =    19.70
 EFFECTIVE AREA(ACRES) =    17.51    AREA-AVERAGED Fm(INCH/HR) =  0.08
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.42
 TOTAL AREA(ACRES) =    17.51        PEAK FLOW RATE(CFS) =       35.44

****************************************************************************
 FLOW PROCESS FROM NODE    640.00 TO NODE    650.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    55.00  DOWNSTREAM(FEET) =    54.00
 FLOW LENGTH(FEET) =   240.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.51
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
```

```
 PIPE-FLOW(CFS) =     35.44
 PIPE TRAVEL TIME(MIN.) =   0.61    Tc(MIN.) =  18.66
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    650.00 =  2260.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    650.00 TO NODE    650.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  18.66
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.291
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.51      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    1.51      SUBAREA RUNOFF(CFS) =    3.09
 EFFECTIVE AREA(ACRES) =    19.02   AREA-AVERAGED Fm(INCH/HR) =  0.08
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.40
 TOTAL AREA(ACRES) =    19.02       PEAK FLOW RATE(CFS) =      37.87

****************************************************************************
 FLOW PROCESS FROM NODE    650.00 TO NODE    660.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    54.00  DOWNSTREAM(FEET) =    53.00
 FLOW LENGTH(FEET) =   240.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.56
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     37.87
 PIPE TRAVEL TIME(MIN.) =   0.61    Tc(MIN.) =  19.27
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    660.00 =  2500.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    660.00 TO NODE    660.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)         (ACRES)     NODE
     1     37.87  19.27     2.250  0.20( 0.08) 0.40     19.0      600.00
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    660.00 =  2500.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)         (ACRES)     NODE
     1     50.79  10.89     3.122  0.20( 0.07) 0.33     15.6      410.00
     2     56.39  15.40     2.555  0.20( 0.07) 0.33     21.4      440.00
     3     57.64  23.58     2.008  0.20( 0.07) 0.37     29.6      470.00
     4     38.93  48.78     1.332  0.20( 0.07) 0.37     32.6      510.00
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    660.00 =  3435.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    380.00 TO NODE    390.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     59.80  DOWNSTREAM(FEET) =     59.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.313
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.211
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.83      0.20       0.10    75   10.31
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      2.38
 TOTAL AREA(ACRES) =      0.83   PEAK FLOW RATE(CFS) =      2.38

****************************************************************************
 FLOW PROCESS FROM NODE    390.00 TO NODE    400.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     59.00
 DOWNSTREAM NODE ELEVATION(FEET) =     55.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   520.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.576
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.11      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.80
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.79
 AVERAGE FLOW DEPTH(FEET) =   0.28   FLOOD WIDTH(FEET) =   31.90
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   4.84   Tc(MIN.) =  15.15
 SUBAREA AREA(ACRES) =    2.11      SUBAREA RUNOFF(CFS) =    4.85
 EFFECTIVE AREA(ACRES) =    2.94    AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    2.94        PEAK FLOW RATE(CFS) =      6.76

 END OF SUBAREA "V" GUTTER HYDRAULICS:
```

```
 DEPTH(FEET) =  0.31   FLOOD WIDTH(FEET) =   36.63
 FLOW VELOCITY(FEET/SEC.) =   1.94   DEPTH*VELOCITY(FT*FT/SEC) =   0.60
 LONGEST FLOWPATH FROM NODE    380.00 TO NODE    400.00 =   850.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    400.00 TO NODE    402.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     51.50  DOWNSTREAM(FEET) =     51.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =    20.00   CHANNEL SLOPE =  0.0250
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   4.00
 CHANNEL FLOW THRU SUBAREA(CFS) =      6.76
 FLOW VELOCITY(FEET/SEC) =   3.51   FLOW DEPTH(FEET) =   0.49
 TRAVEL TIME(MIN.) =   0.09   Tc(MIN.) =  15.25
 LONGEST FLOWPATH FROM NODE    380.00 TO NODE    402.00 =   870.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
     1       6.76  15.25     2.568   0.20( 0.02) 0.10      2.9      380.00
 LONGEST FLOWPATH FROM NODE    380.00 TO NODE    402.00 =   870.00 FEET.

 ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
     1      80.77  13.44     2.765   0.20( 0.07) 0.35     26.9      410.00
     2      90.90  17.87     2.345   0.20( 0.07) 0.35     37.1      440.00
     3      94.85  21.72     2.104   0.20( 0.07) 0.36     44.8      600.00
     4      91.30  26.05     1.898   0.20( 0.08) 0.38     49.1      470.00
     5      60.79  51.52     1.290   0.20( 0.08) 0.38     52.2      510.00
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    402.00 =  3965.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
     1      87.20  13.44     2.765   0.20( 0.07) 0.33     29.5      410.00
     2      91.67  15.25     2.568   0.20( 0.07) 0.33     34.0      380.00
     3      97.07  17.87     2.345   0.20( 0.07) 0.33     40.1      440.00
     4     100.38  21.72     2.104   0.20( 0.07) 0.35     47.7      600.00
     5      96.28  26.05     1.898   0.20( 0.07) 0.36     52.0      470.00
     6      64.16  51.52     1.290   0.20( 0.07) 0.36     55.1      510.00
   TOTAL AREA(ACRES) =     55.10

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =     100.38  Tc(MIN.) =   21.723
 EFFECTIVE AREA(ACRES) =    47.75  AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.35
 TOTAL AREA(ACRES) =     55.10
```

```
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    402.00 =  3965.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    402.00 TO NODE    404.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     51.00  DOWNSTREAM(FEET) =     50.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   270.00   CHANNEL SLOPE =  0.0037
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   4.00
 CHANNEL FLOW THRU SUBAREA(CFS) =    100.38
 FLOW VELOCITY(FEET/SEC) =   3.63   FLOW DEPTH(FEET) =   3.04
 TRAVEL TIME(MIN.) =   1.24   Tc(MIN.) =  22.96
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    404.00 =  4235.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  22.96
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.038
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.19      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.19      SUBAREA RUNOFF(CFS) =     0.35
 EFFECTIVE AREA(ACRES) =    47.94   AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.35
 TOTAL AREA(ACRES) =    55.29       PEAK FLOW RATE(CFS) =     100.38
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    404.00 TO NODE    406.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    45.86  DOWNSTREAM(FEET) =    45.50
 FLOW LENGTH(FEET) =    89.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  54.0 INCH PIPE IS  38.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.37
 GIVEN PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    100.38
 PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =  23.14
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    406.00 =  4324.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    406.00 TO NODE    406.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  23.14
```

```
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.029
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        2.44      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     2.44      SUBAREA RUNOFF(CFS) =     4.41
 EFFECTIVE AREA(ACRES) =    50.38    AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.34
 TOTAL AREA(ACRES) =    57.73        PEAK FLOW RATE(CFS) =     100.38
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    406.00 TO NODE    408.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    45.50  DOWNSTREAM(FEET) =    44.00
 FLOW LENGTH(FEET) =   840.50   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.31
 GIVEN PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    100.38
 PIPE TRAVEL TIME(MIN.) =   2.22    Tc(MIN.) =  25.36
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    408.00 =  5164.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    408.00 TO NODE    408.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  25.36
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.926
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        3.62      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     3.62      SUBAREA RUNOFF(CFS) =     6.21
 EFFECTIVE AREA(ACRES) =    54.00    AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.32
 TOTAL AREA(ACRES) =    61.35        PEAK FLOW RATE(CFS) =     100.38
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =     61.35  TC(MIN.) =     25.36
 EFFECTIVE AREA(ACRES) =     54.00  AREA-AVERAGED Fm(INCH/HR)=  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.32
 PEAK FLOW RATE(CFS)    =    100.38

 ** PEAK FLOW RATE TABLE **
  STREAM     Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER   (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
    1     87.20  17.46     2.373   0.20( 0.06) 0.29     35.7      410.00
```

2	91.67	19.13	2.259	0.20(0.06)	0.29	40.2	380.00
3	97.07	21.59	2.111	0.20(0.06)	0.30	46.3	440.00
4	100.38	25.36	1.926	0.20(0.06)	0.32	54.0	600.00
5	96.28	29.80	1.757	0.20(0.07)	0.33	58.3	470.00
6	64.56	55.64	1.237	0.20(0.07)	0.34	61.3	510.00

END OF RATIONAL METHOD ANALYSIS

1

Appendix C

Existing 100-Year Hydrology Calculations

```
**************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 OCEMA HYDROLOGY CRITERION)
       (c) Copyright 1983-2000 Advanced Engineering Software (aes)
           Ver. 8.0  Release Date: 01/01/2000  License TD 1355

                        Analysis prepared by:

                      FUSCOE ENGINEERING, INC.
                    16795 VON KARMAN, SUITE 100
                         IRVINE, CA  92606
                   TEL: 949.474.1960    FAX: 949.474.5315

 ************************** DESCRIPTION OF STUDY **************************
* Orange County Fair Grounds                                              *
* Existing 100 Yr. Hydrology                                              *
* Area A thru Area N                                                      *
 **************************************************************************

  FILE NAME: 30902A.100
  TIME/DATE OF STUDY: 15:21 07/30/2002
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*


**************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     20.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =     76.18  DOWNSTREAM(FEET) =     73.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.825
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.787
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  D        1.95      0.20       0.10    75    7.83
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      8.37
  TOTAL AREA(ACRES) =     1.95   PEAK FLOW RATE(CFS) =      8.37

**************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     30.00 IS CODE =   9
```

```
------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
========================================================================
  UPSTREAM NODE ELEVATION(FEET) =      73.00
  DOWNSTREAM NODE ELEVATION(FEET) =     70.76
  CHANNEL LENGTH THRU SUBAREA(FEET) =   630.00
  "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.080
  PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   1.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.452
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        4.79      0.20       0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     15.66
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.72
  AVERAGE FLOW DEPTH(FEET) =   0.38   FLOOD WIDTH(FEET) =   60.12
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   6.12   Tc(MIN.) =  13.94
  SUBAREA AREA(ACRES) =    4.79       SUBAREA RUNOFF(CFS) =   14.80
  EFFECTIVE AREA(ACRES) =    6.74     AREA-AVERAGED Fm(INCH/HR) =   0.02
  AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =    6.74         PEAK FLOW RATE(CFS) =      20.82

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.41   FLOOD WIDTH(FEET) =   66.87
  FLOW VELOCITY(FEET/SEC.) =   1.85   DEPTH*VELOCITY(FT*FT/SEC) =   0.77
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     30.00 =   960.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     30.00 TO NODE     30.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  13.94
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.452
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        2.47      0.20       0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.47       SUBAREA RUNOFF(CFS) =    7.63
  EFFECTIVE AREA(ACRES) =    9.21     AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    9.21         PEAK FLOW RATE(CFS) =      28.45

****************************************************************************
  FLOW PROCESS FROM NODE     30.00 TO NODE     40.00 IS CODE =   9
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =      70.76
  DOWNSTREAM NODE ELEVATION(FEET) =     70.51
  CHANNEL LENGTH THRU SUBAREA(FEET) =    85.00
```

```
"V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
MAXIMUM DEPTH(FEET) =   1.00
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.343
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 D        0.10      0.20        0.10    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     28.60
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.86
AVERAGE FLOW DEPTH(FEET) =   0.54   FLOOD WIDTH(FEET) =   77.83
"V" GUTTER FLOW TRAVEL TIME(MIN.) =   0.76   Tc(MIN.) =  14.70
SUBAREA AREA(ACRES) =     0.10       SUBAREA RUNOFF(CFS) =     0.30
EFFECTIVE AREA(ACRES) =     9.31     AREA-AVERAGED Fm(INCH/HR) =   0.02
AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
TOTAL AREA(ACRES) =     9.31         PEAK FLOW RATE(CFS) =       28.45
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

END OF SUBAREA "V" GUTTER HYDRAULICS:
DEPTH(FEET) =  0.54   FLOOD WIDTH(FEET) =   77.83
FLOW VELOCITY(FEET/SEC.) =   1.85   DEPTH*VELOCITY(FT*FT/SEC) =   1.01
LONGEST FLOWPATH FROM NODE     10.00 TO NODE     40.00 =  1045.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     50.00 TO NODE     60.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
ELEVATION DATA: UPSTREAM(FEET) =     74.25  DOWNSTREAM(FEET) =     71.30

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.944
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.769
SUBAREA Tc AND LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
COMMERCIAL                 D        0.88      0.20        0.10    75    7.94
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA RUNOFF(CFS) =      3.76
TOTAL AREA(ACRES) =      0.88   PEAK FLOW RATE(CFS) =      3.76

****************************************************************************
FLOW PROCESS FROM NODE     60.00 TO NODE     70.00 IS CODE =   9
----------------------------------------------------------------------------
>>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
UPSTREAM NODE ELEVATION(FEET) =     71.30
DOWNSTREAM NODE ELEVATION(FEET) =     68.25
CHANNEL LENGTH THRU SUBAREA(FEET) =   260.00
"V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.080
PAVEMENT LIP(FEET) =  0.030   MANNING'S N = .0150
```

```
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.218
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.86      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      7.24
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.33
 AVERAGE FLOW DEPTH(FEET) =   0.27   FLOOD WIDTH(FEET) =   34.51
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.86   Tc(MIN.) =   9.80
 SUBAREA AREA(ACRES) =    1.86       SUBAREA RUNOFF(CFS) =    7.03
 EFFECTIVE AREA(ACRES) =    2.74     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    2.74         PEAK FLOW RATE(CFS) =      10.35

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.30   FLOOD WIDTH(FEET) =   40.07
 FLOW VELOCITY(FEET/SEC.) =   2.50   DEPTH*VELOCITY(FT*FT/SEC) =   0.75
 LONGEST FLOWPATH FROM NODE     50.00 TO NODE     70.00 =   590.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     70.00 TO NODE     80.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    64.25  DOWNSTREAM(FEET) =    62.50
 FLOW LENGTH(FEET) =   500.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.50
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     10.35
 PIPE TRAVEL TIME(MIN.) =   1.85    Tc(MIN.) =  11.65
 LONGEST FLOWPATH FROM NODE     50.00 TO NODE     80.00 =  1090.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     80.00 TO NODE     80.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  11.65
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.830
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        3.42      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    3.42       SUBAREA RUNOFF(CFS) =   11.73
 EFFECTIVE AREA(ACRES) =    6.16     AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     6.16        PEAK FLOW RATE(CFS) =      21.12

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

```
 FLOW PROCESS FROM NODE     80.00 TO NODE     90.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    62.50  DOWNSTREAM(FEET) =    62.20
 FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.80
 ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     21.12
 PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =  11.85
 LONGEST FLOWPATH FROM NODE     50.00 TO NODE     90.00 =  1160.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    114.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     72.00  DOWNSTREAM(FEET) =     67.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.300
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.003
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.48      0.20       0.10    75    7.30
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      2.15
 TOTAL AREA(ACRES) =      0.48   PEAK FLOW RATE(CFS) =      2.15

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =    110.00  DOWNSTREAM(FEET) =     45.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.190
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        6.47      0.20       0.10    75    5.00
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    6.47   INITIAL SUBAREA RUNOFF(CFS) =   35.93

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN) =   7.30
```

```
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.003
 SUBAREA AREA(ACRES) =     6.47      SUBAREA RUNOFF(CFS) =    29.02
 EFFECTIVE AREA(ACRES) =     6.95    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     6.95        PEAK FLOW RATE(CFS) =      31.17

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     67.50
 DOWNSTREAM NODE ELEVATION(FEET) =     65.30
 CHANNEL LENGTH THRU SUBAREA(FEET) =   340.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.338
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        3.86      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     38.71
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.70
 AVERAGE FLOW DEPTH(FEET) =   0.53   FLOOD WIDTH(FEET) =   75.23
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.10   Tc(MIN.) =   9.40
 SUBAREA AREA(ACRES) =     3.86      SUBAREA RUNOFF(CFS) =   15.00
 EFFECTIVE AREA(ACRES) =   10.81     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =   10.81         PEAK FLOW RATE(CFS) =      42.01

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.54   FLOOD WIDTH(FEET) =   77.51
 FLOW VELOCITY(FEET/SEC.) =   2.76   DEPTH*VELOCITY(FT*FT/SEC) =   1.50
 LONGEST FLOWPATH FROM NODE    112.00 TO NODE    120.00 =   670.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     65.30
 DOWNSTREAM NODE ELEVATION(FEET) =     63.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   380.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.835
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        6.30      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
```

```
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     52.80
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.85
 AVERAGE FLOW DEPTH(FEET) =   0.58   FLOOD WIDTH(FEET) =   85.66
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.22   Tc(MIN.) =  11.62
 SUBAREA AREA(ACRES) =    6.30       SUBAREA RUNOFF(CFS) =   21.63
 EFFECTIVE AREA(ACRES) =   17.11     AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =   17.11         PEAK FLOW RATE(CFS) =      58.75

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.60   FLOOD WIDTH(FEET) =   89.25
 FLOW VELOCITY(FEET/SEC.) =   2.92   DEPTH*VELOCITY(FT*FT/SEC) =   1.76
 LONGEST FLOWPATH FROM NODE    112.00 TO NODE    130.00 =  1050.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    130.00 TO NODE    140.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    60.00  DOWNSTREAM(FEET) =    58.00
 FLOW LENGTH(FEET) =   480.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  32.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.29
 ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     58.75
 PIPE TRAVEL TIME(MIN.) =   1.10    Tc(MIN.) =  12.72
 LONGEST FLOWPATH FROM NODE    112.00 TO NODE    140.00 =  1530.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    150.00 TO NODE    160.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     75.90  DOWNSTREAM(FEET) =     73.90

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.586
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.579
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.52      0.20       0.10     75    8.59
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      2.13
 TOTAL AREA(ACRES) =      0.52   PEAK FLOW RATE(CFS) =      2.13

****************************************************************************
 FLOW PROCESS FROM NODE    160.00 TO NODE    170.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     73.90
```

```
 DOWNSTREAM NODE ELEVATION(FEET) =     71.20
 CHANNEL LENGTH THRU SUBAREA(FEET) =   410.00
 "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.050
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.724
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        3.37      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      7.57
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.90
 AVERAGE FLOW DEPTH(FEET) =   0.23   FLOOD WIDTH(FEET) =   39.33
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.59   Tc(MIN.) =  12.18
 SUBAREA AREA(ACRES) =    3.37       SUBAREA RUNOFF(CFS) =   11.23
 EFFECTIVE AREA(ACRES) =    3.89     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    3.89         PEAK FLOW RATE(CFS) =      12.97

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.28   FLOOD WIDTH(FEET) =   48.88
 FLOW VELOCITY(FEET/SEC.) =   2.13   DEPTH*VELOCITY(FT*FT/SEC) =   0.60
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    170.00 =   740.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    170.00 TO NODE    180.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    67.20  DOWNSTREAM(FEET) =    65.60
 FLOW LENGTH(FEET) =   280.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.74
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     12.97
 PIPE TRAVEL TIME(MIN.) =   0.81    Tc(MIN.) =  12.99
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    180.00 =  1020.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    180.00 TO NODE    180.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  12.99
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.589
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        2.21      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    2.21       SUBAREA RUNOFF(CFS) =    7.10
 EFFECTIVE AREA(ACRES) =    6.10     AREA-AVERAGED Fm(INCH/HR) =  0.02
```

```
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     6.10       PEAK FLOW RATE(CFS) =      19.59

****************************************************************************
 FLOW PROCESS FROM NODE    180.00 TO NODE    190.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    65.60  DOWNSTREAM(FEET) =    62.10
 FLOW LENGTH(FEET) =   600.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  19.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.36
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     19.59
 PIPE TRAVEL TIME(MIN.) =   1.57    Tc(MIN.) =  14.56
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    190.00 =  1620.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    190.00 TO NODE    190.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  14.56
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.363
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D       14.20      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =   14.20      SUBAREA RUNOFF(CFS) =   42.72
 EFFECTIVE AREA(ACRES) =    20.30   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    20.30       PEAK FLOW RATE(CFS) =      61.07

****************************************************************************
 FLOW PROCESS FROM NODE    190.00 TO NODE    200.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    62.10  DOWNSTREAM(FEET) =    60.90
 FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  29.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.59
 ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     61.07
 PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =  14.95
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    200.00 =  1820.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    200.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  14.95
```

```
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.307
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.48      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     2.48      SUBAREA RUNOFF(CFS) =     7.34
 EFFECTIVE AREA(ACRES) =    22.78    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    22.78        PEAK FLOW RATE(CFS) =       67.38

****************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    60.90  DOWNSTREAM(FEET) =    59.80
 FLOW LENGTH(FEET) =   190.00  MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  32.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.57
 ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     67.38
 PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =  15.32
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    210.00 =  2010.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  15.32
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.264
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.47      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     2.47      SUBAREA RUNOFF(CFS) =     7.21
 EFFECTIVE AREA(ACRES) =    25.25    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    25.25        PEAK FLOW RATE(CFS) =       73.72

****************************************************************************
 FLOW PROCESS FROM NODE    210.00 TO NODE    220.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    59.80  DOWNSTREAM(FEET) =    58.40
 FLOW LENGTH(FEET) =   240.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  45.0 INCH PIPE IS  31.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.89
 ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     73.72
```

```
 PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =  15.77
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    220.00 =  2250.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    220.00 TO NODE    220.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  15.77
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.213
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        6.68      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    6.68      SUBAREA RUNOFF(CFS) =   19.20
 EFFECTIVE AREA(ACRES) =   31.93    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    31.93       PEAK FLOW RATE(CFS) =      91.77

****************************************************************************
 FLOW PROCESS FROM NODE    220.00 TO NODE    230.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    58.40  DOWNSTREAM(FEET) =    55.10
 FLOW LENGTH(FEET) =   580.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  48.0 INCH PIPE IS  35.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.25
 ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     91.77
 PIPE TRAVEL TIME(MIN.) =   1.05    Tc(MIN.) =  16.82
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    230.00 =  2830.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  16.82
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.096
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D       11.53      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =   11.53      SUBAREA RUNOFF(CFS) =   31.92
 EFFECTIVE AREA(ACRES) =   43.46    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    43.46       PEAK FLOW RATE(CFS) =     120.33

****************************************************************************
 FLOW PROCESS FROM NODE    230.00 TO NODE    240.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     55.10  DOWNSTREAM(FEET) =     54.00
  FLOW LENGTH(FEET) =     65.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  33.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.70
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =    1
  PIPE-FLOW(CFS) =     120.33
  PIPE TRAVEL TIME(MIN.) =    0.07    Tc(MIN.) =  16.89
  LONGEST FLOWPATH FROM NODE    150.00 TO NODE    240.00 =  2895.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    260.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =     63.50  DOWNSTREAM(FEET) =     59.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.437
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.932
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  D        0.32      0.20       0.10    75    7.44
  NATURAL GOOD COVER
  "MEADOWS"                   D        0.87      0.20       1.00    78   22.88
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.76
  SUBAREA RUNOFF(CFS) =      5.12
  TOTAL AREA(ACRES) =      1.19   PEAK FLOW RATE(CFS) =      5.12

****************************************************************************
  FLOW PROCESS FROM NODE    260.00 TO NODE    270.00 IS CODE =   9
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =     59.40
  DOWNSTREAM NODE ELEVATION(FEET) =     56.86
  CHANNEL LENGTH THRU SUBAREA(FEET) =   610.00
  "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
  PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   1.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.577
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        5.62      0.20       0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     13.82
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.80
  AVERAGE FLOW DEPTH(FEET) =   0.43   FLOOD WIDTH(FEET) =   54.68
```

```
"V" GUTTER FLOW TRAVEL TIME(MIN.) =   5.64   Tc(MIN.) =  13.08
SUBAREA AREA(ACRES) =    5.62       SUBAREA RUNOFF(CFS) =   17.99
EFFECTIVE AREA(ACRES) =    6.81     AREA-AVERAGED Fm(INCH/HR) =   0.04
AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.21
TOTAL AREA(ACRES) =    6.81         PEAK FLOW RATE(CFS) =      21.66

END OF SUBAREA "V" GUTTER HYDRAULICS:
DEPTH(FEET) =  0.48   FLOOD WIDTH(FEET) =   65.44
FLOW VELOCITY(FEET/SEC.) =   1.99   DEPTH*VELOCITY(FT*FT/SEC) =   0.96
LONGEST FLOWPATH FROM NODE    250.00 TO NODE    270.00 =   940.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    270.00 TO NODE    280.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    52.86  DOWNSTREAM(FEET) =    50.00
FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  13.01
ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     21.66
PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =  13.18
LONGEST FLOWPATH FROM NODE    250.00 TO NODE    280.00 =  1020.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    300.00 TO NODE    310.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
ELEVATION DATA: UPSTREAM(FEET) =     59.00  DOWNSTREAM(FEET) =     58.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.862
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.201
SUBAREA Tc AND LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
COMMERCIAL                 D        0.79      0.20        0.10    75    9.86
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA RUNOFF(CFS) =      2.97
TOTAL AREA(ACRES) =      0.79   PEAK FLOW RATE(CFS) =      2.97

****************************************************************************
FLOW PROCESS FROM NODE    310.00 TO NODE    320.00 IS CODE =   9
----------------------------------------------------------------------------
>>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
UPSTREAM NODE ELEVATION(FEET) =     58.00
DOWNSTREAM NODE ELEVATION(FEET) =     53.80
CHANNEL LENGTH THRU SUBAREA(FEET) =  1070.00
"V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
```

```
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.711
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.30      0.20       0.10    75
 NATURAL FAIR COVER
 "GRASS"                     D        3.50      0.20       1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.76
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      8.25
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.58
 AVERAGE FLOW DEPTH(FEET) =   0.38   FLOOD WIDTH(FEET) =   44.89
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =  11.31   Tc(MIN.) =  21.17
 SUBAREA AREA(ACRES) =    4.80       SUBAREA RUNOFF(CFS) =   11.06
 EFFECTIVE AREA(ACRES) =    5.59     AREA-AVERAGED Fm(INCH/HR) =   0.13
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.66
 TOTAL AREA(ACRES) =    5.59         PEAK FLOW RATE(CFS) =      12.97

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.43   FLOOD WIDTH(FEET) =   54.02
 FLOW VELOCITY(FEET/SEC.) =   1.73   DEPTH*VELOCITY(FT*FT/SEC) =   0.74
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    320.00 =  1400.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    320.00 TO NODE    330.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    50.80  DOWNSTREAM(FEET) =    50.00
 FLOW LENGTH(FEET) =   130.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.91
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     12.97
 PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =  21.54
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    330.00 =  1530.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    330.00 TO NODE    330.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  21.54
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.683
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 NATURAL FAIR COVER
 "GRASS"                     D        4.80      0.20       1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA AREA(ACRES) =    4.80       SUBAREA RUNOFF(CFS) =   10.73
 EFFECTIVE AREA(ACRES) =   10.39     AREA-AVERAGED Fm(INCH/HR) =  0.16
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.82
```

```
 TOTAL AREA(ACRES) =    10.39       PEAK FLOW RATE(CFS) =      23.56

****************************************************************************
 FLOW PROCESS FROM NODE    350.00 TO NODE    360.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     58.00  DOWNSTREAM(FEET) =     56.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.094
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.428
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        1.40      0.20       0.10     75    9.09
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      5.55
 TOTAL AREA(ACRES) =      1.40   PEAK FLOW RATE(CFS) =      5.55

****************************************************************************
 FLOW PROCESS FROM NODE    360.00 TO NODE    370.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     56.50
 DOWNSTREAM NODE ELEVATION(FEET) =     55.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   320.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0350
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.233
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.60      0.20       0.10     75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      6.43
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.82
 AVERAGE FLOW DEPTH(FEET) =   0.43   FLOOD WIDTH(FEET) =   55.33
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   6.51   Tc(MIN.) =  15.60
 SUBAREA AREA(ACRES) =    0.60       SUBAREA RUNOFF(CFS) =    1.73
 EFFECTIVE AREA(ACRES) =    2.00     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    2.00         PEAK FLOW RATE(CFS) =       5.78

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.42   FLOOD WIDTH(FEET) =   53.05
 FLOW VELOCITY(FEET/SEC.) =   0.80   DEPTH*VELOCITY(FT*FT/SEC) =   0.34
 LONGEST FLOWPATH FROM NODE    350.00 TO NODE    370.00 =   650.00 FEET.

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

```
 FLOW PROCESS FROM NODE    510.00 TO NODE    520.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     73.00  DOWNSTREAM(FEET) =     70.80

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   19.563
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.838
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 NATURAL FAIR COVER
 "GRASS"                     D        0.47      0.20       1.00    84   19.56
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA RUNOFF(CFS) =      1.12
 TOTAL AREA(ACRES) =      0.47   PEAK FLOW RATE(CFS) =      1.12

****************************************************************************
 FLOW PROCESS FROM NODE    520.00 TO NODE    530.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     70.80
 DOWNSTREAM NODE ELEVATION(FEET) =     67.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   720.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.293
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 NATURAL FAIR COVER
 "GRASS"                     D        1.39      0.20       1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     2.41
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.37
 AVERAGE FLOW DEPTH(FEET) =   0.25   FLOOD WIDTH(FEET) =   25.48
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   8.77   Tc(MIN.) =  28.33
 SUBAREA AREA(ACRES) =    1.39       SUBAREA RUNOFF(CFS) =    2.62
 EFFECTIVE AREA(ACRES) =    1.86     AREA-AVERAGED Fm(INCH/HR) =   0.20
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   1.00
 TOTAL AREA(ACRES) =    1.86        PEAK FLOW RATE(CFS) =       3.50

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.28   FLOOD WIDTH(FEET) =   30.21
 FLOW VELOCITY(FEET/SEC.) =   1.45   DEPTH*VELOCITY(FT*FT/SEC) =   0.40
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    530.00 =  1050.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    530.00 TO NODE    540.00 IS CODE =   9
```

```
------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
========================================================================
 UPSTREAM NODE ELEVATION(FEET) =     67.00
 DOWNSTREAM NODE ELEVATION(FEET) =     62.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   400.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.168
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.42      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.88
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.20
 AVERAGE FLOW DEPTH(FEET) =   0.27   FLOOD WIDTH(FEET) =   28.86
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.03   Tc(MIN.) =  31.36
 SUBAREA AREA(ACRES) =    1.42       SUBAREA RUNOFF(CFS) =    2.75
 EFFECTIVE AREA(ACRES) =    3.28     AREA-AVERAGED Fm(INCH/HR) =   0.12
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.61
 TOTAL AREA(ACRES) =    3.28         PEAK FLOW RATE(CFS) =       6.04

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.28   FLOOD WIDTH(FEET) =   31.57
 FLOW VELOCITY(FEET/SEC.) =   2.30   DEPTH*VELOCITY(FT*FT/SEC) =   0.65
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    540.00 =  1450.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    540.00 TO NODE    540.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  31.36
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.168
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.00      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    1.00       SUBAREA RUNOFF(CFS) =    1.93
 EFFECTIVE AREA(ACRES) =    4.28     AREA-AVERAGED Fm(INCH/HR) =  0.10
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.49
 TOTAL AREA(ACRES) =    4.28         PEAK FLOW RATE(CFS) =       7.97

****************************************************************************
 FLOW PROCESS FROM NODE    540.00 TO NODE    500.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (NEW ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     62.00  DOWNSTREAM(FEET) =     58.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =  1050.00   CHANNEL SLOPE =  0.0033
```

```
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =      7.97
  FLOW VELOCITY(FEET/SEC) =   1.83   FLOW DEPTH(FEET) =   1.06
  TRAVEL TIME(MIN.) =   9.55   Tc(MIN.) =  40.91
  LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2500.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  40.91
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.859
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        0.98      0.20       0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.98      SUBAREA RUNOFF(CFS) =    1.62
  EFFECTIVE AREA(ACRES) =    5.26    AREA-AVERAGED Fm(INCH/HR) =  0.08
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.42
  TOTAL AREA(ACRES) =    5.26       PEAK FLOW RATE(CFS) =       8.40

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    470.00 TO NODE    480.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =     73.00  DOWNSTREAM(FEET) =     70.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.917
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.777
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  D        0.51      0.20       0.10    75    7.92
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      2.18
  TOTAL AREA(ACRES) =      0.51   PEAK FLOW RATE(CFS) =      2.18

****************************************************************************
  FLOW PROCESS FROM NODE    480.00 TO NODE    490.00 IS CODE =   9
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
```

```
 UPSTREAM NODE ELEVATION(FEET) =     70.00
 DOWNSTREAM NODE ELEVATION(FEET) =     64.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   720.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.382
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.07      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      5.24
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.84
 AVERAGE FLOW DEPTH(FEET) =   0.29   FLOOD WIDTH(FEET) =   32.92
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   6.52   Tc(MIN.) =  14.43
 SUBAREA AREA(ACRES) =    2.07       SUBAREA RUNOFF(CFS) =    6.26
 EFFECTIVE AREA(ACRES) =    2.58     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    2.58         PEAK FLOW RATE(CFS) =       7.81

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.32   FLOOD WIDTH(FEET) =   39.00
 FLOW VELOCITY(FEET/SEC.) =   1.98   DEPTH*VELOCITY(FT*FT/SEC) =   0.63
 LONGEST FLOWPATH FROM NODE    470.00 TO NODE    490.00 =  1050.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    490.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  14.43
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.382
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.21      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    2.21       SUBAREA RUNOFF(CFS) =    6.69
 EFFECTIVE AREA(ACRES) =    4.79     AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    4.79         PEAK FLOW RATE(CFS) =      14.49

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    490.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  14.43
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.382
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.33      0.20        0.10    75
```

```
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     2.33      SUBAREA RUNOFF(CFS) =     7.05
 EFFECTIVE AREA(ACRES) =     7.12    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     7.12        PEAK FLOW RATE(CFS) =      21.54

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    500.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     64.50
 DOWNSTREAM NODE ELEVATION(FEET) =     58.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   530.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.059
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.60      0.20        0.10    75
 NATURAL FAIR COVER
 "GRASS"                     D        7.35      0.20        1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.76
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     34.45
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.25
 AVERAGE FLOW DEPTH(FEET) =   0.45   FLOOD WIDTH(FEET) =   64.68
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.72   Tc(MIN.) =  17.15
 SUBAREA AREA(ACRES) =     9.95      SUBAREA RUNOFF(CFS) =   26.03
 EFFECTIVE AREA(ACRES) =   17.07     AREA-AVERAGED Fm(INCH/HR) =   0.10
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.49
 TOTAL AREA(ACRES) =   17.07         PEAK FLOW RATE(CFS) =      45.50

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.49   FLOOD WIDTH(FEET) =   72.11
 FLOW VELOCITY(FEET/SEC.) =   3.46   DEPTH*VELOCITY(FT*FT/SEC) =   1.68
 LONGEST FLOWPATH FROM NODE    470.00 TO NODE    500.00 =  1580.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1      45.50  17.15     3.059   0.20( 0.10) 0.49     17.1      470.00
 LONGEST FLOWPATH FROM NODE    470.00 TO NODE    500.00 =  1580.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
```

```
    1       8.40  40.91    1.859  0.20( 0.08) 0.42      5.3      510.00
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2500.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
    1      51.41  17.15    3.059  0.20( 0.10) 0.48     19.3      470.00
    2      35.47  40.91    1.859  0.20( 0.09) 0.47     22.3      510.00
   TOTAL AREA(ACRES) =      22.33

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       51.41  Tc(MIN.) =   17.149
 EFFECTIVE AREA(ACRES) =     19.27  AREA-AVERAGED Fm(INCH/HR) =  0.10
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.48
 TOTAL AREA(ACRES) =     22.33
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2500.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     58.50  DOWNSTREAM(FEET) =     58.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   270.00   CHANNEL SLOPE =  0.0019
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   3.00
 CHANNEL FLOW THRU SUBAREA(CFS) =     51.41
 FLOW VELOCITY(FEET/SEC) =   2.37   FLOW DEPTH(FEET) =   2.63
 TRAVEL TIME(MIN.) =   1.90   Tc(MIN.) =  19.05
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2770.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    460.00 TO NODE    460.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  19.05
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.884
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D         0.25      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.25      SUBAREA RUNOFF(CFS) =     0.64
 EFFECTIVE AREA(ACRES) =    19.52   AREA-AVERAGED Fm(INCH/HR) =  0.09
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.47
 TOTAL AREA(ACRES) =    22.58       PEAK FLOW RATE(CFS) =       51.41
 NOTE:  PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    460.00 TO NODE    460.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    440.00 TO NODE    450.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     65.40  DOWNSTREAM(FEET) =    62.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.971
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.761
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        1.60      0.20        0.10    75    7.97
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      6.83
 TOTAL AREA(ACRES) =      1.60   PEAK FLOW RATE(CFS) =      6.83

****************************************************************************
 FLOW PROCESS FROM NODE    450.00 TO NODE    460.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     62.50
 DOWNSTREAM NODE ELEVATION(FEET) =     58.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   490.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.904
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        5.00      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     15.45
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.47
 AVERAGE FLOW DEPTH(FEET) =   0.37   FLOOD WIDTH(FEET) =   49.47
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.31   Tc(MIN.) =  11.28
 SUBAREA AREA(ACRES) =    5.00       SUBAREA RUNOFF(CFS) =   17.48
 EFFECTIVE AREA(ACRES) =    6.60     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    6.60        PEAK FLOW RATE(CFS) =      23.07

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.41   FLOOD WIDTH(FEET) =   57.58
 FLOW VELOCITY(FEET/SEC.) =   2.74   DEPTH*VELOCITY(FT*FT/SEC) =   1.13
 LONGEST FLOWPATH FROM NODE    440.00 TO NODE    460.00 =   820.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    460.00 TO NODE    460.00 IS CODE =  11
----------------------------------------------------------------------------
```

```
>>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
================================================================================

** MAIN STREAM CONFLUENCE DATA **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1      23.07  11.28     3.904  0.20( 0.02) 0.10      6.6      440.00
LONGEST FLOWPATH FROM NODE    440.00 TO NODE    460.00 =   820.00 FEET.

** MEMORY BANK #  2 CONFLUENCE DATA **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1      51.41  19.05     2.884  0.20( 0.09) 0.47     19.5      470.00
    2      35.47  43.01     1.811  0.20( 0.09) 0.47     22.6      510.00
LONGEST FLOWPATH FROM NODE    510.00 TO NODE    460.00 =  2770.00 FEET.

** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1      64.65  11.28     3.904  0.20( 0.07) 0.34     18.2      440.00
    2      68.42  19.05     2.884  0.20( 0.08) 0.38     26.1      470.00
    3      46.10  43.01     1.811  0.20( 0.08) 0.38     29.2      510.00
  TOTAL AREA(ACRES) =     29.18

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      68.42  Tc(MIN.) =   19.050
EFFECTIVE AREA(ACRES) =    26.12  AREA-AVERAGED Fm(INCH/HR) =  0.08
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.38
TOTAL AREA(ACRES) =     29.18
LONGEST FLOWPATH FROM NODE    510.00 TO NODE    460.00 =  2770.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    460.00 TO NODE    430.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =     58.00  DOWNSTREAM(FEET) =     56.70
CHANNEL LENGTH THRU SUBAREA(FEET) =   465.00   CHANNEL SLOPE =  0.0028
CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   3.00
CHANNEL FLOW THRU SUBAREA(CFS) =     68.42
FLOW VELOCITY(FEET/SEC) =   2.97   FLOW DEPTH(FEET) =   2.73
TRAVEL TIME(MIN.) =   2.61   Tc(MIN.) =  21.66
LONGEST FLOWPATH FROM NODE    510.00 TO NODE    430.00 =  3235.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  21.66
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.674
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 D        0.32      0.20       0.10     75
```

```
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     0.32     SUBAREA RUNOFF(CFS) =     0.76
 EFFECTIVE AREA(ACRES) =    26.44   AREA-AVERAGED Fm(INCH/HR) =  0.08
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.38
 TOTAL AREA(ACRES) =    29.50      PEAK FLOW RATE(CFS) =      68.42
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    410.00 TO NODE    420.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     60.00  DOWNSTREAM(FEET) =     57.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.211
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.690
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.62      0.20        0.10    75    8.21
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      2.61
 TOTAL AREA(ACRES) =      0.62   PEAK FLOW RATE(CFS) =      2.61

****************************************************************************
 FLOW PROCESS FROM NODE    420.00 TO NODE    430.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     57.50
 DOWNSTREAM NODE ELEVATION(FEET) =     56.70
 CHANNEL LENGTH THRU SUBAREA(FEET) =   150.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.249
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.64      0.20        0.10    75
 NATURAL FAIR COVER
 "GRASS"                     D        0.70      0.20        1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.37
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      6.94
```

```
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =    1.68
 AVERAGE FLOW DEPTH(FEET) =   0.33   FLOOD WIDTH(FEET) =   40.01
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.49   Tc(MIN.) =   9.70
 SUBAREA AREA(ACRES) =    2.34       SUBAREA RUNOFF(CFS) =    8.79
 EFFECTIVE AREA(ACRES) =    2.96     AREA-AVERAGED Fm(INCH/HR) =   0.06
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.31
 TOTAL AREA(ACRES) =    2.96         PEAK FLOW RATE(CFS) =      11.15

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.37   FLOOD WIDTH(FEET) =   48.12
 FLOW VELOCITY(FEET/SEC.) =   1.88   DEPTH*VELOCITY(FT*FT/SEC) =   0.69
 LONGEST FLOWPATH FROM NODE    410.00 TO NODE    430.00 =   480.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
     1      11.15    9.70     4.249  0.20( 0.06) 0.31      3.0      410.00
 LONGEST FLOWPATH FROM NODE    410.00 TO NODE    430.00 =   480.00 FEET.

 ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
     1      64.65   13.93     3.454  0.20( 0.07) 0.33     18.5      440.00
     2      68.42   21.66     2.674  0.20( 0.08) 0.38     26.4      470.00
     3      46.10   45.90     1.744  0.20( 0.08) 0.38     29.5      510.00
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    430.00 =  3235.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
     1      66.73    9.70     4.249  0.20( 0.07) 0.33     15.8      410.00
     2      73.68   13.93     3.454  0.20( 0.07) 0.33     21.4      440.00
     3      75.37   21.66     2.674  0.20( 0.07) 0.37     29.4      470.00
     4      50.58   45.90     1.744  0.20( 0.07) 0.37     32.5      510.00
   TOTAL AREA(ACRES) =      32.46

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       75.37  Tc(MIN.) =   21.663
 EFFECTIVE AREA(ACRES) =     29.40  AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.37
 TOTAL AREA(ACRES) =     32.46
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    430.00 =  3235.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    430.00 TO NODE    660.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     56.70  DOWNSTREAM(FEET) =     56.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   200.00   CHANNEL SLOPE =  0.0035
```

```
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   3.00
 CHANNEL FLOW THRU SUBAREA(CFS) =     75.37
 FLOW VELOCITY(FEET/SEC) =   3.30   FLOW DEPTH(FEET) =   2.71
 TRAVEL TIME(MIN.) =   1.01   Tc(MIN.) =  22.67
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    660.00 =  3435.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    660.00 TO NODE    660.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  22.67
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.600
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.19      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.19      SUBAREA RUNOFF(CFS) =    0.44
 EFFECTIVE AREA(ACRES) =    29.59   AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.37
 TOTAL AREA(ACRES) =    32.65       PEAK FLOW RATE(CFS) =      75.37
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    660.00 TO NODE    660.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    660.00 TO NODE    660.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    600.00 TO NODE    610.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     70.20  DOWNSTREAM(FEET) =     66.90

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.767
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.821
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.56      0.20       0.10    75    7.77
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      2.42
```

```
 TOTAL AREA(ACRES) =      0.56   PEAK FLOW RATE(CFS) =      2.42

****************************************************************************
 FLOW PROCESS FROM NODE    610.00 TO NODE    620.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     66.90
 DOWNSTREAM NODE ELEVATION(FEET) =     63.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   750.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.331
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        5.06      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      9.56
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.78
 AVERAGE FLOW DEPTH(FEET) =   0.35   FLOOD WIDTH(FEET) =   45.76
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   7.02   Tc(MIN.) =  14.78
 SUBAREA AREA(ACRES) =    5.06       SUBAREA RUNOFF(CFS) =   15.08
 EFFECTIVE AREA(ACRES) =    5.62     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    5.62         PEAK FLOW RATE(CFS) =      16.75

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.41   FLOOD WIDTH(FEET) =   56.91
 FLOW VELOCITY(FEET/SEC.) =   2.03   DEPTH*VELOCITY(FT*FT/SEC) =   0.83
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    620.00 =  1080.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    620.00 TO NODE    630.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    61.00  DOWNSTREAM(FEET) =    59.40
 FLOW LENGTH(FEET) =   560.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.71
 ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     16.75
 PIPE TRAVEL TIME(MIN.) =   1.98    Tc(MIN.) =  16.77
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    630.00 =  1640.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    630.00 TO NODE    630.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  16.77
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.102
```

```
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.94      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     1.94      SUBAREA RUNOFF(CFS) =     5.38
 EFFECTIVE AREA(ACRES) =     7.56    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     7.56        PEAK FLOW RATE(CFS) =       20.97

****************************************************************************
 FLOW PROCESS FROM NODE     630.00 TO NODE     640.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     59.40  DOWNSTREAM(FEET) =     55.00
 FLOW LENGTH(FEET) =   380.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.33
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     20.97
 PIPE TRAVEL TIME(MIN.) =   0.76    Tc(MIN.) =  17.53
 LONGEST FLOWPATH FROM NODE     600.00 TO NODE     640.00 =  2020.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     640.00 TO NODE     640.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.53
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.018
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        3.71      0.20       0.10    75
 NATURAL FAIR COVER
 "GRASS"                     D        6.24      0.20       1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.66
 SUBAREA AREA(ACRES) =     9.95      SUBAREA RUNOFF(CFS) =    25.83
 EFFECTIVE AREA(ACRES) =    17.51    AREA-AVERAGED Fm(INCH/HR) =  0.08
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.42
 TOTAL AREA(ACRES) =     17.51       PEAK FLOW RATE(CFS) =       46.23

****************************************************************************
 FLOW PROCESS FROM NODE     640.00 TO NODE     650.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     55.00  DOWNSTREAM(FEET) =     54.00
 FLOW LENGTH(FEET) =   240.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  29.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.91
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
```

```
 PIPE-FLOW(CFS) =     46.23
 PIPE TRAVEL TIME(MIN.) =   0.58    Tc(MIN.) =  18.10
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    650.00 =  2260.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    650.00 TO NODE    650.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  18.10
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.967
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.51      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    1.51      SUBAREA RUNOFF(CFS) =    4.00
 EFFECTIVE AREA(ACRES) =    19.02   AREA-AVERAGED Fm(INCH/HR) =  0.08
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.40
 TOTAL AREA(ACRES) =    19.02       PEAK FLOW RATE(CFS) =      49.43

****************************************************************************
 FLOW PROCESS FROM NODE    650.00 TO NODE    660.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    54.00  DOWNSTREAM(FEET) =    53.00
 FLOW LENGTH(FEET) =   240.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  31.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.95
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     49.43
 PIPE TRAVEL TIME(MIN.) =   0.58    Tc(MIN.) =  18.68
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    660.00 =  2500.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    660.00 TO NODE    660.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1      49.43   18.68     2.916   0.20( 0.08) 0.40     19.0      600.00
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    660.00 =  2500.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1      66.73   10.74     4.012   0.20( 0.07) 0.33     16.0      410.00
     2      73.68   14.94     3.308   0.20( 0.07) 0.33     21.6      440.00
     3      75.37   22.67     2.600   0.20( 0.07) 0.37     29.6      470.00
     4      50.58   47.01     1.719   0.20( 0.07) 0.37     32.6      510.00
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    660.00 =  3435.00 FEET.
```

```
** PEAK FLOW RATE TABLE **
 STREAM     Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER   (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1    106.13  10.74     4.012   0.20( 0.07) 0.36     27.0      410.00
    2    118.69  14.94     3.308   0.20( 0.07) 0.36     36.8      440.00
    3    123.93  18.68     2.916   0.20( 0.07) 0.37     44.5      600.00
    4    119.29  22.67     2.600   0.20( 0.08) 0.38     48.6      470.00
    5     79.15  47.01     1.719   0.20( 0.08) 0.38     51.7      510.00
  TOTAL AREA(ACRES) =     51.67

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      123.93  Tc(MIN.) =   18.680
 EFFECTIVE AREA(ACRES) =     44.50  AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.36
 TOTAL AREA(ACRES) =     51.67
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    660.00 =  3435.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    660.00 TO NODE    402.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     53.00  DOWNSTREAM(FEET) =     51.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   530.00   CHANNEL SLOPE =  0.0038
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   3.00

       ==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
           CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
           ALLOWABLE DEPTH).
           AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
           ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.

 CHANNEL FLOW THRU SUBAREA(CFS) =    123.93
 FLOW VELOCITY(FEET/SEC) =   4.59   FLOW DEPTH(FEET) =   3.00
 TRAVEL TIME(MIN.) =   1.92   Tc(MIN.) =  20.60

 ==>FLOWDEPTH EXCEEDS MAXIMUM ALLOWABLE DEPTH

 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    402.00 =  3965.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  20.60
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.754
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        0.49      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.49      SUBAREA RUNOFF(CFS) =    1.21
```

```
 EFFECTIVE AREA(ACRES) =    44.99   AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.37
 TOTAL AREA(ACRES) =    52.16       PEAK FLOW RATE(CFS) =     123.93
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    380.00 TO NODE    390.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     59.80  DOWNSTREAM(FEET) =     59.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.313
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.097
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.83      0.20       0.10    75   10.31
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      3.05
 TOTAL AREA(ACRES) =      0.83   PEAK FLOW RATE(CFS) =      3.05

****************************************************************************
 FLOW PROCESS FROM NODE    390.00 TO NODE    400.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     59.00
 DOWNSTREAM NODE ELEVATION(FEET) =     55.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   520.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.315
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.11      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
```

```
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      6.14
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.89
 AVERAGE FLOW DEPTH(FEET) =   0.30   FLOOD WIDTH(FEET) =   35.28
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   4.58   Tc(MIN.) =  14.90
 SUBAREA AREA(ACRES) =    2.11       SUBAREA RUNOFF(CFS) =    6.26
 EFFECTIVE AREA(ACRES) =    2.94     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    2.94         PEAK FLOW RATE(CFS) =       8.72

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.33   FLOOD WIDTH(FEET) =   40.69
 FLOW VELOCITY(FEET/SEC.) =   2.04   DEPTH*VELOCITY(FT*FT/SEC) =   0.67
 LONGEST FLOWPATH FROM NODE    380.00 TO NODE    400.00 =   850.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    400.00 TO NODE    402.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     51.50  DOWNSTREAM(FEET) =     51.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =    20.00   CHANNEL SLOPE =  0.0250
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   4.00
 CHANNEL FLOW THRU SUBAREA(CFS) =      8.72
 FLOW VELOCITY(FEET/SEC) =   3.76   FLOW DEPTH(FEET) =   0.56
 TRAVEL TIME(MIN.) =   0.09   Tc(MIN.) =  14.98
 LONGEST FLOWPATH FROM NODE    380.00 TO NODE    402.00 =   870.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS) (MIN.) (INCH/HR) (INCH/HR)         (ACRES)     NODE
     1       8.72  14.98     3.302  0.20( 0.02) 0.10      2.9      380.00
 LONGEST FLOWPATH FROM NODE    380.00 TO NODE    402.00 =   870.00 FEET.

 ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS) (MIN.) (INCH/HR) (INCH/HR)         (ACRES)     NODE
     1     106.13  12.99     3.590  0.20( 0.07) 0.35     27.4      410.00
     2     118.69  16.95     3.081  0.20( 0.07) 0.35     37.3      440.00
     3     123.93  20.60     2.754  0.20( 0.07) 0.37     45.0      600.00
     4     119.29  24.67     2.480  0.20( 0.08) 0.38     49.1      470.00
     5      79.15  49.58     1.660  0.20( 0.08) 0.38     52.2      510.00
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    402.00 =  3965.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS) (MIN.) (INCH/HR) (INCH/HR)         (ACRES)     NODE
     1     114.35  12.99     3.590  0.20( 0.07) 0.33     30.0      410.00
     2     121.17  14.98     3.302  0.20( 0.07) 0.33     35.4      380.00
     3     126.82  16.95     3.081  0.20( 0.07) 0.33     40.3      440.00
```

```
    4     131.19  20.60     2.754  0.20( 0.07) 0.35     47.9      600.00
    5     125.82  24.67     2.480  0.20( 0.07) 0.36     52.0      470.00
    6      83.51  49.58     1.660  0.20( 0.07) 0.36     55.1      510.00
  TOTAL AREA(ACRES) =      55.10

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      131.19  Tc(MIN.) =   20.605
  EFFECTIVE AREA(ACRES) =     47.93  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =     55.10
  LONGEST FLOWPATH FROM NODE    510.00 TO NODE    402.00 =  3965.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    404.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     51.00  DOWNSTREAM(FEET) =     50.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   270.00   CHANNEL SLOPE =  0.0037
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   4.00
  CHANNEL FLOW THRU SUBAREA(CFS) =    131.19
  FLOW VELOCITY(FEET/SEC) =   3.88   FLOW DEPTH(FEET) =   3.43
  TRAVEL TIME(MIN.) =   1.16   Tc(MIN.) =  21.76
  LONGEST FLOWPATH FROM NODE    510.00 TO NODE    404.00 =  4235.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  21.76
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.666
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        0.19      0.20       0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.19      SUBAREA RUNOFF(CFS) =    0.45
  EFFECTIVE AREA(ACRES) =    48.12   AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =    55.29      PEAK FLOW RATE(CFS) =     131.19
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    406.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    45.86  DOWNSTREAM(FEET) =    45.50
  FLOW LENGTH(FEET) =    89.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.25
  GIVEN PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
```

END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 61.35 TC(MIN.) = 23.64
EFFECTIVE AREA(ACRES) = 54.18 AREA-AVERAGED Fm(INCH/HR)= 0.06
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.32
PEAK FLOW RATE(CFS) = 131.19

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	114.35	16.31	3.153	0.20(0.06)	0.29	36.2	410.00
2	121.17	18.20	2.958	0.20(0.06)	0.30	41.6	380.00
3	126.82	20.07	2.795	0.20(0.06)	0.30	46.5	440.00
4	131.19	23.64	2.541	0.20(0.06)	0.32	54.2	600.00
5	125.82	27.80	2.317	0.20(0.07)	0.33	58.3	470.00
6	84.09	53.73	1.590	0.20(0.07)	0.34	61.3	510.00

==========
==========
END OF RATIONAL METHOD ANALYSIS

1

```
 PIPE-FLOW(CFS) =    131.19
 PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =  21.94
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    406.00 =  4324.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    406.00 TO NODE    406.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  21.94
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.652
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.44      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    2.44      SUBAREA RUNOFF(CFS) =    5.78
 EFFECTIVE AREA(ACRES) =    50.56   AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.34
 TOTAL AREA(ACRES) =    57.73       PEAK FLOW RATE(CFS) =     131.19
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    406.00 TO NODE    408.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    45.50  DOWNSTREAM(FEET) =    44.00
 FLOW LENGTH(FEET) =   840.50   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.25
 GIVEN PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    131.19
 PIPE TRAVEL TIME(MIN.) =   1.70    Tc(MIN.) =  23.64
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    408.00 =  5164.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    408.00 TO NODE    408.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  23.64
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.541
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        3.62      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    3.62      SUBAREA RUNOFF(CFS) =    8.21
 EFFECTIVE AREA(ACRES) =    54.18   AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.32
 TOTAL AREA(ACRES) =    61.35       PEAK FLOW RATE(CFS) =     131.19
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE
============================================================================
```

Appendix D

Proposed 10-Year Hydrology Calculations

```
**************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 OCEMA HYDROLOGY CRITERION)
        (c) Copyright 1983-2001 Advanced Engineering Software (aes)
            Ver. 8.0  Release Date: 01/01/2001  License ID 1355

                          Analysis prepared by:

                          Fuscoe Engineering, Inc.
                        16795 Von Karman, Suite 100
                           Irvine, Calif.  92606
                      (949) 474 - 1960  Fax: (949) 474 - 5315

 ************************* DESCRIPTION OF STUDY *************************
* Orange County Fair Grounds                                            *
* Proposed 10 yr. Hydrology                                             *
* Area A thru H                                                         *
 ************************************************************************

  FILE NAME: 30902B.10
  TIME/DATE OF STUDY: 11:14 08/09/2002
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.    (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)   (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ======  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00  0.0313  0.167  0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =     72.00  DOWNSTREAM(FEET) =     67.50
```

```
 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.300
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.268
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 D        0.48      0.20       0.10     75    7.30
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      1.40
 TOTAL AREA(ACRES) =      0.48   PEAK FLOW RATE(CFS) =      1.40

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   220.00
 ELEVATION DATA: UPSTREAM(FEET) =    102.50  DOWNSTREAM(FEET) =     67.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.859
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.771
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "1 DWELLING/ACRE"          D        3.99      0.20       0.80     75    5.86
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.80
 SUBAREA AREA(ACRES) =    3.99   INITIAL SUBAREA RUNOFF(CFS) =   12.97

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN) =   7.30
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.287
 SUBAREA AREA(ACRES) =    3.99      SUBAREA RUNOFF(CFS) =   11.23
 EFFECTIVE AREA(ACRES) =     4.47   AREA-AVERAGED Fm(INCH/HR) =  0.14
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.72
 TOTAL AREA(ACRES) =     4.47       PEAK FLOW RATE(CFS) =      12.64

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     67.50
 DOWNSTREAM NODE ELEVATION(FEET) =     65.30
 CHANNEL LENGTH THRU SUBAREA(FEET) =   330.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.787
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
```

```
   RESIDENTIAL
   "1 DWELLING/ACRE"          D        4.11      0.20      0.80     75
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.80
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     17.51
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.28
   AVERAGE FLOW DEPTH(FEET) =   0.43   FLOOD WIDTH(FEET) =   54.68
   "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.41   Tc(MIN.) =   9.71
   SUBAREA AREA(ACRES) =    4.11       SUBAREA RUNOFF(CFS) =    9.72
   EFFECTIVE AREA(ACRES) =    8.58     AREA-AVERAGED Fm(INCH/HR) =   0.15
   AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.76
   TOTAL AREA(ACRES) =    8.58        PEAK FLOW RATE(CFS) =      20.35

   END OF SUBAREA "V" GUTTER HYDRAULICS:
   DEPTH(FEET) =  0.44   FLOOD WIDTH(FEET) =   57.94
   FLOW VELOCITY(FEET/SEC.) =   2.37   DEPTH*VELOCITY(FT*FT/SEC) =   1.05
   LONGEST FLOWPATH FROM NODE    100.00 TO NODE    120.00 =   660.00 FEET.

****************************************************************************
   FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =  91
----------------------------------------------------------------------------
   >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
   UPSTREAM NODE ELEVATION(FEET) =     65.30
   DOWNSTREAM NODE ELEVATION(FEET) =     63.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   380.00
   "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
   PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
   PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
   MAXIMUM DEPTH(FEET) =   1.00
   *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.422
   SUBAREA LOSS RATE DATA(AMC  II):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
   COMMERCIAL                  D        5.77      0.20       0.10     75
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     26.57
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.41
   AVERAGE FLOW DEPTH(FEET) =   0.48   FLOOD WIDTH(FEET) =   65.77
   "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.62   Tc(MIN.) =  12.33
   SUBAREA AREA(ACRES) =    5.77       SUBAREA RUNOFF(CFS) =   12.47
   EFFECTIVE AREA(ACRES) =   14.35     AREA-AVERAGED Fm(INCH/HR) =   0.10
   AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.50
   TOTAL AREA(ACRES) =   14.35         PEAK FLOW RATE(CFS) =      30.00

   END OF SUBAREA "V" GUTTER HYDRAULICS:
   DEPTH(FEET) =  0.50   FLOOD WIDTH(FEET) =   69.03
   FLOW VELOCITY(FEET/SEC.) =   2.48   DEPTH*VELOCITY(FT*FT/SEC) =   1.24
   LONGEST FLOWPATH FROM NODE    100.00 TO NODE    130.00 =  1040.00 FEET.

****************************************************************************
   FLOW PROCESS FROM NODE    130.00 TO NODE    140.00 IS CODE =  31
----------------------------------------------------------------------------
   >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
   >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
 ELEVATION DATA: UPSTREAM(FEET) =     60.00  DOWNSTREAM(FEET) =     58.00
 FLOW LENGTH(FEET) =    480.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  33.0 INCH PIPE IS  25.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.19
 ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     30.00
 PIPE TRAVEL TIME(MIN.) =   1.29    Tc(MIN.) =  13.63
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    140.00 =  1520.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    150.00 TO NODE    160.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     75.90  DOWNSTREAM(FEET) =     73.80

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.502
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.024
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 D        0.60      0.20       0.10     75    8.50
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      1.62
 TOTAL AREA(ACRES) =      0.60   PEAK FLOW RATE(CFS) =      1.62

****************************************************************************
 FLOW PROCESS FROM NODE    160.00 TO NODE    170.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     73.80
 DOWNSTREAM NODE ELEVATION(FEET) =     71.20
 CHANNEL LENGTH THRU SUBAREA(FEET) =   420.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.394
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        3.30      0.20       0.10     75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      5.07
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.72
 AVERAGE FLOW DEPTH(FEET) =   0.32   FLOOD WIDTH(FEET) =   33.15
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   4.06   Tc(MIN.) =  12.56
 SUBAREA AREA(ACRES) =    3.30       SUBAREA RUNOFF(CFS) =    7.05
 EFFECTIVE AREA(ACRES) =    3.90     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    3.90        PEAK FLOW RATE(CFS) =       8.33
```

```
  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.36   FLOOD WIDTH(FEET) =   40.98
  FLOW VELOCITY(FEET/SEC.) =   1.90   DEPTH*VELOCITY(FT*FT/SEC) =   0.68
  LONGEST FLOWPATH FROM NODE    150.00 TO NODE    170.00 =   750.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    170.00 TO NODE    180.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    65.60  DOWNSTREAM(FEET) =    64.00
  FLOW LENGTH(FEET) =   230.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.58
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      8.33
  PIPE TRAVEL TIME(MIN.) =   0.69    Tc(MIN.) =  13.25
  LONGEST FLOWPATH FROM NODE    150.00 TO NODE    180.00 =   980.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    180.00 TO NODE    180.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  13.25
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.328
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 D       3.35      0.20        0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    3.35      SUBAREA RUNOFF(CFS) =    6.96
  EFFECTIVE AREA(ACRES) =     7.25   AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     7.25       PEAK FLOW RATE(CFS) =      15.06

****************************************************************************
  FLOW PROCESS FROM NODE    180.00 TO NODE    190.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    64.00  DOWNSTREAM(FEET) =    59.20
  FLOW LENGTH(FEET) =   690.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.39
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     15.06
  PIPE TRAVEL TIME(MIN.) =   1.80    Tc(MIN.) =  15.05
  LONGEST FLOWPATH FROM NODE    150.00 TO NODE    190.00 =  1670.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    190.00 TO NODE    190.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
MAINLINE Tc(MIN) =  15.05
*  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.156
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  D       11.54      0.20       0.10     75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =   11.54      SUBAREA RUNOFF(CFS) =   22.19
EFFECTIVE AREA(ACRES) =    18.79   AREA-AVERAGED Fm(INCH/HR) =  0.02
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =    18.79       PEAK FLOW RATE(CFS) =      36.13

********************************************************************************
FLOW PROCESS FROM NODE    190.00 TO NODE    200.00 IS CODE =  31
--------------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
ELEVATION DATA: UPSTREAM(FEET) =    59.20  DOWNSTREAM(FEET) =    56.83
FLOW LENGTH(FEET) =   590.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  36.0 INCH PIPE IS  26.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.42
ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     36.13
PIPE TRAVEL TIME(MIN.) =   1.53    Tc(MIN.) =  16.58
LONGEST FLOWPATH FROM NODE    150.00 TO NODE    200.00 =  2260.00 FEET.

********************************************************************************
FLOW PROCESS FROM NODE    200.00 TO NODE    200.00 IS CODE =  81
--------------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
MAINLINE Tc(MIN) =  16.58
*  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.046
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  D        6.51      0.20       0.10     75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =    6.51      SUBAREA RUNOFF(CFS) =   11.87
EFFECTIVE AREA(ACRES) =    25.30   AREA-AVERAGED Fm(INCH/HR) =  0.02
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =    25.30       PEAK FLOW RATE(CFS) =      46.13

********************************************************************************
FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  31
--------------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
ELEVATION DATA: UPSTREAM(FEET) =    56.83  DOWNSTREAM(FEET) =    54.79
FLOW LENGTH(FEET) =   340.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.8 INCHES
```

```
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.89
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     46.13
 PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =  17.30
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    210.00 =  2600.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.30
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.994
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        5.30      0.20       0.10     75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    5.30      SUBAREA RUNOFF(CFS) =    9.42
 EFFECTIVE AREA(ACRES) =    30.60   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    30.60       PEAK FLOW RATE(CFS) =      54.37

****************************************************************************
 FLOW PROCESS FROM NODE    210.00 TO NODE    220.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    54.79  DOWNSTREAM(FEET) =    52.72
 FLOW LENGTH(FEET) =   345.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  28.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.27
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     54.37
 PIPE TRAVEL TIME(MIN.) =   0.70    Tc(MIN.) =  18.00
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    220.00 =  2945.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    220.00 TO NODE    220.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  18.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.950
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        9.35      0.20       0.10     75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    9.35      SUBAREA RUNOFF(CFS) =   16.24
 EFFECTIVE AREA(ACRES) =    39.95   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    39.95       PEAK FLOW RATE(CFS) =      69.40
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    220.00 TO NODE    230.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    52.72  DOWNSTREAM(FEET) =    52.00
 FLOW LENGTH(FEET) =   120.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  32.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.74
 ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     69.40
 PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =  18.23
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    230.00 =  3065.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    250.00 TO NODE    260.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     61.00  DOWNSTREAM(FEET) =     58.10

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.971
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.128
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.85      0.20       0.10    75    7.97
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      2.38
 TOTAL AREA(ACRES) =      0.85   PEAK FLOW RATE(CFS) =      2.38

****************************************************************************
 FLOW PROCESS FROM NODE    260.00 TO NODE    270.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     58.10
 DOWNSTREAM NODE ELEVATION(FEET) =     57.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   340.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.429
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.62      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      5.18
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.31
```

```
 AVERAGE FLOW DEPTH(FEET) =  0.35  FLOOD WIDTH(FEET) =  38.69
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =  4.31  Tc(MIN.) =  12.28
 SUBAREA AREA(ACRES) =  2.62  SUBAREA RUNOFF(CFS) =  5.68
 EFFECTIVE AREA(ACRES) =  3.47  AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =  3.47  PEAK FLOW RATE(CFS) =  7.52

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.38  FLOOD WIDTH(FEET) =  44.89
 FLOW VELOCITY(FEET/SEC.) =  1.44  DEPTH*VELOCITY(FT*FT/SEC) =  0.55
 LONGEST FLOWPATH FROM NODE  250.00 TO NODE  270.00 =  670.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE  270.00 TO NODE  280.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  51.00  DOWNSTREAM(FEET) =  44.60
 FLOW LENGTH(FEET) =  85.00  MANNING'S N =  0.013
 DEPTH OF FLOW IN  12.0 INCH PIPE IS  8.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  13.16
 ESTIMATED PIPE DIAMETER(INCH) =  12.00  NUMBER OF PIPES =  1
 PIPE-FLOW(CFS) =  7.52
 PIPE TRAVEL TIME(MIN.) =  0.11  Tc(MIN.) =  12.39
 LONGEST FLOWPATH FROM NODE  250.00 TO NODE  280.00 =  755.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE  300.00 TO NODE  310.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =  330.00
 ELEVATION DATA: UPSTREAM(FEET) =  57.60  DOWNSTREAM(FEET) =  56.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =  27.612
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.526
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/  SCS SOIL  AREA  Fp  Ap  SCS  Tc
      LAND USE  GROUP  (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 AGRICULTURAL GOOD COVER
 "PASTURE,DRYLAND"  D  0.78  0.20  1.00  80  27.61
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA RUNOFF(CFS) =  0.93
 TOTAL AREA(ACRES) =  0.78  PEAK FLOW RATE(CFS) =  0.93

****************************************************************************
 FLOW PROCESS FROM NODE  310.00 TO NODE  320.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =  56.00
 DOWNSTREAM NODE ELEVATION(FEET) =  52.90
 CHANNEL LENGTH THRU SUBAREA(FEET) =  400.00
```

```
"V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
MAXIMUM DEPTH(FEET) =   1.00
*  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.418
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
AGRICULTURAL GOOD COVER
"PASTURE,DRYLAND"            D        4.73      0.20       1.00    80
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.51
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.78
AVERAGE FLOW DEPTH(FEET) =   0.29   FLOOD WIDTH(FEET) =   26.63
"V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.74   Tc(MIN.) =  31.35
SUBAREA AREA(ACRES) =    4.73        SUBAREA RUNOFF(CFS) =    5.18
EFFECTIVE AREA(ACRES) =    5.51      AREA-AVERAGED Fm(INCH/HR) =   0.20
AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =   1.00
TOTAL AREA(ACRES) =    5.51         PEAK FLOW RATE(CFS) =       6.04

END OF SUBAREA "V" GUTTER HYDRAULICS:
DEPTH(FEET) =  0.33   FLOOD WIDTH(FEET) =   34.13
FLOW VELOCITY(FEET/SEC.) =   1.94   DEPTH*VELOCITY(FT*FT/SEC) =   0.63
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    320.00 =   730.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    320.00 TO NODE    330.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    50.00  DOWNSTREAM(FEET) =    48.00
FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  15.0 INCH PIPE IS  10.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.67
ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      6.04
PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =  31.70
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    330.00 =   870.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    330.00 TO NODE    330.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  31.70
*  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.409
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
AGRICULTURAL GOOD COVER
"PASTURE,DRYLAND"            D        2.88      0.20       1.00    80
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
SUBAREA AREA(ACRES) =    2.88        SUBAREA RUNOFF(CFS) =    3.13
EFFECTIVE AREA(ACRES) =    8.39      AREA-AVERAGED Fm(INCH/HR) =  0.20
```

```
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  1.00
 TOTAL AREA(ACRES) =     8.39       PEAK FLOW RATE(CFS) =       9.13

****************************************************************************
 FLOW PROCESS FROM NODE    350.00 TO NODE    360.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     67.00  DOWNSTREAM(FEET) =     63.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.474
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.229
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.92      0.20       0.10     75    7.47
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      2.66
 TOTAL AREA(ACRES) =      0.92   PEAK FLOW RATE(CFS) =      2.66

****************************************************************************
 FLOW PROCESS FROM NODE    360.00 TO NODE    370.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     63.00
 DOWNSTREAM NODE ELEVATION(FEET) =     62.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   100.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.057
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.44      0.20       0.10     75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.26
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.94
 AVERAGE FLOW DEPTH(FEET) =   0.28   FLOOD WIDTH(FEET) =   24.34
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   0.86   Tc(MIN.) =   8.33
 SUBAREA AREA(ACRES) =    0.44       SUBAREA RUNOFF(CFS) =    1.20
 EFFECTIVE AREA(ACRES) =    1.36     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    1.36         PEAK FLOW RATE(CFS) =       3.72

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.28   FLOOD WIDTH(FEET) =   25.97
 FLOW VELOCITY(FEET/SEC.) =   1.98   DEPTH*VELOCITY(FT*FT/SEC) =   0.56
 LONGEST FLOWPATH FROM NODE    350.00 TO NODE    370.00 =   430.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    370.00 TO NODE    370.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =   8.33
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.057
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.00      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     1.00      SUBAREA RUNOFF(CFS) =     2.73
 EFFECTIVE AREA(ACRES) =     2.36    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     2.36        PEAK FLOW RATE(CFS) =        6.45

****************************************************************************
 FLOW PROCESS FROM NODE    370.00 TO NODE    380.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     62.00  DOWNSTREAM(FEET) =     59.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   790.00   CHANNEL SLOPE =  0.0038
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
 CHANNEL FLOW THRU SUBAREA(CFS) =      6.45
 FLOW VELOCITY(FEET/SEC) =   1.98   FLOW DEPTH(FEET) =   0.73
 TRAVEL TIME(MIN.) =   6.64   Tc(MIN.) =  14.97
 LONGEST FLOWPATH FROM NODE    350.00 TO NODE    380.00 =  1220.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    380.00 TO NODE    380.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  14.97
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.163
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.69      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     0.69      SUBAREA RUNOFF(CFS) =     1.33
 EFFECTIVE AREA(ACRES) =     3.05    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     3.05        PEAK FLOW RATE(CFS) =        6.45
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    380.00 TO NODE    380.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================
```

```
****************************************************************************
 FLOW PROCESS FROM NODE     400.00 TO NODE     410.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     73.00  DOWNSTREAM(FEET) =     70.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   13.672
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.287
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 AGRICULTURAL POOR COVER
 "ROW CROPS,STRAIGHT ROW"    D        1.10      0.20        1.00    91   13.67
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA RUNOFF(CFS) =      2.07
 TOTAL AREA(ACRES) =      1.10   PEAK FLOW RATE(CFS) =      2.07

****************************************************************************
 FLOW PROCESS FROM NODE     410.00 TO NODE     420.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     70.00
 DOWNSTREAM NODE ELEVATION(FEET) =     67.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   400.00
 "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.500
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0350
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.866
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 AGRICULTURAL POOR COVER
 "ROW CROPS,STRAIGHT ROW"    D        4.70      0.20        1.00    91
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      5.61
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.16
 AVERAGE FLOW DEPTH(FEET) =   0.72   FLOOD WIDTH(FEET) =   39.84
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   5.73   Tc(MIN.) =  19.40
 SUBAREA AREA(ACRES) =    4.70      SUBAREA RUNOFF(CFS) =    7.05
 EFFECTIVE AREA(ACRES) =    5.80    AREA-AVERAGED Fm(INCH/HR) =   0.20
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   1.00
 TOTAL AREA(ACRES) =    5.80        PEAK FLOW RATE(CFS) =       8.70

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.78   FLOOD WIDTH(FEET) =   50.62
 FLOW VELOCITY(FEET/SEC.) =   1.20   DEPTH*VELOCITY(FT*FT/SEC) =   0.93
 LONGEST FLOWPATH FROM NODE     400.00 TO NODE     420.00 =   730.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    420.00 TO NODE    430.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    59.61  DOWNSTREAM(FEET) =    58.41
 FLOW LENGTH(FEET) =   250.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.85
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      8.70
 PIPE TRAVEL TIME(MIN.) =   0.86    Tc(MIN.) =  20.26
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    430.00 =   980.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  20.26
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.818
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 PUBLIC PARK                 D        2.40      0.20        0.85    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
 SUBAREA AREA(ACRES) =    2.40      SUBAREA RUNOFF(CFS) =    3.56
 EFFECTIVE AREA(ACRES) =    8.20    AREA-AVERAGED Fm(INCH/HR) =  0.19
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.96
 TOTAL AREA(ACRES) =     8.20       PEAK FLOW RATE(CFS) =      12.00

****************************************************************************
 FLOW PROCESS FROM NODE    430.00 TO NODE    440.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    58.41  DOWNSTREAM(FEET) =    57.98
 FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.26
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     12.00
 PIPE TRAVEL TIME(MIN.) =   0.29    Tc(MIN.) =  20.54
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    440.00 =  1070.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    440.00 TO NODE    440.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  20.54
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.804
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
```

```
      LAND USE                GROUP   (ACRES)   (INCH/HR)   (DECIMAL)   CN
   PUBLIC PARK                  D        3.39       0.20        0.85     75
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
   SUBAREA AREA(ACRES) =     3.39      SUBAREA RUNOFF(CFS) =     4.99
   EFFECTIVE AREA(ACRES) =    11.59    AREA-AVERAGED Fm(INCH/HR) =  0.19
   AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.93
   TOTAL AREA(ACRES) =     11.59       PEAK FLOW RATE(CFS) =       16.89

****************************************************************************
  FLOW PROCESS FROM NODE     440.00 TO NODE     450.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     57.98  DOWNSTREAM(FEET) =     55.77
  FLOW LENGTH(FEET) =    460.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    5.73
  ESTIMATED PIPE DIAMETER(INCH) =  27.00     NUMBER OF PIPES =    1
  PIPE-FLOW(CFS) =     16.89
  PIPE TRAVEL TIME(MIN.) =    1.34     Tc(MIN.) =  21.88
  LONGEST FLOWPATH FROM NODE     400.00 TO NODE     450.00 =  1530.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     450.00 TO NODE     450.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     460.00 TO NODE     470.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =     67.50  DOWNSTREAM(FEET) =     65.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   13.046
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.348
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 D        0.78      0.20        0.85    75   13.05
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
  SUBAREA RUNOFF(CFS) =      1.53
  TOTAL AREA(ACRES) =      0.78   PEAK FLOW RATE(CFS) =      1.53

****************************************************************************
  FLOW PROCESS FROM NODE     470.00 TO NODE     450.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =     65.00
```

```
 DOWNSTREAM NODE ELEVATION(FEET) =      61.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   720.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.500
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0300
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.647
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 PUBLIC PARK                 D        8.53      0.20       0.85    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      7.12
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.09
 AVERAGE FLOW DEPTH(FEET) =   0.77   FLOOD WIDTH(FEET) =   48.90
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =  11.03   Tc(MIN.) =  24.08
 SUBAREA AREA(ACRES) =    8.53       SUBAREA RUNOFF(CFS) =   11.34
 EFFECTIVE AREA(ACRES) =    9.31     AREA-AVERAGED Fm(INCH/HR) =   0.17
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.85
 TOTAL AREA(ACRES) =    9.31         PEAK FLOW RATE(CFS) =      12.38

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.84   FLOOD WIDTH(FEET) =   62.55
 FLOW VELOCITY(FEET/SEC.) =   1.20   DEPTH*VELOCITY(FT*FT/SEC) =   1.01
 LONGEST FLOWPATH FROM NODE    460.00 TO NODE    450.00 =  1050.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    450.00 TO NODE    450.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)         (ACRES)     NODE
     1      12.38  24.08     1.647   0.20( 0.17) 0.85      9.3      460.00
 LONGEST FLOWPATH FROM NODE    460.00 TO NODE    450.00 =  1050.00 FEET.

 ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)         (ACRES)     NODE
     1      16.89  21.88     1.740   0.20( 0.19) 0.93     11.6      400.00
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    450.00 =  1530.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)         (ACRES)     NODE
     1      28.84  21.88     1.740   0.20( 0.18) 0.89     20.1      400.00
     2      28.26  24.08     1.647   0.20( 0.18) 0.89     20.9      460.00
   TOTAL AREA(ACRES) =      20.90

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       28.84  Tc(MIN.) =   21.883
 EFFECTIVE AREA(ACRES) =     20.05  AREA-AVERAGED Fm(INCH/HR) =  0.18
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.89
 TOTAL AREA(ACRES) =     20.90
```

```
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    450.00 =  1530.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    450.00 TO NODE    380.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    55.77  DOWNSTREAM(FEET) =    55.55
 FLOW LENGTH(FEET) =    45.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.59
 ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     28.84
 PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =  22.00
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    380.00 =  1575.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    380.00 TO NODE    380.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1      28.84  22.00     1.734   0.20( 0.18) 0.89     20.1      400.00
     2      28.26  24.19     1.642   0.20( 0.18) 0.89     20.9      460.00
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    380.00 =  1575.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1       6.45  14.97     2.163   0.20( 0.02) 0.10      3.1      350.00
 LONGEST FLOWPATH FROM NODE    350.00 TO NODE    380.00 =  1220.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1      31.49  14.97     2.163   0.20( 0.15) 0.75     16.7      350.00
     2      34.00  22.00     1.734   0.20( 0.16) 0.79     23.1      400.00
     3      33.14  24.19     1.642   0.20( 0.16) 0.79     24.0      460.00
   TOTAL AREA(ACRES) =     23.95

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       34.00  Tc(MIN.) =   21.997
 EFFECTIVE AREA(ACRES) =     23.10  AREA-AVERAGED Fm(INCH/HR) =  0.16
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.75
 TOTAL AREA(ACRES) =     23.95
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    380.00 =  1575.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    380.00 TO NODE    480.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
 ELEVATION DATA: UPSTREAM(FEET) =    55.55  DOWNSTREAM(FEET) =    54.16
 FLOW LENGTH(FEET) =   290.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  33.0 INCH PIPE IS  26.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.67
 ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     34.00
 PIPE TRAVEL TIME(MIN.) =   0.73    Tc(MIN.) =  22.72
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    480.00 =  1865.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    480.00 TO NODE    480.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  22.72
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.701
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.29      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.29      SUBAREA RUNOFF(CFS) =    0.44
 EFFECTIVE AREA(ACRES) =    23.39   AREA-AVERAGED Fm(INCH/HR) =  0.16
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.78
 TOTAL AREA(ACRES) =    24.24       PEAK FLOW RATE(CFS) =      34.00
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    480.00 TO NODE    480.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  22.72
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.701
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.15      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    1.15      SUBAREA RUNOFF(CFS) =    1.74
 EFFECTIVE AREA(ACRES) =    24.54   AREA-AVERAGED Fm(INCH/HR) =  0.15
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.75
 TOTAL AREA(ACRES) =    25.39       PEAK FLOW RATE(CFS) =      34.27

****************************************************************************
 FLOW PROCESS FROM NODE    480.00 TO NODE    490.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    54.16  DOWNSTREAM(FEET) =    52.92
 FLOW LENGTH(FEET) =   260.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  33.0 INCH PIPE IS  26.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.65
 ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
```

```
 PIPE-FLOW(CFS) =     34.27
 PIPE TRAVEL TIME(MIN.) =   0.65    Tc(MIN.) =  23.37
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    490.00 =  2125.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    490.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  23.37
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.675
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.25      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.25      SUBAREA RUNOFF(CFS) =    0.37
 EFFECTIVE AREA(ACRES) =    24.79   AREA-AVERAGED Fm(INCH/HR) =  0.15
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.74
 TOTAL AREA(ACRES) =    25.64       PEAK FLOW RATE(CFS) =      34.27
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    490.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  23.37
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.675
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.75      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    1.75      SUBAREA RUNOFF(CFS) =    2.61
 EFFECTIVE AREA(ACRES) =    26.54   AREA-AVERAGED Fm(INCH/HR) =  0.14
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.70
 TOTAL AREA(ACRES) =    27.39       PEAK FLOW RATE(CFS) =      36.67

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    500.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    52.92  DOWNSTREAM(FEET) =    49.80
 FLOW LENGTH(FEET) =   650.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.94
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     36.67
 PIPE TRAVEL TIME(MIN.) =   1.56    Tc(MIN.) =  24.93
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    500.00 =  2775.00 FEET.

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

```
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  24.93
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.613
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.32      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.32      SUBAREA RUNOFF(CFS) =    0.46
 EFFECTIVE AREA(ACRES) =    26.86   AREA-AVERAGED Fm(INCH/HR) =  0.14
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.69
 TOTAL AREA(ACRES) =    27.71       PEAK FLOW RATE(CFS) =      36.67
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    510.00 TO NODE    520.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     68.00  DOWNSTREAM(FEET) =     65.70

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   13.265
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.327
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 PUBLIC PARK                 D        1.00      0.20       0.85    75   13.27
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
 SUBAREA RUNOFF(CFS) =      1.94
 TOTAL AREA(ACRES) =      1.00   PEAK FLOW RATE(CFS) =      1.94

****************************************************************************
 FLOW PROCESS FROM NODE    520.00 TO NODE    530.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    60.00  DOWNSTREAM(FEET) =    58.68
 FLOW LENGTH(FEET) =   220.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.65
 ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      1.94
```

```
 PIPE TRAVEL TIME(MIN.) =   1.01    Tc(MIN.) =  14.27
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    530.00 =   550.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    530.00 TO NODE    530.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  14.27
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.230
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.16      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     2.16     SUBAREA RUNOFF(CFS) =     4.30
 EFFECTIVE AREA(ACRES) =     3.16   AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.34
 TOTAL AREA(ACRES) =     3.16       PEAK FLOW RATE(CFS) =       6.15

****************************************************************************
 FLOW PROCESS FROM NODE    530.00 TO NODE    540.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    58.68  DOWNSTREAM(FEET) =    56.10
 FLOW LENGTH(FEET) =   430.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.85
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      6.15
 PIPE TRAVEL TIME(MIN.) =   1.48    Tc(MIN.) =  15.75
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    540.00 =   980.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    540.00 TO NODE    540.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  15.75
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.106
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        5.60      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     5.60     SUBAREA RUNOFF(CFS) =    10.51
 EFFECTIVE AREA(ACRES) =     8.76   AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.19
 TOTAL AREA(ACRES) =     8.76       PEAK FLOW RATE(CFS) =       16.31

****************************************************************************
 FLOW PROCESS FROM NODE    540.00 TO NODE    550.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
ELEVATION DATA: UPSTREAM(FEET) =    56.10  DOWNSTREAM(FEET) =    54.78
FLOW LENGTH(FEET) =   220.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  24.0 INCH PIPE IS  19.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.03
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     16.31
PIPE TRAVEL TIME(MIN.) =   0.61    Tc(MIN.) =  16.36
LONGEST FLOWPATH FROM NODE    510.00 TO NODE    550.00 =  1200.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    550.00 TO NODE    550.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  16.36
*  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.062
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)   (DECIMAL)  CN
COMMERCIAL                 D        2.46      0.20        0.10     75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =    2.46      SUBAREA RUNOFF(CFS) =     4.52
EFFECTIVE AREA(ACRES) =    11.22   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.17
TOTAL AREA(ACRES) =    11.22       PEAK FLOW RATE(CFS) =       20.49

****************************************************************************
FLOW PROCESS FROM NODE    550.00 TO NODE    550.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  16.36
*  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.062
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)   (DECIMAL)  CN
COMMERCIAL                 D        2.05      0.20        0.10     75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =    2.05      SUBAREA RUNOFF(CFS) =     3.77
EFFECTIVE AREA(ACRES) =    13.27   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.16
TOTAL AREA(ACRES) =    13.27       PEAK FLOW RATE(CFS) =       24.26

****************************************************************************
FLOW PROCESS FROM NODE    550.00 TO NODE    560.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    54.78  DOWNSTREAM(FEET) =    52.08
FLOW LENGTH(FEET) =   450.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.4 INCHES
```

```
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.83
 ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     24.26
 PIPE TRAVEL TIME(MIN.) =   1.10    Tc(MIN.) =  17.46
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    560.00 =  1650.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    560.00 TO NODE    560.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.46
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.983
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 AGRICULTURAL GOOD COVER
 "PASTURE,IRRIGATED"         D        3.05      0.20       1.00    79
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA AREA(ACRES) =     3.05      SUBAREA RUNOFF(CFS) =     4.89
 EFFECTIVE AREA(ACRES) =    16.32    AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.31
 TOTAL AREA(ACRES) =    16.32        PEAK FLOW RATE(CFS) =       28.21

****************************************************************************
 FLOW PROCESS FROM NODE    560.00 TO NODE    560.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.46
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.983
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.62      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     1.62      SUBAREA RUNOFF(CFS) =     2.86
 EFFECTIVE AREA(ACRES) =    17.94    AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.29
 TOTAL AREA(ACRES) =    17.94        PEAK FLOW RATE(CFS) =       31.07

****************************************************************************
 FLOW PROCESS FROM NODE    560.00 TO NODE    570.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    52.08  DOWNSTREAM(FEET) =    50.04
 FLOW LENGTH(FEET) =   340.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.27
 ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     31.07
 PIPE TRAVEL TIME(MIN.) =   0.78    Tc(MIN.) =  18.24
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    570.00 =  1990.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    570.00 TO NODE    570.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  18.24
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.936
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        4.95      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    4.95      SUBAREA RUNOFF(CFS) =    8.54
 EFFECTIVE AREA(ACRES) =    22.89   AREA-AVERAGED Fm(INCH/HR) =  0.05
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.25
 TOTAL AREA(ACRES) =    22.89       PEAK FLOW RATE(CFS) =      38.84

****************************************************************************
 FLOW PROCESS FROM NODE    570.00 TO NODE    500.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    50.04  DOWNSTREAM(FEET) =    49.80
 FLOW LENGTH(FEET) =    40.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  33.0 INCH PIPE IS  27.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.46
 ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     38.84
 PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =  18.32
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2030.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
     1      38.84  18.32     1.931  0.20( 0.05) 0.25    22.9      510.00
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2030.00 FEET.

 ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
     1      35.07  17.93     1.954  0.20( 0.13) 0.63    20.5      350.00
     2      36.67  24.93     1.613  0.20( 0.14) 0.69    26.9      400.00
     3      35.77  27.14     1.542  0.20( 0.14) 0.70    27.7      460.00
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    500.00 =  2775.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
```

```
    1     73.55  17.93    1.954  0.20( 0.09) 0.43     42.9      350.00
    2     74.00  18.32    1.931  0.20( 0.09) 0.43     43.7      510.00
    3     68.95  24.93    1.613  0.20( 0.10) 0.49     49.8      400.00
    4     66.58  27.14    1.542  0.20( 0.10) 0.50     50.6      460.00
  TOTAL AREA(ACRES) =     50.60

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       74.00  Tc(MIN.) =   18.325
 EFFECTIVE AREA(ACRES) =     43.71  AREA-AVERAGED Fm(INCH/HR) =  0.09
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.43
 TOTAL AREA(ACRES) =     50.60
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    500.00 =  2775.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    580.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    49.80  DOWNSTREAM(FEET) =    48.02
 FLOW LENGTH(FEET) =   370.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  45.0 INCH PIPE IS  34.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.18
 ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     74.00
 PIPE TRAVEL TIME(MIN.) =   0.75    Tc(MIN.) =  19.08
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    580.00 =  3145.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    580.00 TO NODE    580.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  19.08
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.885
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.26      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     0.26      SUBAREA RUNOFF(CFS) =     0.44
 EFFECTIVE AREA(ACRES) =    43.97   AREA-AVERAGED Fm(INCH/HR) =  0.09
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.43
 TOTAL AREA(ACRES) =    50.86       PEAK FLOW RATE(CFS) =       74.00
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    580.00 TO NODE    580.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  19.08
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.885
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
```

```
  COMMERCIAL                   D         5.90       0.20       0.10     75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     5.90      SUBAREA RUNOFF(CFS) =     9.90
  EFFECTIVE AREA(ACRES) =    49.87    AREA-AVERAGED Fm(INCH/HR) =  0.08
  AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.39
  TOTAL AREA(ACRES) =     56.76       PEAK FLOW RATE(CFS) =       81.10

****************************************************************************
  FLOW PROCESS FROM NODE    580.00 TO NODE    590.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    48.02  DOWNSTREAM(FEET) =    46.24
  FLOW LENGTH(FEET) =   370.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  34.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.45
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     81.10
  PIPE TRAVEL TIME(MIN.) =   0.73    Tc(MIN.) =  19.81
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    590.00 =  3515.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    590.00 TO NODE    590.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  19.81
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.842
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                   D        0.30      0.20       0.10     75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     0.30      SUBAREA RUNOFF(CFS) =     0.49
  EFFECTIVE AREA(ACRES) =    50.17    AREA-AVERAGED Fm(INCH/HR) =  0.08
  AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.39
  TOTAL AREA(ACRES) =     57.06       PEAK FLOW RATE(CFS) =       81.10
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    590.00 TO NODE    590.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    590.00 TO NODE    590.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    610.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
================================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =     64.50  DOWNSTREAM(FEET) =     63.10

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.221
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.883
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  D        0.81      0.20       0.10     75    9.22
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      2.09
  TOTAL AREA(ACRES) =      0.81   PEAK FLOW RATE(CFS) =      2.09

********************************************************************************
  FLOW PROCESS FROM NODE    610.00 TO NODE    620.00 IS CODE =  61
--------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
================================================================================
  UPSTREAM ELEVATION(FEET) =   63.10  DOWNSTREAM ELEVATION(FEET) =   59.50
  STREET LENGTH(FEET) =   660.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.017
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.017

  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 =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.64
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.38
    HALFSTREET FLOOD WIDTH(FEET) =   14.65
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.87
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.71
  STREET FLOW TRAVEL TIME(MIN.) =   5.87   Tc(MIN.) =  15.09
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.153
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        1.61      0.20       0.10     75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.61      SUBAREA RUNOFF(CFS) =    3.09
  EFFECTIVE AREA(ACRES) =    2.42    AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    2.42        PEAK FLOW RATE(CFS) =       4.65

  END OF SUBAREA STREET FLOW HYDRAULICS:
```

```
 DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  16.13
 FLOW VELOCITY(FEET/SEC.) =  1.99   DEPTH*VELOCITY(FT*FT/SEC.) =   0.81
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    620.00 =   990.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    620.00 TO NODE    630.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    53.00  DOWNSTREAM(FEET) =    49.89
 FLOW LENGTH(FEET) =   400.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  15.0 INCH PIPE IS  10.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.95
 ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      4.65
 PIPE TRAVEL TIME(MIN.) =   1.35    Tc(MIN.) =  16.44
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    630.00 =  1390.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    630.00 TO NODE    630.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  16.44
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.056
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.20      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    2.20      SUBAREA RUNOFF(CFS) =    4.03
 EFFECTIVE AREA(ACRES) =     4.62   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     4.62       PEAK FLOW RATE(CFS) =       8.47

****************************************************************************
 FLOW PROCESS FROM NODE    630.00 TO NODE    630.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  16.44
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.056
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        4.22      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    4.22      SUBAREA RUNOFF(CFS) =    7.73
 EFFECTIVE AREA(ACRES) =     8.84   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     8.84       PEAK FLOW RATE(CFS) =      16.20

****************************************************************************
 FLOW PROCESS FROM NODE    630.00 TO NODE    640.00 IS CODE =  31
```

```
------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    49.89  DOWNSTREAM(FEET) =    46.48
  FLOW LENGTH(FEET) =   560.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  19.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.07
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     16.20
  PIPE TRAVEL TIME(MIN.) =   1.54    Tc(MIN.) =  17.97
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    640.00 =  1950.00 FEET.

************************************************************************
  FLOW PROCESS FROM NODE    640.00 TO NODE    640.00 IS CODE =  81
------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
========================================================================
  MAINLINE Tc(MIN) =  17.97
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.952
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        2.30      0.20       0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.30      SUBAREA RUNOFF(CFS) =    4.00
  EFFECTIVE AREA(ACRES) =    11.14   AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    11.14       PEAK FLOW RATE(CFS) =      19.37

************************************************************************
  FLOW PROCESS FROM NODE    640.00 TO NODE    590.00 IS CODE =  31
------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    46.48  DOWNSTREAM(FEET) =    46.24
  FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  21.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.83
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     19.37
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =  18.12
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    590.00 =  2000.00 FEET.

************************************************************************
  FLOW PROCESS FROM NODE    590.00 TO NODE    590.00 IS CODE =  11
------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
========================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM     Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
   NUMBER   (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
     1     19.37   18.12     1.943   0.20( 0.02) 0.10     11.1      600.00
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    590.00 =  2000.00 FEET.
```

```
** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1      80.77  19.41     1.865   0.20( 0.08) 0.39     49.3      350.00
    2      81.10  19.81     1.842   0.20( 0.08) 0.39     50.2      510.00
    3      75.40  26.45     1.564   0.20( 0.09) 0.45     56.2      400.00
    4      72.88  28.65     1.493   0.20( 0.09) 0.45     57.1      460.00
LONGEST FLOWPATH FROM NODE    400.00 TO NODE    590.00 =  3515.00 FEET.

** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1      98.02  18.12     1.943   0.20( 0.07) 0.33     57.2      600.00
    2      99.35  19.41     1.865   0.20( 0.07) 0.34     60.5      350.00
    3      99.44  19.81     1.842   0.20( 0.07) 0.34     61.3      510.00
    4      90.95  26.45     1.564   0.20( 0.08) 0.39     67.4      400.00
    5      87.71  28.65     1.493   0.20( 0.08) 0.39     68.2      460.00
  TOTAL AREA(ACRES) =     68.20

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       99.44  Tc(MIN.) =   19.807
EFFECTIVE AREA(ACRES) =     61.31  AREA-AVERAGED Fm(INCH/HR) =  0.07
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.34
TOTAL AREA(ACRES) =     68.20
LONGEST FLOWPATH FROM NODE    400.00 TO NODE    590.00 =  3515.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    590.00 TO NODE    650.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    46.24  DOWNSTREAM(FEET) =    45.86
FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  51.0 INCH PIPE IS  37.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   8.81
ESTIMATED PIPE DIAMETER(INCH) =  51.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     99.44
PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =  19.96
LONGEST FLOWPATH FROM NODE    400.00 TO NODE    650.00 =  3595.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    650.00 TO NODE    650.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  19.96
*  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.832
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 D        2.44      0.20        0.10    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =    2.44      SUBAREA RUNOFF(CFS) =    3.98
EFFECTIVE AREA(ACRES) =    63.75   AREA-AVERAGED Fm(INCH/HR) =  0.07
```

```
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.33
 TOTAL AREA(ACRES) =    70.64       PEAK FLOW RATE(CFS) =     101.37

****************************************************************************
 FLOW PROCESS FROM NODE    650.00 TO NODE    660.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    45.50  DOWNSTREAM(FEET) =    44.00
 FLOW LENGTH(FEET) =   840.50   MANNING'S N =  0.013
 DEPTH OF FLOW IN  60.0 INCH PIPE IS  47.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.06
 ESTIMATED PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    101.37
 PIPE TRAVEL TIME(MIN.) =   2.31    Tc(MIN.) =  22.27
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    660.00 =  4435.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    650.00 TO NODE    650.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  22.27
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.721
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.62      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    1.62      SUBAREA RUNOFF(CFS) =    2.48
 EFFECTIVE AREA(ACRES) =   65.37   AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.32
 TOTAL AREA(ACRES) =    72.26       PEAK FLOW RATE(CFS) =     101.37
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =     72.26  TC(MIN.) =     22.27
 EFFECTIVE AREA(ACRES) =     65.37  AREA-AVERAGED Fm(INCH/HR)=  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.32
 PEAK FLOW RATE(CFS)    =    101.37

 ** PEAK FLOW RATE TABLE **
  STREAM     Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER   (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1    100.27  20.58     1.802   0.20( 0.06) 0.32     61.2      600.00
     2    101.37  21.88     1.740   0.20( 0.06) 0.32     64.5      350.00
     3    101.37  22.27     1.721   0.20( 0.06) 0.32     65.4      510.00
     4     93.16  28.93     1.484   0.20( 0.07) 0.37     71.4      400.00
     5     89.72  31.20     1.421   0.20( 0.08) 0.38     72.3      460.00
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

Appendix E

Proposed 25-Year Hydrology Calculations

```
**************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 OCEMA HYDROLOGY CRITERION)
        (c) Copyright 1983-2001 Advanced Engineering Software (aes)
            Ver. 8.0  Release Date: 01/01/2001  License ID 1355

                          Analysis prepared by:

                          Fuscoe Engineering, Inc.
                        16795 Von Karman, Suite 100
                            Irvine, Calif.  92606
                      (949) 474 - 1960  Fax: (949) 474 - 5315

 ************************* DESCRIPTION OF STUDY *************************
* Orange County Fair Grounds                                            *
* Proposed 25 yr. Hydrology                                             *
* Area A thru H                                                         *
 ************************************************************************

  FILE NAME: 30902B.25
  TIME/DATE OF STUDY: 11:08 08/09/2002
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)     SIDE / SIDE/ WAY    (FT)    (FT)   (FT)  (FT)    (n)
===  =====  =========  ==================  ======  =====  ======  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00  0.0313  0.167  0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =     72.00  DOWNSTREAM(FEET) =     67.50
```

```
 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.300
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.894
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.48      0.20       0.10     75    7.30
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      1.67
 TOTAL AREA(ACRES) =      0.48   PEAK FLOW RATE(CFS) =      1.67

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   220.00
 ELEVATION DATA: UPSTREAM(FEET) =    102.50  DOWNSTREAM(FEET) =     67.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.859
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.480
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "1 DWELLING/ACRE"           D        3.99      0.20       0.80     75    5.86
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.80
 SUBAREA AREA(ACRES) =    3.99   INITIAL SUBAREA RUNOFF(CFS) =   15.51

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN) =   7.30
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.909
 SUBAREA AREA(ACRES) =    3.99      SUBAREA RUNOFF(CFS) =   13.46
 EFFECTIVE AREA(ACRES) =     4.47   AREA-AVERAGED Fm(INCH/HR) =  0.14
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.72
 TOTAL AREA(ACRES) =     4.47       PEAK FLOW RATE(CFS) =      15.14

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     67.50
 DOWNSTREAM NODE ELEVATION(FEET) =     65.30
 CHANNEL LENGTH THRU SUBAREA(FEET) =   330.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.347
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
```

```
  RESIDENTIAL
  "1 DWELLING/ACRE"          D        4.11      0.20      0.80     75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.80
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     21.04
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.37
  AVERAGE FLOW DEPTH(FEET) =   0.45   FLOOD WIDTH(FEET) =   58.92
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.32   Tc(MIN.) =   9.62
  SUBAREA AREA(ACRES) =    4.11       SUBAREA RUNOFF(CFS) =   11.79
  EFFECTIVE AREA(ACRES) =    8.58     AREA-AVERAGED Fm(INCH/HR) =   0.15
  AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.76
  TOTAL AREA(ACRES) =    8.58        PEAK FLOW RATE(CFS) =      24.67

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.47   FLOOD WIDTH(FEET) =   62.83
  FLOW VELOCITY(FEET/SEC.) =   2.45   DEPTH*VELOCITY(FT*FT/SEC) =   1.15
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    120.00 =   660.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =     65.30
  DOWNSTREAM NODE ELEVATION(FEET) =     63.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   380.00
  "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
  PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   1.00
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.927
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        5.77      0.20       0.10     75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     32.21
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.52
  AVERAGE FLOW DEPTH(FEET) =   0.51   FLOOD WIDTH(FEET) =   70.99
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.52   Tc(MIN.) =  12.13
  SUBAREA AREA(ACRES) =    5.77       SUBAREA RUNOFF(CFS) =   15.10
  EFFECTIVE AREA(ACRES) =   14.35     AREA-AVERAGED Fm(INCH/HR) =   0.10
  AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.50
  TOTAL AREA(ACRES) =   14.35         PEAK FLOW RATE(CFS) =      36.52

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.53   FLOOD WIDTH(FEET) =   74.57
  FLOW VELOCITY(FEET/SEC.) =   2.59   DEPTH*VELOCITY(FT*FT/SEC) =   1.37
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    130.00 =  1040.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    140.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
 ELEVATION DATA: UPSTREAM(FEET) =     60.00  DOWNSTREAM(FEET) =     58.00
 FLOW LENGTH(FEET) =   480.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  26.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.53
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     36.52
 PIPE TRAVEL TIME(MIN.) =   1.22    Tc(MIN.) =  13.36
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    140.00 =  1520.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    150.00 TO NODE    160.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     75.90  DOWNSTREAM(FEET) =     73.80

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.502
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.601
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.60      0.20        0.10    75    8.50
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      1.93
 TOTAL AREA(ACRES) =      0.60   PEAK FLOW RATE(CFS) =      1.93

****************************************************************************
 FLOW PROCESS FROM NODE    160.00 TO NODE    170.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     73.80
 DOWNSTREAM NODE ELEVATION(FEET) =     71.20
 CHANNEL LENGTH THRU SUBAREA(FEET) =   420.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.875
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        3.30      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      6.09
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.77
 AVERAGE FLOW DEPTH(FEET) =   0.34   FLOOD WIDTH(FEET) =   36.08
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.96   Tc(MIN.) =  12.47
 SUBAREA AREA(ACRES) =    3.30       SUBAREA RUNOFF(CFS) =    8.48
 EFFECTIVE AREA(ACRES) =    3.90     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    3.90        PEAK FLOW RATE(CFS) =      10.02
```

```
  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.38   FLOOD WIDTH(FEET) =   44.24
  FLOW VELOCITY(FEET/SEC.) =   1.97   DEPTH*VELOCITY(FT*FT/SEC) =   0.74
  LONGEST FLOWPATH FROM NODE    150.00 TO NODE    170.00 =   750.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    170.00 TO NODE    180.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    65.60  DOWNSTREAM(FEET) =    64.00
  FLOW LENGTH(FEET) =   230.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.79
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     10.02
  PIPE TRAVEL TIME(MIN.) =   0.66    Tc(MIN.) =  13.13
  LONGEST FLOWPATH FROM NODE    150.00 TO NODE    180.00 =   980.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    180.00 TO NODE    180.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  13.13
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.800
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        3.35      0.20        0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    3.35      SUBAREA RUNOFF(CFS) =    8.38
  EFFECTIVE AREA(ACRES) =     7.25   AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     7.25       PEAK FLOW RATE(CFS) =      18.14

****************************************************************************
  FLOW PROCESS FROM NODE    180.00 TO NODE    190.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    64.00  DOWNSTREAM(FEET) =    59.20
  FLOW LENGTH(FEET) =   690.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.74
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     18.14
  PIPE TRAVEL TIME(MIN.) =   1.70    Tc(MIN.) =  14.83
  LONGEST FLOWPATH FROM NODE    150.00 TO NODE    190.00 =  1670.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    190.00 TO NODE    190.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
 MAINLINE Tc(MIN) =  14.83
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.609
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D       11.54      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =   11.54      SUBAREA RUNOFF(CFS) =   26.89
 EFFECTIVE AREA(ACRES) =    18.79   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    18.79       PEAK FLOW RATE(CFS) =      43.78

********************************************************************************
 FLOW PROCESS FROM NODE    190.00 TO NODE    200.00 IS CODE =  31
--------------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    59.20  DOWNSTREAM(FEET) =    56.83
 FLOW LENGTH(FEET) =   590.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  28.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.75
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     43.78
 PIPE TRAVEL TIME(MIN.) =   1.46    Tc(MIN.) =  16.29
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    200.00 =  2260.00 FEET.

********************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    200.00 IS CODE =  81
--------------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
 MAINLINE Tc(MIN) =  16.29
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.477
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        6.51      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    6.51      SUBAREA RUNOFF(CFS) =   14.39
 EFFECTIVE AREA(ACRES) =    25.30   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    25.30       PEAK FLOW RATE(CFS) =      55.94

********************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  31
--------------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    56.83  DOWNSTREAM(FEET) =    54.79
 FLOW LENGTH(FEET) =   340.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  29.5 INCHES
```

```
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.30
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     55.94
 PIPE TRAVEL TIME(MIN.) =   0.68    Tc(MIN.) =  16.97
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    210.00 =  2600.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  16.97
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.416
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        5.30      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     5.30      SUBAREA RUNOFF(CFS) =   11.43
 EFFECTIVE AREA(ACRES) =    30.60    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    30.60        PEAK FLOW RATE(CFS) =      66.00

****************************************************************************
 FLOW PROCESS FROM NODE    210.00 TO NODE    220.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    54.79  DOWNSTREAM(FEET) =    52.72
 FLOW LENGTH(FEET) =   345.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  30.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.69
 ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     66.00
 PIPE TRAVEL TIME(MIN.) =   0.66    Tc(MIN.) =  17.63
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    220.00 =  2945.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    220.00 TO NODE    220.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.63
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.361
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        9.35      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     9.35      SUBAREA RUNOFF(CFS) =   19.70
 EFFECTIVE AREA(ACRES) =    39.95    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    39.95        PEAK FLOW RATE(CFS) =      84.17
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    220.00 TO NODE    230.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    52.72  DOWNSTREAM(FEET) =    52.00
 FLOW LENGTH(FEET) =   120.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  45.0 INCH PIPE IS  34.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.15
 ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     84.17
 PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =  17.85
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    230.00 =  3065.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    250.00 TO NODE    260.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     61.00  DOWNSTREAM(FEET) =     58.10

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.971
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.723
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 D        0.85      0.20        0.10    75    7.97
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      2.83
 TOTAL AREA(ACRES) =      0.85   PEAK FLOW RATE(CFS) =      2.83

****************************************************************************
 FLOW PROCESS FROM NODE    260.00 TO NODE    270.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     58.10
 DOWNSTREAM NODE ELEVATION(FEET) =     57.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   340.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.932
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        2.62      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      6.21
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.37
```

```
 AVERAGE FLOW DEPTH(FEET) =   0.36   FLOOD WIDTH(FEET) =   41.63
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   4.13   Tc(MIN.) =  12.10
 SUBAREA AREA(ACRES) =    2.62       SUBAREA RUNOFF(CFS) =    6.87
 EFFECTIVE AREA(ACRES) =    3.47     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    3.47         PEAK FLOW RATE(CFS) =       9.09

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.40   FLOOD WIDTH(FEET) =   48.81
 FLOW VELOCITY(FEET/SEC.) =   1.48   DEPTH*VELOCITY(FT*FT/SEC) =   0.59
 LONGEST FLOWPATH FROM NODE    250.00 TO NODE    270.00 =   670.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    270.00 TO NODE    280.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    51.00  DOWNSTREAM(FEET) =    44.60
 FLOW LENGTH(FEET) =    85.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  12.0 INCH PIPE IS   9.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  13.46
 ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      9.09
 PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =  12.21
 LONGEST FLOWPATH FROM NODE    250.00 TO NODE    280.00 =   755.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    300.00 TO NODE    310.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     57.60  DOWNSTREAM(FEET) =     56.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   27.612
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.836
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 AGRICULTURAL GOOD COVER
 "PASTURE,DRYLAND"          D        0.78      0.20       1.00     80   27.61
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA RUNOFF(CFS) =      1.15
 TOTAL AREA(ACRES) =      0.78   PEAK FLOW RATE(CFS) =      1.15

****************************************************************************
 FLOW PROCESS FROM NODE    310.00 TO NODE    320.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     56.00
 DOWNSTREAM NODE ELEVATION(FEET) =     52.90
 CHANNEL LENGTH THRU SUBAREA(FEET) =   400.00
```

```
"V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
MAXIMUM DEPTH(FEET) =   1.00
*  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.712
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
AGRICULTURAL GOOD COVER
"PASTURE,DRYLAND"           D        4.73      0.20       1.00    80
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.34
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.82
AVERAGE FLOW DEPTH(FEET) =   0.30   FLOOD WIDTH(FEET) =   29.56
"V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.65   Tc(MIN.) =  31.27
SUBAREA AREA(ACRES) =    4.73       SUBAREA RUNOFF(CFS) =    6.44
EFFECTIVE AREA(ACRES) =    5.51     AREA-AVERAGED Fm(INCH/HR) =   0.20
AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   1.00
TOTAL AREA(ACRES) =    5.51         PEAK FLOW RATE(CFS) =       7.50

END OF SUBAREA "V" GUTTER HYDRAULICS:
DEPTH(FEET) =  0.34   FLOOD WIDTH(FEET) =   37.39
FLOW VELOCITY(FEET/SEC.) =   2.03   DEPTH*VELOCITY(FT*FT/SEC) =   0.69
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    320.00 =   730.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    320.00 TO NODE    330.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    50.00  DOWNSTREAM(FEET) =    48.00
FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.12
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      7.50
PIPE TRAVEL TIME(MIN.) =   0.33    Tc(MIN.) =  31.59
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    330.00 =   870.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    330.00 TO NODE    330.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  31.59
*  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.702
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
AGRICULTURAL GOOD COVER
"PASTURE,DRYLAND"           D        2.88      0.20       1.00    80
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
SUBAREA AREA(ACRES) =    2.88       SUBAREA RUNOFF(CFS) =    3.89
EFFECTIVE AREA(ACRES) =    8.39     AREA-AVERAGED Fm(INCH/HR) =  0.20
```

```
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  1.00
 TOTAL AREA(ACRES) =      8.39       PEAK FLOW RATE(CFS) =      11.34

****************************************************************************
 FLOW PROCESS FROM NODE    350.00 TO NODE    360.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     67.00  DOWNSTREAM(FEET) =     63.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.474
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.840
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.92      0.20       0.10     75    7.47
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      3.16
 TOTAL AREA(ACRES) =      0.92   PEAK FLOW RATE(CFS) =      3.16

****************************************************************************
 FLOW PROCESS FROM NODE    360.00 TO NODE    370.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     63.00
 DOWNSTREAM NODE ELEVATION(FEET) =     62.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   100.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.648
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.44      0.20       0.10     75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.88
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.02
 AVERAGE FLOW DEPTH(FEET) =   0.29   FLOOD WIDTH(FEET) =   26.30
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   0.83   Tc(MIN.) =   8.30
 SUBAREA AREA(ACRES) =    0.44      SUBAREA RUNOFF(CFS) =    1.44
 EFFECTIVE AREA(ACRES) =    1.36    AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    1.36        PEAK FLOW RATE(CFS) =       4.44

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.30   FLOOD WIDTH(FEET) =   28.26
 FLOW VELOCITY(FEET/SEC.) =   2.03   DEPTH*VELOCITY(FT*FT/SEC) =   0.60
 LONGEST FLOWPATH FROM NODE    350.00 TO NODE    370.00 =   430.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    370.00 TO NODE    370.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =   8.30
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.648
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D       1.00      0.20       0.10     75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     1.00      SUBAREA RUNOFF(CFS) =     3.26
 EFFECTIVE AREA(ACRES) =     2.36    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     2.36        PEAK FLOW RATE(CFS) =        7.70

****************************************************************************
 FLOW PROCESS FROM NODE    370.00 TO NODE    380.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     62.00  DOWNSTREAM(FEET) =     59.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   790.00   CHANNEL SLOPE =  0.0038
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
 CHANNEL FLOW THRU SUBAREA(CFS) =      7.70
 FLOW VELOCITY(FEET/SEC) =   2.08   FLOW DEPTH(FEET) =   0.80
 TRAVEL TIME(MIN.) =   6.33   Tc(MIN.) =  14.63
 LONGEST FLOWPATH FROM NODE    350.00 TO NODE    380.00 =  1220.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    380.00 TO NODE    380.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  14.63
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.631
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D       0.69      0.20       0.10     75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     0.69      SUBAREA RUNOFF(CFS) =     1.62
 EFFECTIVE AREA(ACRES) =     3.05    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     3.05        PEAK FLOW RATE(CFS) =        7.70
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    380.00 TO NODE    380.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================
```

```
****************************************************************************
 FLOW PROCESS FROM NODE     400.00 TO NODE     410.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     73.00  DOWNSTREAM(FEET) =     70.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   13.672
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.739
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 AGRICULTURAL POOR COVER
 "ROW CROPS,STRAIGHT ROW"    D        1.10      0.20       1.00    91   13.67
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA RUNOFF(CFS) =      2.51
 TOTAL AREA(ACRES) =      1.10   PEAK FLOW RATE(CFS) =      2.51

****************************************************************************
 FLOW PROCESS FROM NODE     410.00 TO NODE     420.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     70.00
 DOWNSTREAM NODE ELEVATION(FEET) =     67.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   400.00
 "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.500
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0350
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.240
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 AGRICULTURAL POOR COVER
 "ROW CROPS,STRAIGHT ROW"    D        4.70      0.20       1.00    91
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      6.83
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.16
 AVERAGE FLOW DEPTH(FEET) =   0.75   FLOOD WIDTH(FEET) =   44.87
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   5.74   Tc(MIN.) =  19.41
 SUBAREA AREA(ACRES) =    4.70      SUBAREA RUNOFF(CFS) =    8.63
 EFFECTIVE AREA(ACRES) =    5.80    AREA-AVERAGED Fm(INCH/HR) =   0.20
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   1.00
 TOTAL AREA(ACRES) =    5.80        PEAK FLOW RATE(CFS) =      10.65

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.81   FLOOD WIDTH(FEET) =   56.01
 FLOW VELOCITY(FEET/SEC.) =   1.23   DEPTH*VELOCITY(FT*FT/SEC) =   0.99
 LONGEST FLOWPATH FROM NODE     400.00 TO NODE     420.00 =   730.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    420.00 TO NODE    430.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    59.61  DOWNSTREAM(FEET) =    58.41
 FLOW LENGTH(FEET) =   250.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.15
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     10.65
 PIPE TRAVEL TIME(MIN.) =   0.81    Tc(MIN.) =  20.22
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    430.00 =   980.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  20.22
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.188
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 PUBLIC PARK                 D        2.40      0.20       0.85    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
 SUBAREA AREA(ACRES) =    2.40      SUBAREA RUNOFF(CFS) =    4.36
 EFFECTIVE AREA(ACRES) =     8.20   AREA-AVERAGED Fm(INCH/HR) =  0.19
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.96
 TOTAL AREA(ACRES) =     8.20       PEAK FLOW RATE(CFS) =      14.73

****************************************************************************
 FLOW PROCESS FROM NODE    430.00 TO NODE    440.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    58.41  DOWNSTREAM(FEET) =    57.98
 FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  19.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.38
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     14.73
 PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =  20.50
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    440.00 =  1070.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    440.00 TO NODE    440.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  20.50
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.172
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
```

```
     LAND USE              GROUP   (ACRES)   (INCH/HR)   (DECIMAL)   CN
  PUBLIC PARK               D        3.39       0.20        0.85     75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
  SUBAREA AREA(ACRES) =     3.39      SUBAREA RUNOFF(CFS) =     6.11
  EFFECTIVE AREA(ACRES) =    11.59    AREA-AVERAGED Fm(INCH/HR) =  0.19
  AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.93
  TOTAL AREA(ACRES) =     11.59       PEAK FLOW RATE(CFS) =       20.73

****************************************************************************
  FLOW PROCESS FROM NODE     440.00 TO NODE     450.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     57.98  DOWNSTREAM(FEET) =     55.77
  FLOW LENGTH(FEET) =    460.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  19.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    6.06
  ESTIMATED PIPE DIAMETER(INCH) =  30.00     NUMBER OF PIPES =    1
  PIPE-FLOW(CFS) =      20.73
  PIPE TRAVEL TIME(MIN.) =    1.27     Tc(MIN.) =  21.76
  LONGEST FLOWPATH FROM NODE     400.00 TO NODE     450.00 =  1530.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     450.00 TO NODE     450.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     460.00 TO NODE     470.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =      67.50  DOWNSTREAM(FEET) =      65.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   13.046
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.809
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                D        0.78      0.20        0.85     75   13.05
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
  SUBAREA RUNOFF(CFS) =       1.85
  TOTAL AREA(ACRES) =       0.78   PEAK FLOW RATE(CFS) =       1.85

****************************************************************************
  FLOW PROCESS FROM NODE     470.00 TO NODE     450.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =      65.00
```

```
 DOWNSTREAM NODE ELEVATION(FEET) =      61.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   720.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.500
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0300
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.999
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 PUBLIC PARK                 D        8.53      0.20       0.85    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      8.67
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.12
 AVERAGE FLOW DEPTH(FEET) =   0.80   FLOOD WIDTH(FEET) =   53.57
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =  10.72   Tc(MIN.) =  23.77
 SUBAREA AREA(ACRES) =    8.53       SUBAREA RUNOFF(CFS) =   14.04
 EFFECTIVE AREA(ACRES) =    9.31     AREA-AVERAGED Fm(INCH/HR) =   0.17
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.85
 TOTAL AREA(ACRES) =    9.31         PEAK FLOW RATE(CFS) =      15.33

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.87   FLOOD WIDTH(FEET) =   68.30
 FLOW VELOCITY(FEET/SEC.) =   1.25   DEPTH*VELOCITY(FT*FT/SEC) =   1.09
 LONGEST FLOWPATH FROM NODE    460.00 TO NODE    450.00 =  1050.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    450.00 TO NODE    450.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
     1     15.33  23.77    1.999  0.20( 0.17) 0.85      9.3      460.00
 LONGEST FLOWPATH FROM NODE    460.00 TO NODE    450.00 =  1050.00 FEET.

 ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
     1     20.73  21.76    2.101  0.20( 0.19) 0.93     11.6      400.00
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    450.00 =  1530.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
     1     35.54  21.76    2.101  0.20( 0.18) 0.89     20.1      400.00
     2     34.95  23.77    1.999  0.20( 0.18) 0.89     20.9      460.00
   TOTAL AREA(ACRES) =      20.90

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       35.54  Tc(MIN.) =   21.763
 EFFECTIVE AREA(ACRES) =     20.11  AREA-AVERAGED Fm(INCH/HR) =  0.18
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.89
 TOTAL AREA(ACRES) =     20.90
```

```
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    450.00 =  1530.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    450.00 TO NODE    380.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    55.77  DOWNSTREAM(FEET) =    55.55
 FLOW LENGTH(FEET) =    45.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  24.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.96
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     35.54
 PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =  21.87
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    380.00 =  1575.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    380.00 TO NODE    380.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1      35.54  21.87    2.095   0.20( 0.18) 0.89     20.1      400.00
     2      34.95  23.88    1.994   0.20( 0.18) 0.89     20.9      460.00
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    380.00 =  1575.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1       7.70  14.63    2.631   0.20( 0.02) 0.10      3.1      350.00
 LONGEST FLOWPATH FROM NODE    350.00 TO NODE    380.00 =  1220.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1      38.13  14.63    2.631   0.20( 0.15) 0.75     16.5      350.00
     2      41.67  21.87    2.095   0.20( 0.16) 0.79     23.2      400.00
     3      40.77  23.88    1.994   0.20( 0.16) 0.79     24.0      460.00
   TOTAL AREA(ACRES) =     23.95

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       41.67  Tc(MIN.) =   21.871
 EFFECTIVE AREA(ACRES) =     23.16  AREA-AVERAGED Fm(INCH/HR) =  0.16
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.75
 TOTAL AREA(ACRES) =     23.95
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    380.00 =  1575.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    380.00 TO NODE    480.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
 ELEVATION DATA: UPSTREAM(FEET) =    55.55  DOWNSTREAM(FEET) =    54.16
 FLOW LENGTH(FEET) =   290.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  28.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.05
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     41.67
 PIPE TRAVEL TIME(MIN.) =   0.69    Tc(MIN.) =  22.56
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    480.00 =  1865.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    480.00 TO NODE    480.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  22.56
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.057
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        0.29      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.29      SUBAREA RUNOFF(CFS) =    0.53
 EFFECTIVE AREA(ACRES) =    23.45   AREA-AVERAGED Fm(INCH/HR) =  0.16
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.78
 TOTAL AREA(ACRES) =    24.24      PEAK FLOW RATE(CFS) =      41.67
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    480.00 TO NODE    480.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  22.56
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.057
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        1.15      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    1.15      SUBAREA RUNOFF(CFS) =    2.11
 EFFECTIVE AREA(ACRES) =    24.60   AREA-AVERAGED Fm(INCH/HR) =  0.15
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.75
 TOTAL AREA(ACRES) =    25.39      PEAK FLOW RATE(CFS) =      42.24

****************************************************************************
 FLOW PROCESS FROM NODE    480.00 TO NODE    490.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    54.16  DOWNSTREAM(FEET) =    52.92
 FLOW LENGTH(FEET) =   260.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  28.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.04
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
```

```
 PIPE-FLOW(CFS) =     42.24
 PIPE TRAVEL TIME(MIN.) =   0.62    Tc(MIN.) =  23.17
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    490.00 =  2125.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    490.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  23.17
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.028
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.25      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.25      SUBAREA RUNOFF(CFS) =    0.45
 EFFECTIVE AREA(ACRES) =    24.85   AREA-AVERAGED Fm(INCH/HR) =  0.15
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.74
 TOTAL AREA(ACRES) =    25.64       PEAK FLOW RATE(CFS) =      42.24
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    490.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  23.17
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.028
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.75      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    1.75      SUBAREA RUNOFF(CFS) =    3.16
 EFFECTIVE AREA(ACRES) =    26.60   AREA-AVERAGED Fm(INCH/HR) =  0.14
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.70
 TOTAL AREA(ACRES) =    27.39       PEAK FLOW RATE(CFS) =      45.20

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    500.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   52.92  DOWNSTREAM(FEET) =    49.80
 FLOW LENGTH(FEET) =   650.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  27.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.32
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     45.20
 PIPE TRAVEL TIME(MIN.) =   1.48    Tc(MIN.) =  24.65
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    500.00 =  2775.00 FEET.

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

```
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  24.65
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.957
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA     Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.32      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.32      SUBAREA RUNOFF(CFS) =    0.56
 EFFECTIVE AREA(ACRES) =    26.92   AREA-AVERAGED Fm(INCH/HR) =  0.14
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.69
 TOTAL AREA(ACRES) =    27.71       PEAK FLOW RATE(CFS) =      45.20
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    510.00 TO NODE    520.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     68.00  DOWNSTREAM(FEET) =     65.70

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   13.265
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.784
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA     Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 PUBLIC PARK                 D        1.00      0.20       0.85    75   13.27
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
 SUBAREA RUNOFF(CFS) =      2.35
 TOTAL AREA(ACRES) =      1.00   PEAK FLOW RATE(CFS) =      2.35

****************************************************************************
 FLOW PROCESS FROM NODE    520.00 TO NODE    530.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    60.00  DOWNSTREAM(FEET) =    58.68
 FLOW LENGTH(FEET) =   220.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  12.0 INCH PIPE IS   8.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.77
 ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      2.35
```

```
 PIPE TRAVEL TIME(MIN.) =   0.97    Tc(MIN.) =  14.24
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    530.00 =   550.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    530.00 TO NODE    530.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  14.24
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.675
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.16      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    2.16      SUBAREA RUNOFF(CFS) =    5.16
 EFFECTIVE AREA(ACRES) =     3.16   AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.34
 TOTAL AREA(ACRES) =     3.16       PEAK FLOW RATE(CFS) =       7.42

****************************************************************************
 FLOW PROCESS FROM NODE    530.00 TO NODE    540.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    58.68  DOWNSTREAM(FEET) =    56.10
 FLOW LENGTH(FEET) =   430.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  14.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.98
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      7.42
 PIPE TRAVEL TIME(MIN.) =   1.44    Tc(MIN.) =  15.68
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    540.00 =   980.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    540.00 TO NODE    540.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  15.68
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.530
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        5.60      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    5.60      SUBAREA RUNOFF(CFS) =   12.65
 EFFECTIVE AREA(ACRES) =     8.76   AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.19
 TOTAL AREA(ACRES) =     8.76       PEAK FLOW RATE(CFS) =      19.66

****************************************************************************
 FLOW PROCESS FROM NODE    540.00 TO NODE    550.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
ELEVATION DATA: UPSTREAM(FEET) =    56.10  DOWNSTREAM(FEET) =    54.78
FLOW LENGTH(FEET) =   220.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  27.0 INCH PIPE IS  19.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.44
ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     19.66
PIPE TRAVEL TIME(MIN.) =   0.57    Tc(MIN.) =  16.25
LONGEST FLOWPATH FROM NODE    510.00 TO NODE    550.00 =  1200.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    550.00 TO NODE    550.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  16.25
*  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.480
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 D        2.46      0.20        0.10    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =    2.46      SUBAREA RUNOFF(CFS) =    5.45
EFFECTIVE AREA(ACRES) =    11.22   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.17
TOTAL AREA(ACRES) =    11.22       PEAK FLOW RATE(CFS) =      24.71

****************************************************************************
FLOW PROCESS FROM NODE    550.00 TO NODE    550.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  16.25
*  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.480
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 D        2.05      0:20        0.10    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =    2.05      SUBAREA RUNOFF(CFS) =    4.54
EFFECTIVE AREA(ACRES) =    13.27   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.16
TOTAL AREA(ACRES) =    13.27       PEAK FLOW RATE(CFS) =      29.25

****************************************************************************
FLOW PROCESS FROM NODE    550.00 TO NODE    560.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    54.78  DOWNSTREAM(FEET) =    52.08
FLOW LENGTH(FEET) =   450.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  30.0 INCH PIPE IS  23.8 INCHES
```

```
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.00
 ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     29.25
 PIPE TRAVEL TIME(MIN.) =   1.07    Tc(MIN.) =  17.32
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    560.00 =  1650.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    560.00 TO NODE    560.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.32
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.386
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 AGRICULTURAL GOOD COVER
 "PASTURE,IRRIGATED"         D        3.05      0.20       1.00    79
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA AREA(ACRES) =    3.05      SUBAREA RUNOFF(CFS) =    6.00
 EFFECTIVE AREA(ACRES) =    16.32   AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.31
 TOTAL AREA(ACRES) =    16.32       PEAK FLOW RATE(CFS) =      34.12

****************************************************************************
 FLOW PROCESS FROM NODE    560.00 TO NODE    560.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.32
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.386
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.62      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    1.62      SUBAREA RUNOFF(CFS) =    3.45
 EFFECTIVE AREA(ACRES) =    17.94   AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.29
 TOTAL AREA(ACRES) =    17.94       PEAK FLOW RATE(CFS) =      37.57

****************************************************************************
 FLOW PROCESS FROM NODE    560.00 TO NODE    570.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    52.08  DOWNSTREAM(FEET) =    50.04
 FLOW LENGTH(FEET) =   340.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  33.0 INCH PIPE IS  26.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.45
 ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     37.57
 PIPE TRAVEL TIME(MIN.) =   0.76    Tc(MIN.) =  18.08
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    570.00 =  1990.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    570.00 TO NODE    570.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  18.08
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.331
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        4.95      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    4.95      SUBAREA RUNOFF(CFS) =   10.29
 EFFECTIVE AREA(ACRES) =    22.89   AREA-AVERAGED Fm(INCH/HR) =  0.05
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.25
 TOTAL AREA(ACRES) =    22.89       PEAK FLOW RATE(CFS) =      46.97

****************************************************************************
 FLOW PROCESS FROM NODE    570.00 TO NODE    500.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    50.04  DOWNSTREAM(FEET) =    49.80
 FLOW LENGTH(FEET) =    40.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  28.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.90
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     46.97
 PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =  18.16
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2030.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
     1      46.97  18.16     2.325  0.20( 0.05) 0.25    22.9      510.00
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2030.00 FEET.

 ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
     1      42.72  17.48     2.372  0.20( 0.13) 0.63    20.3      350.00
     2      45.20  24.65     1.957  0.20( 0.14) 0.69    26.9      400.00
     3      44.17  26.67     1.873  0.20( 0.14) 0.70    27.7      460.00
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    500.00 =  2775.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)        (ACRES)     NODE
```

```
      1      88.85  17.48    2.372  0.20( 0.09) 0.43     42.3      350.00
      2      89.93  18.16    2.325  0.20( 0.09) 0.43     43.8      510.00
      3      84.57  24.65    1.957  0.20( 0.10) 0.49     49.8      400.00
      4      81.81  26.67    1.873  0.20( 0.10) 0.50     50.6      460.00
    TOTAL AREA(ACRES) =      50.60

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       89.93  Tc(MIN.) =   18.164
  EFFECTIVE AREA(ACRES) =     43.79  AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.43
  TOTAL AREA(ACRES) =     50.60
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    500.00 =  2775.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    580.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    49.80  DOWNSTREAM(FEET) =    48.02
  FLOW LENGTH(FEET) =   370.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  37.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.56
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     89.93
  PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =  18.88
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    580.00 =  3145.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    580.00 TO NODE    580.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  18.88
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.276
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        0.26      0.20       0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.26      SUBAREA RUNOFF(CFS) =     0.53
  EFFECTIVE AREA(ACRES) =    44.05   AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.43
  TOTAL AREA(ACRES) =    50.86      PEAK FLOW RATE(CFS) =      89.93
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    580.00 TO NODE    580.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  18.88
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.276
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
```

```
  COMMERCIAL                    D        5.90      0.20      0.10     75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     5.90      SUBAREA RUNOFF(CFS) =    11.98
  EFFECTIVE AREA(ACRES) =    49.95    AREA-AVERAGED Fm(INCH/HR) =  0.08
  AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.39
  TOTAL AREA(ACRES) =     56.76       PEAK FLOW RATE(CFS) =       98.79

****************************************************************************
  FLOW PROCESS FROM NODE    580.00 TO NODE    590.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    48.02  DOWNSTREAM(FEET) =    46.24
  FLOW LENGTH(FEET) =   370.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  51.0 INCH PIPE IS  37.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.85
  ESTIMATED PIPE DIAMETER(INCH) =  51.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     98.79
  PIPE TRAVEL TIME(MIN.) =   0.70    Tc(MIN.) =  19.58
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    590.00 =  3515.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    590.00 TO NODE    590.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  19.58
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.228
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)   (DECIMAL)  CN
  COMMERCIAL                   D        0.30      0.20      0.10     75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     0.30      SUBAREA RUNOFF(CFS) =     0.60
  EFFECTIVE AREA(ACRES) =    50.25    AREA-AVERAGED Fm(INCH/HR) =  0.08
  AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.39
  TOTAL AREA(ACRES) =     57.06       PEAK FLOW RATE(CFS) =       98.79
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    590.00 TO NODE    590.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    590.00 TO NODE    590.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    610.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     64.50  DOWNSTREAM(FEET) =     63.10

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.221
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.438
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 D        0.81      0.20        0.10     75    9.22
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      2.49
 TOTAL AREA(ACRES) =      0.81   PEAK FLOW RATE(CFS) =      2.49

****************************************************************************
 FLOW PROCESS FROM NODE    610.00 TO NODE    620.00 IS CODE =  61
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   63.10  DOWNSTREAM ELEVATION(FEET) =   59.50
 STREET LENGTH(FEET) =   660.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 20.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.017
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.017

 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 =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.38
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.40
   HALFSTREET FLOOD WIDTH(FEET) =   15.82
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.95
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.78
 STREET FLOW TRAVEL TIME(MIN.) =   5.65   Tc(MIN.) =  14.87
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.605
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        1.61      0.20        0.10     75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     1.61      SUBAREA RUNOFF(CFS) =     3.75
 EFFECTIVE AREA(ACRES) =    2.42     AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     2.42       PEAK FLOW RATE(CFS) =       5.63

 END OF SUBAREA STREET FLOW HYDRAULICS:
```

```
 DEPTH(FEET) = 0.43   HALFSTREET FLOOD WIDTH(FEET) =  17.46
 FLOW VELOCITY(FEET/SEC.) =  2.07   DEPTH*VELOCITY(FT*FT/SEC.) =   0.89
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    620.00 =   990.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    620.00 TO NODE    630.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    53.00  DOWNSTREAM(FEET) =    49.89
 FLOW LENGTH(FEET) =   400.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.27
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      5.63
 PIPE TRAVEL TIME(MIN.) =   1.26    Tc(MIN.) =  16.13
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    630.00 =  1390.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    630.00 TO NODE    630.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  16.13
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.490
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)   (DECIMAL)  CN
 COMMERCIAL                  D        2.20      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    2.20      SUBAREA RUNOFF(CFS) =    4.89
 EFFECTIVE AREA(ACRES) =     4.62   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     4.62       PEAK FLOW RATE(CFS) =      10.27

****************************************************************************
 FLOW PROCESS FROM NODE    630.00 TO NODE    630.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  16.13
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.490
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)   (DECIMAL)  CN
 COMMERCIAL                  D        4.22      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    4.22      SUBAREA RUNOFF(CFS) =    9.38
 EFFECTIVE AREA(ACRES) =     8.84   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     8.84       PEAK FLOW RATE(CFS) =      19.65

****************************************************************************
 FLOW PROCESS FROM NODE    630.00 TO NODE    640.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    49.89  DOWNSTREAM(FEET) =    46.48
  FLOW LENGTH(FEET) =   560.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  19.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.48
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     19.65
  PIPE TRAVEL TIME(MIN.) =   1.44    Tc(MIN.) =  17.57
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    640.00 =  1950.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    640.00 TO NODE    640.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  17.57
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.365
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        2.30      0.20       0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.30      SUBAREA RUNOFF(CFS) =    4.85
  EFFECTIVE AREA(ACRES) =    11.14   AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    11.14       PEAK FLOW RATE(CFS) =      23.51

****************************************************************************
  FLOW PROCESS FROM NODE    640.00 TO NODE    590.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    46.48  DOWNSTREAM(FEET) =    46.24
  FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.19
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     23.51
  PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =  17.71
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    590.00 =  2000.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    590.00 TO NODE    590.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
   NUMBER    (CFS) (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
      1     23.51  17.71    2.356  0.20( 0.02) 0.10    11.1      600.00
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    590.00 =  2000.00 FEET.
```

```
** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1      97.88  18.89     2.275   0.20( 0.08) 0.39     48.7      350.00
    2      98.79  19.58     2.228   0.20( 0.08) 0.39     50.3      510.00
    3      92.46  26.10     1.896   0.20( 0.09) 0.45     56.3      400.00
    4      89.57  28.12     1.818   0.20( 0.09) 0.45     57.1      460.00
LONGEST FLOWPATH FROM NODE    400.00 TO NODE    590.00 =  3515.00 FEET.

** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1     118.61  17.71     2.356   0.20( 0.07) 0.33     56.8      600.00
    2     120.57  18.89     2.275   0.20( 0.07) 0.33     59.9      350.00
    3     121.01  19.58     2.228   0.20( 0.07) 0.34     61.4      510.00
    4     111.35  26.10     1.896   0.20( 0.08) 0.39     67.4      400.00
    5     107.67  28.12     1.818   0.20( 0.08) 0.39     68.2      460.00
  TOTAL AREA(ACRES) =     68.20

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      121.01  Tc(MIN.) =   19.581
EFFECTIVE AREA(ACRES) =     61.39  AREA-AVERAGED Fm(INCH/HR) =  0.07
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.34
TOTAL AREA(ACRES) =     68.20
LONGEST FLOWPATH FROM NODE    400.00 TO NODE    590.00 =  3515.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    590.00 TO NODE    650.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    46.24  DOWNSTREAM(FEET) =    45.86
FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  54.0 INCH PIPE IS  41.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   9.19
ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =    121.01
PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =  19.73
LONGEST FLOWPATH FROM NODE    400.00 TO NODE    650.00 =  3595.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    650.00 TO NODE    650.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  19.73
*  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.219
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 D        2.44      0.20       0.10     75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =    2.44      SUBAREA RUNOFF(CFS) =    4.83
EFFECTIVE AREA(ACRES) =    63.83   AREA-AVERAGED Fm(INCH/HR) =  0.07
```

```
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.33
 TOTAL AREA(ACRES) =    70.64       PEAK FLOW RATE(CFS) =     123.68

****************************************************************************
 FLOW PROCESS FROM NODE    650.00 TO NODE    660.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    45.50  DOWNSTREAM(FEET) =    44.00
 FLOW LENGTH(FEET) =   840.50   MANNING'S N =  0.013
 DEPTH OF FLOW IN  66.0 INCH PIPE IS  49.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.43
 ESTIMATED PIPE DIAMETER(INCH) =  66.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    123.68
 PIPE TRAVEL TIME(MIN.) =   2.18    Tc(MIN.) =  21.91
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    660.00 =  4435.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    650.00 TO NODE    650.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  21.91
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.093
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap       SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
 COMMERCIAL                 D        1.62      0.20        0.10     75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    1.62      SUBAREA RUNOFF(CFS) =     3.02
 EFFECTIVE AREA(ACRES) =    65.45   AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.32
 TOTAL AREA(ACRES) =    72.26       PEAK FLOW RATE(CFS) =     123.68
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =     72.26  TC(MIN.) =     21.91
 EFFECTIVE AREA(ACRES) =     65.45  AREA-AVERAGED Fm(INCH/HR)=  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.32
 PEAK FLOW RATE(CFS)   =    123.68

 ** PEAK FLOW RATE TABLE **
  STREAM     Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER   (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1    121.70  20.04     2.198   0.20( 0.06) 0.32     60.9      600.00
     2    123.42  21.22     2.132   0.20( 0.06) 0.32     63.9      350.00
     3    123.68  21.91     2.093   0.20( 0.06) 0.32     65.5      510.00
     4    114.08  28.48     1.805   0.20( 0.07) 0.37     71.5      400.00
     5    110.34  30.52     1.735   0.20( 0.08) 0.38     72.3      460.00
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

Appendix F

Proposed 100-Year Hydrology Calculations

```
**************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 OCEMA HYDROLOGY CRITERION)
        (c) Copyright 1983-2001 Advanced Engineering Software (aes)
             Ver. 8.0  Release Date: 01/01/2001  License ID 1355

                          Analysis prepared by:

                          Fuscoe Engineering, Inc.
                          16795 Von Karman, Suite 100
                          Irvine, Calif.  92606
                        (949) 474 - 1960  Fax: (949) 474 - 5315

 ************************** DESCRIPTION OF STUDY **************************
* Orange County Fair Grounds                                              *
* Proposed 100 yr. Hydrology                                              *
* Area A thru H                                                           *
 **************************************************************************

  FILE NAME: 30902B.100
  TIME/DATE OF STUDY: 11:13 08/09/2002
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *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   20.0      10.0   0.017/0.017/0.020   0.50    1.50  0.0313  0.125  0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =     72.00  DOWNSTREAM(FEET) =     67.50
```

```
 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.300
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.981
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.48      0.20       0.10    75    7.30
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      2.14
 TOTAL AREA(ACRES) =      0.48   PEAK FLOW RATE(CFS) =      2.14

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   220.00
 ELEVATION DATA: UPSTREAM(FEET) =    102.50  DOWNSTREAM(FEET) =     67.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.859
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.747
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "1 DWELLING/ACRE"           D        3.99      0.20       0.80    75    5.86
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.80
 SUBAREA AREA(ACRES) =    3.99   INITIAL SUBAREA RUNOFF(CFS) =   20.06

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN) =   7.30
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.003
 SUBAREA AREA(ACRES) =    3.99      SUBAREA RUNOFF(CFS) =   17.39
 EFFECTIVE AREA(ACRES) =     4.47   AREA-AVERAGED Fm(INCH/HR) =  0.14
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.72
 TOTAL AREA(ACRES) =     4.47       PEAK FLOW RATE(CFS) =      19.54

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     67.50
 DOWNSTREAM NODE ELEVATION(FEET) =     65.30
 CHANNEL LENGTH THRU SUBAREA(FEET) =   330.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.314
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
```

```
     LAND USE              GROUP   (ACRES)   (INCH/HR)   (DECIMAL)   CN
  RESIDENTIAL
  "1 DWELLING/ACRE"          D        4.11       0.20        0.80    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.80
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     27.24
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.52
  AVERAGE FLOW DEPTH(FEET) =   0.48   FLOOD WIDTH(FEET) =   65.11
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.18   Tc(MIN.) =   9.48
  SUBAREA AREA(ACRES) =    4.11       SUBAREA RUNOFF(CFS) =   15.37
  EFFECTIVE AREA(ACRES) =    8.58     AREA-AVERAGED Fm(INCH/HR) =   0.15
  AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.76
  TOTAL AREA(ACRES) =    8.58         PEAK FLOW RATE(CFS) =      32.14

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.50   FLOOD WIDTH(FEET) =   69.35
  FLOW VELOCITY(FEET/SEC.) =   2.63   DEPTH*VELOCITY(FT*FT/SEC) =   1.32
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    120.00 =   660.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =     65.30
  DOWNSTREAM NODE ELEVATION(FEET) =     63.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   380.00
  "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
  PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   1.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.793
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 D        5.77       0.20        0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     41.92
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.69
  AVERAGE FLOW DEPTH(FEET) =   0.55   FLOOD WIDTH(FEET) =   78.49
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.36   Tc(MIN.) =  11.84
  SUBAREA AREA(ACRES) =    5.77       SUBAREA RUNOFF(CFS) =   19.59
  EFFECTIVE AREA(ACRES) =   14.35     AREA-AVERAGED Fm(INCH/HR) =   0.10
  AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.50
  TOTAL AREA(ACRES) =   14.35         PEAK FLOW RATE(CFS) =      47.70

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.57   FLOOD WIDTH(FEET) =   82.40
  FLOW VELOCITY(FEET/SEC.) =   2.78   DEPTH*VELOCITY(FT*FT/SEC) =   1.58
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    130.00 =  1040.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    140.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```
==========================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    60.00  DOWNSTREAM(FEET) =    58.00
 FLOW LENGTH(FEET) =   480.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  30.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.93
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     47.70
 PIPE TRAVEL TIME(MIN.) =   1.15    Tc(MIN.) =  12.99
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    140.00 =  1520.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    150.00 TO NODE    160.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     75.90  DOWNSTREAM(FEET) =     73.80

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.502
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.603
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.60      0.20       0.10    75    8.50
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      2.47
 TOTAL AREA(ACRES) =      0.60   PEAK FLOW RATE(CFS) =      2.47

****************************************************************************
 FLOW PROCESS FROM NODE    160.00 TO NODE    170.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
==========================================================================
 UPSTREAM NODE ELEVATION(FEET) =     73.80
 DOWNSTREAM NODE ELEVATION(FEET) =     71.20
 CHANNEL LENGTH THRU SUBAREA(FEET) =   420.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.708
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        3.30      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      7.81
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.86
 AVERAGE FLOW DEPTH(FEET) =   0.35   FLOOD WIDTH(FEET) =   40.00
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.76   Tc(MIN.) =  12.26
 SUBAREA AREA(ACRES) =     3.30      SUBAREA RUNOFF(CFS) =   10.95
 EFFECTIVE AREA(ACRES) =     3.90    AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
```

```
 TOTAL AREA(ACRES) =    3.90          PEAK FLOW RATE(CFS) =      12.94

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.40   FLOOD WIDTH(FEET) =   49.13
 FLOW VELOCITY(FEET/SEC.) =   2.08   DEPTH*VELOCITY(FT*FT/SEC) =   0.83
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    170.00 =   750.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    170.00 TO NODE    180.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    65.60  DOWNSTREAM(FEET) =    64.00
 FLOW LENGTH(FEET) =   230.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.21
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     12.94
 PIPE TRAVEL TIME(MIN.) =   0.62    Tc(MIN.) =  12.88
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    180.00 =   980.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    180.00 TO NODE    180.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  12.88
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.606
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        3.35      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    3.35      SUBAREA RUNOFF(CFS) =   10.81
 EFFECTIVE AREA(ACRES) =     7.25   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     7.25       PEAK FLOW RATE(CFS) =      23.40

****************************************************************************
 FLOW PROCESS FROM NODE    180.00 TO NODE    190.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    64.00  DOWNSTREAM(FEET) =    59.20
 FLOW LENGTH(FEET) =   690.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  21.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.02
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     23.40
 PIPE TRAVEL TIME(MIN.) =   1.64    Tc(MIN.) =  14.52
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    190.00 =  1670.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    190.00 TO NODE    190.00 IS CODE =  81
```

```
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  14.52
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.370
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D       11.54      0.20       0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =   11.54      SUBAREA RUNOFF(CFS) =   34.79
  EFFECTIVE AREA(ACRES) =    18.79   AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    18.79       PEAK FLOW RATE(CFS) =      56.64

****************************************************************************
  FLOW PROCESS FROM NODE    190.00 TO NODE    200.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    59.20  DOWNSTREAM(FEET) =    56.83
  FLOW LENGTH(FEET) =   590.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  32.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.15
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     56.64
  PIPE TRAVEL TIME(MIN.) =   1.38    Tc(MIN.) =  15.89
  LONGEST FLOWPATH FROM NODE    150.00 TO NODE    200.00 =  2260.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    200.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  15.89
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.200
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        6.51      0.20       0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    6.51      SUBAREA RUNOFF(CFS) =   18.63
  EFFECTIVE AREA(ACRES) =    25.30   AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    25.30       PEAK FLOW RATE(CFS) =      72.41

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    56.83  DOWNSTREAM(FEET) =    54.79
  FLOW LENGTH(FEET) =   340.00   MANNING'S N =  0.013
```

```
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  33.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.76
 ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     72.41
 PIPE TRAVEL TIME(MIN.) =   0.65    Tc(MIN.) =  16.54
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    210.00 =  2600.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  16.54
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.128
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)   (DECIMAL)  CN
 COMMERCIAL                  D        5.30      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    5.30      SUBAREA RUNOFF(CFS) =   14.82
 EFFECTIVE AREA(ACRES) =    30.60   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    30.60       PEAK FLOW RATE(CFS) =      85.58

****************************************************************************
 FLOW PROCESS FROM NODE    210.00 TO NODE    220.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    54.79  DOWNSTREAM(FEET) =    52.72
 FLOW LENGTH(FEET) =   345.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  45.0 INCH PIPE IS  35.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.16
 ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     85.58
 PIPE TRAVEL TIME(MIN.) =   0.63    Tc(MIN.) =  17.17
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    220.00 =  2945.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    220.00 TO NODE    220.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.17
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.057
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)   (DECIMAL)  CN
 COMMERCIAL                  D        9.35      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    9.35      SUBAREA RUNOFF(CFS) =   25.56
 EFFECTIVE AREA(ACRES) =    39.95   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    39.95       PEAK FLOW RATE(CFS) =     109.21
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    220.00 TO NODE    230.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    52.72  DOWNSTREAM(FEET) =    52.00
 FLOW LENGTH(FEET) =   120.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  51.0 INCH PIPE IS  37.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.87
 ESTIMATED PIPE DIAMETER(INCH) =  51.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    109.21
 PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =  17.37
 LONGEST FLOWPATH FROM NODE    150.00 TO NODE    230.00 =  3065.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    250.00 TO NODE    260.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     61.00  DOWNSTREAM(FEET) =     58.10

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.971
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.761
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  D        0.85      0.20       0.10     75    7.97
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      3.63
 TOTAL AREA(ACRES) =      0.85   PEAK FLOW RATE(CFS) =      3.63

****************************************************************************
 FLOW PROCESS FROM NODE    260.00 TO NODE    270.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     58.10
 DOWNSTREAM NODE ELEVATION(FEET) =     57.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   340.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.781
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.62      0.20       0.10     75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      7.99
```

```
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.44
 AVERAGE FLOW DEPTH(FEET) =   0.39   FLOOD WIDTH(FEET) =   46.20
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.92   Tc(MIN.) =  11.89
 SUBAREA AREA(ACRES) =    2.62        SUBAREA RUNOFF(CFS) =    8.87
 EFFECTIVE AREA(ACRES) =    3.47      AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    3.47         PEAK FLOW RATE(CFS) =      11.75

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.43   FLOOD WIDTH(FEET) =   54.02
 FLOW VELOCITY(FEET/SEC.) =   1.57   DEPTH*VELOCITY(FT*FT/SEC) =   0.67
 LONGEST FLOWPATH FROM NODE    250.00 TO NODE    270.00 =   670.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    270.00 TO NODE    280.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    51.00  DOWNSTREAM(FEET) =    44.60
 FLOW LENGTH(FEET) =    85.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  15.0 INCH PIPE IS   9.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  14.82
 ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     11.75
 PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =  11.99
 LONGEST FLOWPATH FROM NODE    250.00 TO NODE    280.00 =   755.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    300.00 TO NODE    310.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     57.60  DOWNSTREAM(FEET) =     56.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   27.612
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.325
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 AGRICULTURAL GOOD COVER
 "PASTURE,DRYLAND"           D        0.78      0.20       1.00    80   27.61
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA RUNOFF(CFS) =      1.49
 TOTAL AREA(ACRES) =      0.78   PEAK FLOW RATE(CFS) =      1.49

****************************************************************************
 FLOW PROCESS FROM NODE    310.00 TO NODE    320.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     56.00
 DOWNSTREAM NODE ELEVATION(FEET) =     52.90
```

```
 CHANNEL LENGTH THRU SUBAREA(FEET) =   400.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.179
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 AGRICULTURAL GOOD COVER
 "PASTURE,DRYLAND"           D        4.73      0.20       1.00    80
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      5.66
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.92
 AVERAGE FLOW DEPTH(FEET) =   0.32   FLOOD WIDTH(FEET) =   33.15
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.46   Tc(MIN.) =  31.08
 SUBAREA AREA(ACRES) =    4.73       SUBAREA RUNOFF(CFS) =    8.43
 EFFECTIVE AREA(ACRES) =    5.51     AREA-AVERAGED Fm(INCH/HR) =   0.20
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   1.00
 TOTAL AREA(ACRES) =    5.51        PEAK FLOW RATE(CFS) =       9.81

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.36   FLOOD WIDTH(FEET) =   41.96
 FLOW VELOCITY(FEET/SEC.) =   2.14   DEPTH*VELOCITY(FT*FT/SEC) =   0.78
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    320.00 =   730.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    320.00 TO NODE    330.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    50.00  DOWNSTREAM(FEET) =    48.00
 FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.53
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      9.81
 PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =  31.39
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    330.00 =   870.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    330.00 TO NODE    330.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  31.39
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.167
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 AGRICULTURAL GOOD COVER
 "PASTURE,DRYLAND"           D        2.88      0.20       1.00    80
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA AREA(ACRES) =    2.88       SUBAREA RUNOFF(CFS) =    5.10
```

```
 EFFECTIVE AREA(ACRES) =     8.39   AREA-AVERAGED Fm(INCH/HR) =  0.20
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  1.00
 TOTAL AREA(ACRES) =     8.39       PEAK FLOW RATE(CFS) =      14.86

****************************************************************************
 FLOW PROCESS FROM NODE    350.00 TO NODE    360.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     67.00  DOWNSTREAM(FEET) =     63.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.474
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.913
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 D        0.92      0.20       0.10     75    7.47
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =      4.05
 TOTAL AREA(ACRES) =      0.92   PEAK FLOW RATE(CFS) =      4.05

****************************************************************************
 FLOW PROCESS FROM NODE    360.00 TO NODE    370.00 IS CODE =  91
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =     63.00
 DOWNSTREAM NODE ELEVATION(FEET) =     62.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   100.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.125
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.672
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        0.44      0.20       0.10     75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.97
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.09
 AVERAGE FLOW DEPTH(FEET) =   0.30   FLOOD WIDTH(FEET) =   29.56
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   0.80   Tc(MIN.) =   8.27
 SUBAREA AREA(ACRES) =    0.44       SUBAREA RUNOFF(CFS) =    1.84
 EFFECTIVE AREA(ACRES) =    1.36     AREA-AVERAGED Fm(INCH/HR) =   0.02
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    1.36         PEAK FLOW RATE(CFS) =       5.69

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.31   FLOOD WIDTH(FEET) =   31.52
 FLOW VELOCITY(FEET/SEC.) =   2.13   DEPTH*VELOCITY(FT*FT/SEC) =   0.66
 LONGEST FLOWPATH FROM NODE    350.00 TO NODE    370.00 =   430.00 FEET.
```

```
**************************************************************************
 FLOW PROCESS FROM NODE    370.00 TO NODE    370.00 IS CODE =  81
--------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
 MAINLINE Tc(MIN) =   8.27
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.672
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.00      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     1.00      SUBAREA RUNOFF(CFS) =     4.19
 EFFECTIVE AREA(ACRES) =     2.36    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     2.36        PEAK FLOW RATE(CFS) =        9.88

**************************************************************************
 FLOW PROCESS FROM NODE    370.00 TO NODE    380.00 IS CODE =  51
--------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==========================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     62.00  DOWNSTREAM(FEET) =     59.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   790.00   CHANNEL SLOPE =  0.0038
 CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
 CHANNEL FLOW THRU SUBAREA(CFS) =      9.88
 FLOW VELOCITY(FEET/SEC) =   2.22   FLOW DEPTH(FEET) =   0.92
 TRAVEL TIME(MIN.) =   5.92   Tc(MIN.) =  14.19
 LONGEST FLOWPATH FROM NODE    350.00 TO NODE    380.00 =  1220.00 FEET.

**************************************************************************
 FLOW PROCESS FROM NODE    380.00 TO NODE    380.00 IS CODE =  81
--------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
 MAINLINE Tc(MIN) =  14.19
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.416
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.69      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     0.69      SUBAREA RUNOFF(CFS) =     2.11
 EFFECTIVE AREA(ACRES) =     3.05    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     3.05        PEAK FLOW RATE(CFS) =        9.88
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

**************************************************************************
 FLOW PROCESS FROM NODE    380.00 TO NODE    380.00 IS CODE =  10
--------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
```

```
==========================================================================

**************************************************************************
 FLOW PROCESS FROM NODE    400.00 TO NODE    410.00 IS CODE =  21
--------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     73.00  DOWNSTREAM(FEET) =     70.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   13.672
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.491
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 AGRICULTURAL POOR COVER
 "ROW CROPS,STRAIGHT ROW"   D        1.10      0.20       1.00     91   13.67
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA RUNOFF(CFS) =      3.26
 TOTAL AREA(ACRES) =      1.10   PEAK FLOW RATE(CFS) =      3.26

**************************************************************************
 FLOW PROCESS FROM NODE    410.00 TO NODE    420.00 IS CODE =  91
--------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
==========================================================================
 UPSTREAM NODE ELEVATION(FEET) =     70.00
 DOWNSTREAM NODE ELEVATION(FEET) =     67.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   400.00
 "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.500
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0350
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.864
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 AGRICULTURAL POOR COVER
 "ROW CROPS,STRAIGHT ROW"   D        4.70      0.20       1.00     91
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      8.85
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.19
 AVERAGE FLOW DEPTH(FEET) =   0.78   FLOOD WIDTH(FEET) =   51.34
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   5.60   Tc(MIN.) =  19.27
 SUBAREA AREA(ACRES) =    4.70       SUBAREA RUNOFF(CFS) =   11.27
 EFFECTIVE AREA(ACRES) =    5.80     AREA-AVERAGED Fm(INCH/HR) =   0.20
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   1.00
 TOTAL AREA(ACRES) =    5.80        PEAK FLOW RATE(CFS) =      13.91

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.84   FLOOD WIDTH(FEET) =   63.55
 FLOW VELOCITY(FEET/SEC.) =   1.27   DEPTH*VELOCITY(FT*FT/SEC) =   1.07
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    420.00 =   730.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    420.00 TO NODE    430.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    59.61  DOWNSTREAM(FEET) =    58.41
 FLOW LENGTH(FEET) =   250.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.38
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     13.91
 PIPE TRAVEL TIME(MIN.) =   0.77    Tc(MIN.) =  20.05
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    430.00 =   980.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    430.00 TO NODE    430.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  20.05
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.796
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)   (DECIMAL)  CN
 PUBLIC PARK                 D        2.40      0.20        0.85    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
 SUBAREA AREA(ACRES) =    2.40      SUBAREA RUNOFF(CFS) =    5.67
 EFFECTIVE AREA(ACRES) =    8.20    AREA-AVERAGED Fm(INCH/HR) =  0.19
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.96
 TOTAL AREA(ACRES) =     8.20       PEAK FLOW RATE(CFS) =      19.23

****************************************************************************
 FLOW PROCESS FROM NODE    430.00 TO NODE    440.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    58.41  DOWNSTREAM(FEET) =    57.98
 FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.81
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     19.23
 PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =  20.30
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    440.00 =  1070.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    440.00 TO NODE    440.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  20.30
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.777
 SUBAREA LOSS RATE DATA(AMC  II):
```

```
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                 D        3.39      0.20       0.85    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
  SUBAREA AREA(ACRES) =     3.39      SUBAREA RUNOFF(CFS) =     7.95
  EFFECTIVE AREA(ACRES) =    11.59    AREA-AVERAGED Fm(INCH/HR) =  0.19
  AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.93
  TOTAL AREA(ACRES) =     11.59       PEAK FLOW RATE(CFS) =      27.04

****************************************************************************
  FLOW PROCESS FROM NODE     440.00 TO NODE     450.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     57.98  DOWNSTREAM(FEET) =     55.77
  FLOW LENGTH(FEET) =   460.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  21.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.47
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     27.04
  PIPE TRAVEL TIME(MIN.) =   1.18    Tc(MIN.) =  21.49
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    450.00 =  1530.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     450.00 TO NODE     450.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     460.00 TO NODE     470.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =     67.50  DOWNSTREAM(FEET) =     65.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   13.046
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.581
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 D        0.78      0.20       0.85    75   13.05
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
  SUBAREA RUNOFF(CFS) =      2.39
  TOTAL AREA(ACRES) =      0.78   PEAK FLOW RATE(CFS) =      2.39

****************************************************************************
  FLOW PROCESS FROM NODE     470.00 TO NODE     450.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
```

```
 UPSTREAM NODE ELEVATION(FEET) =      65.00
 DOWNSTREAM NODE ELEVATION(FEET) =     61.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   720.00
 "V" GUTTER WIDTH(FEET) =   2.00   GUTTER HIKE(FEET) =  0.500
 PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0300
 PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
 MAXIMUM DEPTH(FEET) =   1.00
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.569
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 PUBLIC PARK                 D        8.53      0.20        0.85    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     11.21
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.18
 AVERAGE FLOW DEPTH(FEET) =   0.83   FLOOD WIDTH(FEET) =   59.68
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =  10.14   Tc(MIN.) =  23.19
 SUBAREA AREA(ACRES) =    8.53       SUBAREA RUNOFF(CFS) =   18.41
 EFFECTIVE AREA(ACRES) =    9.31     AREA-AVERAGED Fm(INCH/HR) =   0.17
 AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.85
 TOTAL AREA(ACRES) =    9.31         PEAK FLOW RATE(CFS) =      20.10

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.91   FLOOD WIDTH(FEET) =   76.57
 FLOW VELOCITY(FEET/SEC.) =   1.32   DEPTH*VELOCITY(FT*FT/SEC) =   1.20
 LONGEST FLOWPATH FROM NODE    460.00 TO NODE    450.00 =  1050.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    450.00 TO NODE    450.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
     1      20.10  23.19    2.569  0.20( 0.17) 0.85      9.3      460.00
 LONGEST FLOWPATH FROM NODE    460.00 TO NODE    450.00 =  1050.00 FEET.

 ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
     1      27.04  21.49    2.687  0.20( 0.19) 0.93     11.6      400.00
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    450.00 =  1530.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
     1      46.58  21.49    2.687  0.20( 0.18) 0.89     20.2      400.00
     2      45.86  23.19    2.569  0.20( 0.18) 0.89     20.9      460.00
   TOTAL AREA(ACRES) =      20.90

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       46.58  Tc(MIN.) =   21.490
 EFFECTIVE AREA(ACRES) =     20.22  AREA-AVERAGED Fm(INCH/HR) =  0.18
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.89
```

```
 TOTAL AREA(ACRES) =     20.90
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    450.00 =  1530.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    450.00 TO NODE    380.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    55.77  DOWNSTREAM(FEET) =    55.55
 FLOW LENGTH(FEET) =    45.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  27.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.41
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     46.58
 PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =  21.59
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    380.00 =  1575.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    380.00 TO NODE    380.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)     NODE
     1      46.58  21.59     2.679  0.20( 0.18) 0.89     20.2      400.00
     2      45.86  23.29     2.563  0.20( 0.18) 0.89     20.9      460.00
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    380.00 =  1575.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)     NODE
     1       9.88  14.19     3.416  0.20( 0.02) 0.10      3.1      350.00
 LONGEST FLOWPATH FROM NODE    350.00 TO NODE    380.00 =  1220.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)     NODE
     1      49.52  14.19     3.416  0.20( 0.15) 0.74     16.3      350.00
     2      54.31  21.59     2.679  0.20( 0.16) 0.79     23.3      400.00
     3      53.25  23.29     2.563  0.20( 0.16) 0.79     24.0      460.00
   TOTAL AREA(ACRES) =     23.95

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      54.31  Tc(MIN.) =   21.591
 EFFECTIVE AREA(ACRES) =    23.27  AREA-AVERAGED Fm(INCH/HR) =  0.16
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.74
 TOTAL AREA(ACRES) =     23.95
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    380.00 =  1575.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    380.00 TO NODE    480.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     55.55  DOWNSTREAM(FEET) =     54.16
  FLOW LENGTH(FEET) =   290.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  29.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.67
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =    1
  PIPE-FLOW(CFS) =     54.31
  PIPE TRAVEL TIME(MIN.) =   0.63    Tc(MIN.) =  22.22
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    480.00 =  1865.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    480.00 TO NODE    480.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  22.22
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.631
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        0.29      0.20       0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.29      SUBAREA RUNOFF(CFS) =    0.68
  EFFECTIVE AREA(ACRES) =    23.56   AREA-AVERAGED Fm(INCH/HR) =  0.16
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.78
  TOTAL AREA(ACRES) =    24.24      PEAK FLOW RATE(CFS) =      54.31
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    480.00 TO NODE    480.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  22.22
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.631
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        1.15      0.20       0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.15      SUBAREA RUNOFF(CFS) =    2.70
  EFFECTIVE AREA(ACRES) =    24.71   AREA-AVERAGED Fm(INCH/HR) =  0.15
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.75
  TOTAL AREA(ACRES) =    25.39      PEAK FLOW RATE(CFS) =      55.18

****************************************************************************
  FLOW PROCESS FROM NODE    480.00 TO NODE    490.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     54.16  DOWNSTREAM(FEET) =     52.92
  FLOW LENGTH(FEET) =   260.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  29.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.67
```

```
 ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     55.18
 PIPE TRAVEL TIME(MIN.) =   0.56    Tc(MIN.) =  22.79
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    490.00 =  2125.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    490.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  22.79
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.593
 SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        0.25      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.25      SUBAREA RUNOFF(CFS) =    0.58
 EFFECTIVE AREA(ACRES) =    24.96   AREA-AVERAGED Fm(INCH/HR) =  0.15
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.74
 TOTAL AREA(ACRES) =    25.64       PEAK FLOW RATE(CFS) =      55.18
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    490.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  22.79
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.593
 SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 D        1.75      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    1.75      SUBAREA RUNOFF(CFS) =    4.05
 EFFECTIVE AREA(ACRES) =    26.71   AREA-AVERAGED Fm(INCH/HR) =  0.14
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.70
 TOTAL AREA(ACRES) =    27.39       PEAK FLOW RATE(CFS) =      58.96

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    500.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    52.92  DOWNSTREAM(FEET) =    49.80
 FLOW LENGTH(FEET) =   650.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  30.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.77
 ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     58.96
 PIPE TRAVEL TIME(MIN.) =   1.39    Tc(MIN.) =  24.18
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    500.00 =  2775.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  24.18
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.509
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.32      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     0.32      SUBAREA RUNOFF(CFS) =     0.72
 EFFECTIVE AREA(ACRES) =    27.03    AREA-AVERAGED Fm(INCH/HR) =  0.14
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.69
 TOTAL AREA(ACRES) =    27.71        PEAK FLOW RATE(CFS) =       58.96
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    510.00 TO NODE    520.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
 ELEVATION DATA: UPSTREAM(FEET) =     68.00  DOWNSTREAM(FEET) =     65.70

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   13.265
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.550
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 PUBLIC PARK                 D        1.00      0.20       0.85    75   13.27
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.85
 SUBAREA RUNOFF(CFS) =      3.04
 TOTAL AREA(ACRES) =      1.00   PEAK FLOW RATE(CFS) =      3.04

****************************************************************************
 FLOW PROCESS FROM NODE    520.00 TO NODE    530.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    60.00  DOWNSTREAM(FEET) =    58.68
 FLOW LENGTH(FEET) =   220.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  15.0 INCH PIPE IS   8.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.10
 ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
```

```
 PIPE-FLOW(CFS) =      3.04
 PIPE TRAVEL TIME(MIN.) =   0.89    Tc(MIN.) =  14.16
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    530.00 =   550.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    530.00 TO NODE    530.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  14.16
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.421
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.16      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     2.16      SUBAREA RUNOFF(CFS) =     6.61
 EFFECTIVE AREA(ACRES) =     3.16    AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.34
 TOTAL AREA(ACRES) =     3.16        PEAK FLOW RATE(CFS) =        9.54

****************************************************************************
 FLOW PROCESS FROM NODE    530.00 TO NODE    540.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    58.68  DOWNSTREAM(FEET) =    56.10
 FLOW LENGTH(FEET) =   430.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.40
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      9.54
 PIPE TRAVEL TIME(MIN.) =   1.33    Tc(MIN.) =  15.49
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    540.00 =   980.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    540.00 TO NODE    540.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  15.49
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.246
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        5.60      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     5.60      SUBAREA RUNOFF(CFS) =    16.26
 EFFECTIVE AREA(ACRES) =     8.76    AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.19
 TOTAL AREA(ACRES) =     8.76        PEAK FLOW RATE(CFS) =       25.30

****************************************************************************
 FLOW PROCESS FROM NODE    540.00 TO NODE    550.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    56.10  DOWNSTREAM(FEET) =    54.78
  FLOW LENGTH(FEET) =   220.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.88
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     25.30
  PIPE TRAVEL TIME(MIN.) =   0.53    Tc(MIN.) =  16.02
  LONGEST FLOWPATH FROM NODE    510.00 TO NODE    550.00 =  1200.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    550.00 TO NODE    550.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  16.02
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.186
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)   (DECIMAL)  CN
  COMMERCIAL                  D        2.46      0.20        0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.46      SUBAREA RUNOFF(CFS) =    7.01
  EFFECTIVE AREA(ACRES) =    11.22   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =    11.22       PEAK FLOW RATE(CFS) =      31.83

****************************************************************************
  FLOW PROCESS FROM NODE    550.00 TO NODE    550.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  16.02
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.186
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)   (DECIMAL)  CN
  COMMERCIAL                  D        2.05      0.20        0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.05      SUBAREA RUNOFF(CFS) =    5.84
  EFFECTIVE AREA(ACRES) =    13.27   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =    13.27       PEAK FLOW RATE(CFS) =      37.68

****************************************************************************
  FLOW PROCESS FROM NODE    550.00 TO NODE    560.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    54.78  DOWNSTREAM(FEET) =    52.08
  FLOW LENGTH(FEET) =   450.00   MANNING'S N =  0.013
```

```
 DEPTH OF FLOW IN  33.0 INCH PIPE IS  26.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.45
 ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     37.68
 PIPE TRAVEL TIME(MIN.) =   1.01    Tc(MIN.) =  17.02
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    560.00 =  1650.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    560.00 TO NODE    560.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.02
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.073
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 AGRICULTURAL GOOD COVER
 "PASTURE,IRRIGATED"         D        3.05      0.20       1.00    79
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA AREA(ACRES) =    3.05      SUBAREA RUNOFF(CFS) =    7.89
 EFFECTIVE AREA(ACRES) =    16.32   AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.31
 TOTAL AREA(ACRES) =    16.32       PEAK FLOW RATE(CFS) =      44.22

****************************************************************************
 FLOW PROCESS FROM NODE    560.00 TO NODE    560.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.02
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.073
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.62      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    1.62      SUBAREA RUNOFF(CFS) =    4.45
 EFFECTIVE AREA(ACRES) =    17.94   AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.29
 TOTAL AREA(ACRES) =    17.94       PEAK FLOW RATE(CFS) =      48.67

****************************************************************************
 FLOW PROCESS FROM NODE    560.00 TO NODE    570.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    52.08  DOWNSTREAM(FEET) =    50.04
 FLOW LENGTH(FEET) =   340.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  29.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.90
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     48.67
 PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =  17.74
```

```
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    570.00 =  1990.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    570.00 TO NODE    570.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.74
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.999
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        4.95      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    4.95      SUBAREA RUNOFF(CFS) =   13.27
 EFFECTIVE AREA(ACRES) =   22.89    AREA-AVERAGED Fm(INCH/HR) =  0.05
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.25
 TOTAL AREA(ACRES) =    22.89       PEAK FLOW RATE(CFS) =      60.74

****************************************************************************
 FLOW PROCESS FROM NODE    570.00 TO NODE    500.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    50.04  DOWNSTREAM(FEET) =    49.80
 FLOW LENGTH(FEET) =    40.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  29.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.58
 ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     60.74
 PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =  17.82
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2030.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1      60.74  17.82    2.992  0.20( 0.05) 0.25     22.9      510.00
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =  2030.00 FEET.

 ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.) (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1      55.64  16.83    3.095  0.20( 0.12) 0.62     20.1      350.00
     2      58.96  24.18    2.509  0.20( 0.14) 0.69     27.0      400.00
     3      57.90  25.90    2.413  0.20( 0.14) 0.70     27.7      460.00
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    500.00 =  2775.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc   Intensity   Fp(Fm)      Ap    Ae      HEADWATER
```

```
 NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)        (ACRES)     NODE
    1     115.02   16.83      3.095  0.20( 0.09) 0.43     41.7      350.00
    2     116.82   17.82      2.992  0.20( 0.09) 0.44     43.9      510.00
    3     109.72   24.18      2.509  0.20( 0.10) 0.49     49.9      400.00
    4     106.68   25.90      2.413  0.20( 0.10) 0.50     50.6      460.00
  TOTAL AREA(ACRES) =      50.60

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      116.82  Tc(MIN.) =   17.819
 EFFECTIVE AREA(ACRES) =    43.92  AREA-AVERAGED Fm(INCH/HR) =  0.09
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.43
 TOTAL AREA(ACRES) =     50.60
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    500.00 =  2775.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    580.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    49.80  DOWNSTREAM(FEET) =    48.02
 FLOW LENGTH(FEET) =   370.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  54.0 INCH PIPE IS  40.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.21
 ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    116.82
 PIPE TRAVEL TIME(MIN.) =   0.67    Tc(MIN.) =  18.49
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    580.00 =  3145.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    580.00 TO NODE    580.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  18.49
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.933
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        0.26      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    0.26      SUBAREA RUNOFF(CFS) =    0.68
 EFFECTIVE AREA(ACRES) =    44.18   AREA-AVERAGED Fm(INCH/HR) =  0.09
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.43
 TOTAL AREA(ACRES) =    50.86       PEAK FLOW RATE(CFS) =     116.82
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    580.00 TO NODE    580.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  18.49
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.933
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
```

```
      LAND USE              GROUP   (ACRES)   (INCH/HR)   (DECIMAL)   CN
  COMMERCIAL                  D        5.90       0.20        0.10     75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     5.90      SUBAREA RUNOFF(CFS) =    15.47
  EFFECTIVE AREA(ACRES) =    50.08    AREA-AVERAGED Fm(INCH/HR) =  0.08
  AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.39
  TOTAL AREA(ACRES) =     56.76       PEAK FLOW RATE(CFS) =      128.64

****************************************************************************
  FLOW PROCESS FROM NODE     580.00 TO NODE     590.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     48.02  DOWNSTREAM(FEET) =     46.24
  FLOW LENGTH(FEET) =    370.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  54.0 INCH PIPE IS  44.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    9.27
  ESTIMATED PIPE DIAMETER(INCH) =  54.00     NUMBER OF PIPES =    1
  PIPE-FLOW(CFS) =     128.64
  PIPE TRAVEL TIME(MIN.) =    0.66     Tc(MIN.) =  19.15
  LONGEST FLOWPATH FROM NODE     400.00 TO NODE     590.00 =  3515.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     590.00 TO NODE     590.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  19.15
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.874
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        0.30       0.20        0.10     75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     0.30      SUBAREA RUNOFF(CFS) =     0.77
  EFFECTIVE AREA(ACRES) =    50.38    AREA-AVERAGED Fm(INCH/HR) =  0.08
  AREA-AVERAGED Fp(INCH/HR) =  0.20   AREA-AVERAGED Ap =  0.39
  TOTAL AREA(ACRES) =     57.06       PEAK FLOW RATE(CFS) =      128.64
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE     590.00 TO NODE     590.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     590.00 TO NODE     590.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     600.00 TO NODE     610.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
  ELEVATION DATA: UPSTREAM(FEET) =     64.50  DOWNSTREAM(FEET) =     63.10

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.221
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.391
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  D        0.81      0.20        0.10    75    9.22
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      3.19
  TOTAL AREA(ACRES) =      0.81   PEAK FLOW RATE(CFS) =      3.19

****************************************************************************
  FLOW PROCESS FROM NODE    610.00 TO NODE    620.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   63.10  DOWNSTREAM ELEVATION(FEET) =   59.50
  STREET LENGTH(FEET) =   660.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.017
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.017

  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 =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.63
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.43
    HALFSTREET FLOOD WIDTH(FEET) =   17.46
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.07
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.89
  STREET FLOW TRAVEL TIME(MIN.) =   5.30   Tc(MIN.) =  14.52
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.369
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  D        1.61      0.20        0.10    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.61      SUBAREA RUNOFF(CFS) =    4.85
  EFFECTIVE AREA(ACRES) =    2.42    AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    2.42        PEAK FLOW RATE(CFS) =       7.29
```

```
 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.46  HALFSTREET FLOOD WIDTH(FEET) =  19.34
 FLOW VELOCITY(FEET/SEC.) =  2.21  DEPTH*VELOCITY(FT*FT/SEC.) =  1.02
 LONGEST FLOWPATH FROM NODE   600.00 TO NODE   620.00 =   990.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   620.00 TO NODE   630.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    53.00  DOWNSTREAM(FEET) =    49.89
 FLOW LENGTH(FEET) =   400.00  MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.56
 ESTIMATED PIPE DIAMETER(INCH) =  18.00   NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      7.29
 PIPE TRAVEL TIME(MIN.) =   1.20   Tc(MIN.) =  15.72
 LONGEST FLOWPATH FROM NODE   600.00 TO NODE   630.00 =  1390.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   630.00 TO NODE   630.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  15.72
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.219
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                D        2.20      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    2.20      SUBAREA RUNOFF(CFS) =    6.33
 EFFECTIVE AREA(ACRES) =     4.62   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     4.62       PEAK FLOW RATE(CFS) =      13.30

****************************************************************************
 FLOW PROCESS FROM NODE   630.00 TO NODE   630.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  15.72
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.219
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                D        4.22      0.20       0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    4.22      SUBAREA RUNOFF(CFS) =   12.15
 EFFECTIVE AREA(ACRES) =     8.84   AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     8.84       PEAK FLOW RATE(CFS) =      25.45

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

```
 FLOW PROCESS FROM NODE    630.00 TO NODE    640.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    49.89  DOWNSTREAM(FEET) =    46.48
 FLOW LENGTH(FEET) =   560.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.93
 ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     25.45
 PIPE TRAVEL TIME(MIN.) =   1.35    Tc(MIN.) =  17.07
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    640.00 =  1950.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    640.00 TO NODE    640.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.07
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.068
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.30      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    2.30      SUBAREA RUNOFF(CFS) =    6.31
 EFFECTIVE AREA(ACRES) =   11.14    AREA-AVERAGED Fm(INCH/HR) =  0.02
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =    11.14       PEAK FLOW RATE(CFS) =      30.56

****************************************************************************
 FLOW PROCESS FROM NODE    640.00 TO NODE    590.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    46.48  DOWNSTREAM(FEET) =    46.24
 FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  33.0 INCH PIPE IS  24.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.60
 ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     30.56
 PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =  17.20
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    590.00 =  2000.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    590.00 TO NODE    590.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1      30.56  17.20     3.054   0.20( 0.02) 0.10     11.1      600.00
```

```
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    590.00 =  2000.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1     126.77   18.17     2.961   0.20( 0.08) 0.39     48.2      350.00
     2     128.64   19.15     2.874   0.20( 0.08) 0.39     50.4      510.00
     3     120.02   25.54     2.432   0.20( 0.09) 0.45     56.4      400.00
     4     116.80   27.27     2.342   0.20( 0.09) 0.45     57.1      460.00
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    590.00 =  3515.00 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc    Intensity    Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
     1     154.41   17.20     3.054   0.20( 0.07) 0.33     56.7      600.00
     2     156.40   18.17     2.961   0.20( 0.07) 0.33     59.3      350.00
     3     157.39   19.15     2.874   0.20( 0.07) 0.34     61.5      510.00
     4     144.32   25.54     2.432   0.20( 0.08) 0.39     67.5      400.00
     5     140.19   27.27     2.342   0.20( 0.08) 0.39     68.2      460.00
   TOTAL AREA(ACRES) =      68.20

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      157.39  Tc(MIN.) =   19.154
 EFFECTIVE AREA(ACRES) =     61.52  AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.34
 TOTAL AREA(ACRES) =     68.20
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    590.00 =  3515.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    590.00 TO NODE    650.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    46.24  DOWNSTREAM(FEET) =    45.86
 FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  60.0 INCH PIPE IS  45.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.84
 ESTIMATED PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    157.39
 PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =  19.29
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    650.00 =  3595.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    650.00 TO NODE    650.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  19.29
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.863
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        2.44      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    2.44      SUBAREA RUNOFF(CFS) =    6.24
```

```
 EFFECTIVE AREA(ACRES) =    63.96   AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.33
 TOTAL AREA(ACRES) =    70.64       PEAK FLOW RATE(CFS) =     160.97

****************************************************************************
 FLOW PROCESS FROM NODE    650.00 TO NODE    660.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    45.50  DOWNSTREAM(FEET) =    44.00
 FLOW LENGTH(FEET) =   840.50   MANNING'S N =  0.013
 DEPTH OF FLOW IN  72.0 INCH PIPE IS  55.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.83
 ESTIMATED PIPE DIAMETER(INCH) =  72.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    160.97
 PIPE TRAVEL TIME(MIN.) =   2.05    Tc(MIN.) =  21.34
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    660.00 =  4435.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    650.00 TO NODE    650.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  21.34
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.698
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  D        1.62      0.20        0.10    75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =    1.62      SUBAREA RUNOFF(CFS) =    3.90
 EFFECTIVE AREA(ACRES) =    65.58   AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.32
 TOTAL AREA(ACRES) =    72.26       PEAK FLOW RATE(CFS) =     160.97
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =     72.26  TC(MIN.) =     21.34
 EFFECTIVE AREA(ACRES) =     65.58  AREA-AVERAGED Fm(INCH/HR)=  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.32
 PEAK FLOW RATE(CFS)    =    160.97

 ** PEAK FLOW RATE TABLE **
  STREAM     Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
  NUMBER   (CFS)  (MIN.)  (INCH/HR) (INCH/HR)          (ACRES)    NODE
     1    158.43  19.38     2.854  0.20( 0.06) 0.32     60.8      600.00
     2    160.33  20.36     2.773  0.20( 0.06) 0.32     63.4      350.00
     3    160.97  21.34     2.698  0.20( 0.06) 0.32     65.6      510.00
     4    147.89  27.79     2.317  0.20( 0.07) 0.37     71.6      400.00
     5    143.57  29.52     2.241  0.20( 0.08) 0.38     72.3      460.00
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

WATER DISCHARGE REQUIREMENTS FOR THE COUNTY OF ORANGE

California Regional Water Quality Control Board
Santa Ana Region

ORDER NO. R8-2002-0010
NPDES No. CAS618030

Waste Discharge Requirements
for
the County of Orange, Orange County Flood Control District
and
The Incorporated Cities of Orange County Within the Santa Ana Region
Areawide Urban Storm Water Runoff
Orange County

The California Regional Water Quality Control Board, Santa Ana Region (hereinafter Regional Board) finds that:

1. The 1987 amendments to the Clean Water Act (CWA) added Section 402(p) establishing a framework for regulating municipal and industrial (including construction) storm water discharges under the National Pollutant Discharge Elimination System (NPDES). Section 402(p) of the CWA requires NPDES permits for storm water discharges from municipal separate storm sewer systems (MS4) as well as other designated storm water discharges that are considered significant contributors of pollutants to waters of the United States. On November 16, 1990, the United States Environmental Protection Agency (hereinafter EPA) amended its NPDES permit regulations (40 CFR Parts 122, 123 and 124) to describe permit application requirements for storm water discharges.

2. Prior to EPA's promulgation of the storm water permit regulations, the three counties (Orange, Riverside, and San Bernardino) and the incorporated cities within the jurisdiction of the Santa Ana Regional Board requested areawide NPDES permits for urban storm water runoff. On July 13, 1990, the Regional Board adopted Order No. 90-71 for urban storm water runoff from urban areas in Orange County within the Santa Ana Region. The County of Orange was named as the principal permittee and the Orange County Flood Control District (OCFCD) and the incorporated cities were named as the co-permittees. Order No. 96-31, issued by the Regional Board on March 8, 1996, renewed the permit for another five years.

3. Order No. 96-31 expired on March 1, 2001. On September 1, 2000, the County of Orange Public Facilities and Resources Department (OCPFRD) and the Orange County Flood Control District (OCFCD) in cooperation with the cities of Anaheim, Brea, Buena Park, Costa Mesa, Cypress, Fountain Valley, Fullerton, Garden Grove, Huntington Beach, Irvine, Laguna Woods, La Habra, La Palma, Lake Forest, Los Alamitos, Newport Beach, Orange, Placentia, Santa Ana, Seal Beach, Stanton, Tustin, Villa Park, Westminster, and Yorba Linda (hereinafter collectively referred to as permittees or dischargers), submitted NPDES Application No. CAS618030 and a Report of Waste Discharge for reissuance of their areawide storm water permit. In order to more effectively carry out the requirements of this order, the permittees have agreed that the County of Orange will continue as principal permittee and the OCFCD and the incorporated cities will continue as co-permittees. On March 5, 2001, Order No. 96-31, NPDES No.

CAS618030, was administratively extended in accordance with Title 23, Division 3, Chapter 9, §2235.4 of the California Code of Regulations.

4. The permittees serve a population of approximately 2.8 million, occupying an area of approximately 786 square miles (including unincorporated areas and the limits of 33 cities, 25 of which are within the jurisdiction of this Regional Board; two of the cities, Laguna Woods and Lake Forest, are within both the San Diego and Santa Ana Regional Boards' jurisdictions). The permitted area is shown on Attachment A. The permittees have jurisdiction over and /or maintenance responsibility for storm water conveyance systems within Orange County. The County's systems include an estimated 400 miles of storm drain systems. A major portion of the urbanized areas of Orange County drains into waterbodies within this Regional Board's jurisdiction. In certain cases, where a natural streambed is modified to convey storm water flows, the conveyance system becomes both an MS4 and a receiving water. The major storm drain systems and drainage areas in Orange County, which are within this Region, are shown on Attachment B. A portion of the Orange County drainage area is within the jurisdiction of the San Diego Regional Board and is regulated under an order issued by that Board.

5. Storm water outfalls from the MS4 systems in Orange County enter, or are tributary to, various water bodies of the Region. The permitted area can be subdivided into five tributary watersheds: the San Gabriel River drainage area, the Huntington Harbour and Bolsa Bay drainage area, the Santa Ana River drainage area, the Newport Bay drainage area, and the Irvine and Newport Coast Areas of Special Biological Significance (see Attachment B). These watersheds are tributary to the Pacific Ocean. The surface water bodies in Orange County include:

   Inland Surface Streams

   a. Santa Ana River, Reaches 1 and 2,
   b. Silverado Creek (tributary to Santiago Creek),
   c. Santiago Creek, Reaches 1, 2, 3, and 4 (tributary to the Santa Ana River),
   d. San Diego Creek, Reaches 1 and 2 (tributary to Newport Bay),
   e. San Joaquin Freshwater Marsh (tributary to San Diego Creek),
   f. All other tributaries to these Creeks: Bonita Creek, Serrano Creek, Peters Canyon Wash, Hicks Canyon Wash, Bee Canyon Wash, Borrego Canyon Wash, Agua Chinon Wash, Laguna Canyon Wash, Rattlesnake Canyon Wash, Sand Canyon Wash, Black Star Creek, Carbon Canyon Creek, Coyote Creek and other tributaries.

   Bays, Estuaries, and Tidal Prisms

   a. Anaheim Bay,
   b. Sunset Bay,
   c. Bolsa Bay and Bolsa Chica Ecological Reserve,
   d. Lower and Upper Newport Bay,

e. Tidal Prism of Santa Ana River (to within 1000 feet of Victoria Street) and Newport Slough, Santa Ana Salt Marsh,

f. Tidal Prism of San Gabriel River (River Mouth to Marina Drive),

g. Tidal Prisms of Flood Control Channels Discharging to Coastal or Bay Waters (e.g. Huntington Harbour).

Ocean Waters

Nearshore Zone

a. San Gabriel River to Poppy Street in Corona Del Mar,

b. Poppy Street to Southeast Regional Boundary.

Offshore Zone

a. Waters between Nearshore Zone and Limit of State Waters.

Lakes and Reservoirs

a. Anaheim Lakes,

b. Irvine Lake (Santiago Reservoir),

c. Laguna, Peters Canyon, and Rattlesnake Reservoirs.

The beneficial uses of these water bodies include: municipal and domestic supply, agricultural supply, industrial service and process supply, groundwater recharge, navigation, hydropower generation, water contact recreation, non-contact water recreation, commercial and sportfishing, warm freshwater and limited warm freshwater habitats, cold freshwater habitat, preservation of biological habitats of special significance, wildlife habitat, preservation of rare, threatened or endangered species, marine habitat, shellfish harvesting, spawning, reproduction and development of aquatic habitats, and estuarine habitat . The ultimate goal of this storm water management program is to protect the beneficial uses of the receiving waters.

6. The Santa Ana River Basin is the major watershed within the jurisdiction of the Regional Board. The lower Santa Ana River Basin (downstream from Prado Basin) includes the Orange County drainage areas and the Upper Santa Ana River Basin includes the San Bernardino and the Riverside drainage areas. Generally, the San Bernardino County drainage areas drain to the Riverside County drainage areas, and Riverside County drainage areas discharge to Orange County.

7. Within the Region, runoff from the San Bernardino County areas is generally conveyed to the Riverside County areas through the Santa Ana River or other drainage channels tributary to the Santa Ana River. These flows are then discharged to Reach 2 of the Santa Ana River through Prado Basin (Reach 3 of the Santa Ana River). Most of the flow in Reach 2 is recharged in Orange County. During wet weather, some of the flow is discharged to the Pacific Ocean through Reach 1 of the Santa Ana River.

8. The three county areas within this Region are regulated under three areawide permits for urban storm water runoff. These areawide NPDES permits are:

    a. Orange County, NPDES No. CAS618030;

    b. Riverside County, NPDES No. CAS618033; and,

    c. San Bernardino County, NPDES No. CAS618036.

    For an effective watershed management program, cooperation and coordination among the regulators, the municipal permittees, the public, and other entities are essential.

9. Studies conducted by the EPA, the states, flood control districts and other entities indicate the following major sources for urban storm water pollution nationwide:

    a. Industrial sites where appropriate pollution control and best management practices (BMPs)[1] are not implemented;

    b. Construction sites where erosion and siltation controls and BMPs are not implemented; and,

    c. Urban runoff where the drainage area is not properly managed.

10. A number of permits were adopted to address pollution from the sources identified in Finding 9, above. The State Board issued two statewide general NPDES permits: one for storm water runoff from industrial activities (NPDES No. CAS000001, General Industrial Activities Storm Water Permit) and a second one for storm water runoff from construction activities (NPDES No. CAS000002, General Construction Activity Storm Water Permit). Industrial activities (as identified in 40 CFR 122.26(b)(14)) and construction sites of five acres or more, are required to obtain coverage under these statewide general permits. The permittees have developed project conditions of approval requiring coverage under the State's General Permit for new developments to be implemented at the time of grading or building permit issuance for construction sites on five acres or more and at the time of local permit issuance for industrial facilities. The State Board also adopted Order No. 99-06-DWQ, NPDES No. CAS000003, for storm water runoff from facilities (including freeways and highways) owned and/or operated by Caltrans. The Regional Board adopted Order 99-11, NPDES No. CAG018001, for concentrated animal feeding operations, including dairies. The Regional Board also issues individual storm water permits for certain industrial facilities within the Region. Currently there are 22 individual storm water NPDES permits; 8 of these facilities are located in the Orange County area. Additionally, for a number of facilities that discharge process wastewater and storm water, storm water discharge requirements are included with the facilities' NPDES permit for process wastewater.

11. In most cases, the industries and construction sites covered under the Statewide General Industrial and Construction Permits discharge into storm drains and/or flood control facilities owned and operated by the permittees. These industries and construction sites are also regulated under local laws and regulations. A coordinated effort between the permittees and the

---

[1] Best Management Practices (BMPs) are water quality management practices that are maximized in efficiency for the control of storm water runoff pollution.

Regional Board staff is critical to avoid duplicative and overlapping efforts when overseeing the compliance of dischargers covered under the Statewide General Permits. As part of this coordination, the permittees have been notifying Regional Board staff when they observe conditions that pose a threat or potential threat to water quality, or when an industrial facility or construction activity that has failed to obtain required coverage under the appropriate general storm water permit.

12. The permittees have the authority to approve plans for residential, commercial, and industrial developments. If not properly controlled and managed, urbanization could result in the discharge of pollutants in storm water runoff. Urban area runoff (Finding 9.c) may contain elevated levels of pathogens (bacteria, protozoa, viruses), sediment, trash, fertilizers (nutrients, compounds of nitrogen and phosphorus), pesticides (DDT, Chlordane, Diazinon, Chlorpyrifos), heavy metals (cadmium, chromium, copper, lead, zinc), and petroleum products (oil, grease, petroleum hydrocarbons, polycyclic aromatic hydrocarbons). Storm water can carry these pollutants to rivers, streams, lakes, bays and the ocean (receiving waters).

13. Pollutants in urban runoff can impact the beneficial uses of the receiving waters and can cause or threaten to cause a condition of pollution or nuisance. Pathogens (from sanitary sewer overflows, septic system leaks, spills and leaks from portable toilets, pets, wildlife and human activities) can impact water contact recreation, non-contact water recreation and shellfish harvesting. Microbial contamination of the beaches from urban runoff and other sources has resulted in a number of health advisories issued by the Orange County Health Officer. Floatables (from trash) are an aesthetic nuisance and can be a substrate for algae and insect vectors. Oil and grease can coat birds and aquatic organisms, adversely affecting respiration and/or thermoregulation. Other petroleum hydrocarbon components can cause toxicity to aquatic organisms and can impact human health. Suspended and settleable solids (from sediment, trash, and industrial activities) can be deleterious to benthic organisms and may cause anaerobic conditions to form. Sediments and other suspended particulates can cause turbidity, clog fish gills and interfere with respiration in aquatic fauna. They can also screen out light, hindering photosynthesis and normal aquatic plant growth and development. Toxic substances (from pesticides, herbicides, petroleum products, metals, industrial wastes) can cause acute and/or chronic toxicity, and can bioaccumulate in organisms to levels that may be harmful to human health. Nutrients (from fertilizers, confined animal facilities, pets, birds) can cause excessive algal blooms. These blooms can lead to problems with taste, odor, color and increased turbidity, and can depress the dissolved oxygen content, leading to fish kills.

14. A major portion of Orange County is urbanized with residential, commercial and industrial developments. Urban development increases impervious surfaces and storm water runoff volume and velocity and decreases vegetated, pervious surface available for infiltration of storm water. Increase in runoff volume and velocity can cause scour, erosion (sheet, rill and/or gully), aggradation (raising of a streambed from sediment deposition) and can change fluvial geomorphology, hydrology and aquatic ecosystems. The local agencies (the permittees) are the owners and operators of the MS4 systems and have established appropriate legal authority to control some but not all discharges to these systems (see Finding 16). The permittees have established appropriate legal authority to control discharges into the MS4 systems. They adopted grading and/or erosion control ordinances, guidelines and best management practices

(BMPs) for municipal, commercial, and industrial activities, and a drainage area management plan (DAMP). The permittees must exercise a combination of these programs, policies, and legal authority to ensure that pollutant loads resulting from urbanization are properly controlled and managed.

15. This order regulates urban storm water runoff from areas under the jurisdiction of the permittees. Urban storm water runoff includes those discharges from residential, commercial, industrial and construction areas within the permitted area and excludes discharges from feedlots, dairies, and farms (also see Finding 16). Storm water discharges consist of surface runoff generated from various land uses in all the hydrologic drainage areas that discharge into the water bodies of the U.S. The quality of these discharges varies considerably and is affected by land use activities, basin hydrology and geology, season, the frequency and duration of storm events, and the presence of illicit[2] disposal practices and illegal connections.

16. The permittees may lack legal jurisdiction over storm water discharges into their systems from some State and Federal facilities, utilities and special districts, Native American tribal lands, waste water management agencies and other point and non-point source discharges otherwise permitted by the Regional Board. The Regional Board recognizes that the permittees should not be held responsible for such facilities and/or discharges. Similarly, certain activities that generate pollutants present in storm water runoff may be beyond the ability of the permittees to eliminate. Examples of these include operation of internal combustion engines, atmospheric deposition, brake pad wear, tire wear and leaching of naturally occurring minerals from local geography.

17. This order is intended to regulate the discharge of pollutants in urban storm water runoff from anthropogenic (generated from human activities) sources within the jurisdiction and control of the permittees and is not intended to address background or naturally occurring pollutants or flows.

18. Water quality assessments conducted by Regional Board staff have identified a number of beneficial use impairments due, in part, to urban runoff. Section 303(b) of the CWA requires each of the regional boards to routinely monitor and assess the quality of waters of the region. If this assessment indicates that beneficial uses and/or water quality objectives are not met, then that waterbody must be listed under Section 303(d) of the CWA as an impaired waterbody. The 1998 water quality assessment listed a number of water bodies within the Region under Section 303(d) as impaired waterbodies. In the Orange County area, these include: (1) San Diego Creek, Reach 1 (listed for sedimentation/siltation, metals, nutrients, pesticides); (2) San Diego Creek, Reach 2 (listed for sedimentation/siltation, nutrients, metals, unknown toxicity); (3) Upper Newport Bay Ecological Reserve (listed for sedimentation/siltation, metals, nutrients, pathogens, pesticides); (4) Lower Newport Bay (listed for metals, pesticides, pathogens, nutrients, priority organics); (5) Anaheim Bay (listed for metals, pesticides); 6) Huntington Harbour (listed for metals, pesticides, pathogens); 7) Santiago Creek, Reach 4 (listed for salinity, TDS, chlorides); and 8) Silverado Creek (listed for pathogens, salinity, TDS,

[2] Illicit Disposal means any disposal, either intentionally or unintentionally, of material or waste that can pollute storm water or create a nuisance.

chlorides). For some of these impaired waterbodies, one of the listed causes of impairment is urban runoff.

19. Federal regulations require that a total maximum daily load (TMDL) be established for each 303(d) listed waterbody for each of the pollutants causing impairment. The TMDL is the total amount of the problem pollutant that can be discharged while water quality standards in the receiving water are attained, i.e., water quality objectives are met and the beneficial uses are protected. It is the sum of the individual wasteload allocations (WLA) for point source inputs, load allocations (LA) for non-point source inputs and natural background, with a margin of safety. The TMDLs are the basis for limitations established in waste discharge requirements. TMDLs have been developed for sediment and nutrients for San Diego Creek and Newport Bay. A fecal coliform TMDL for Newport Bay has also been established The WLAs from these TMDLs are included in this order. Dischargers to these water bodies are currently implementing these TMDLs. This order specifies the WLAs and includes requirements for the implementation of these WLAs.

20. The MS4s generally contain non-storm water flows such as irrigation runoff, runoff from non-commercial car washes, runoff from miscellaneous washing and cleaning operations, and other nuisance flows. Discharges of non-storm water containing pollutants into the MS4 systems and to waters of the U.S. are prohibited unless they are regulated under a separate NPDES permit, or are exempt, as indicated in Discharge Prohibitions, Section III.3 of this order.

21. Order No. 90-71 (first term permit) required the permittees to: (1) develop and implement the DAMP and a storm water and receiving water monitoring plan; (2) eliminate illegal[3] and illicit discharges[4] to the MS4s; and (3) enact the necessary legal authority to effectively prohibit such discharges. The overall goal of these requirements was to reduce pollutant loadings to surface waters from urban runoff to the maximum extent practicable (MEP)[5]. Order No. 96-31 (second term permit) required continued implementation of the DAMP and the monitoring plan, and required the permittees to focus on those areas that threaten beneficial uses.

22. This order (Order No. R8-2002-0010, third term permit) outlines additional steps for an effective storm water management program and specifies requirements to protect the beneficial uses of all receiving waters. This order requires the permittees to examine sources of pollutants in storm water runoff from activities which the permittees conduct, approve, regulate and/or authorize by issuing a license or permit.

23. The Report of Waste Discharge (the permit renewal application) included the following major documents:

---

[3] Illegal discharge means any discharge (or seepage) to the municipal separate storm sewer that is not composed entirely of storm water except for the authorized discharges listed in Section III of this permit. Illegal discharges include the improper disposal of wastes into the storm sewer system.

[4] Illicit Discharge means any discharge to the storm drain system that is prohibited under local, state, or federal statutes, ordinances, codes, or regulations. The term illicit discharge includes all non storm-water discharges except discharges pursuant to an NPDES permit, discharges that are identified in Section III, Discharge Limitations/Prohibitions, of this order, and discharges authorized by the Regional Board Exectutive Officer.

[5] Maximum Extent Practicable (MEP) means to the maximum extent feasible, taking into account considerations of synergistic, additive, and competing factors, including but not limited to, gravity of the problem, technical feasibility, fiscal feasibility, public health risks, societal concerns, and social benefits.

a. A summary of status of current Storm Water Management Program;

b. A Proposed Plan of Storm Water Quality Management Activities for 2001-2006, as outlined in the Updated DAMP. The 2000 DAMP includes all the activities the permittees propose to undertake during the next permit term, goals and objectives of such activities, an evaluation of the need for additional source control and/or structural and non-structural BMPs and proposed pilot studies;

c. A Performance Commitment that includes new and existing program elements and compliance schedules necessary to implement controls that reduce pollutants to the maximum extent practicable;

d. A summary of procedures implemented to detect illegal discharges and illicit disposal practices;

e. A summary of enforcement procedures and actions taken to require storm water discharges to comply with the approved storm water management programs;

f. A summary of public agency activity, results of monitoring program, and program effectiveness; and,

g. A fiscal analysis.

24. The permittees own and/or operate facilities where industrial or related activities take place that may have an impact on storm water quality. Some of the permittees also enter into contracts with outside parties to carry out municipal related activities that may also have an impact on storm water quality. These facilities and related activities include, but are not limited to, street sweeping, catch basin cleaning, maintenance yards, vehicle and equipment maintenance areas, waste transfer stations, corporation and storage yards, parks and recreational facilities, landscape and swimming pool maintenance activities, storm drain system maintenance activities and the application of herbicides, algaecides and pesticides. The permittees have prepared and implemented an environmental performance report for appropriate fixed public facilities under their jurisdiction, and identified best management practices for those activities found to require pollution prevention measures. Non-storm water discharges from these facilities and/or activities could also affect water quality. This order prohibits non-storm water discharges from public facilities, unless the discharges are exempt under Section III, Discharge Limitations, 3 & 5 of this order, or are permitted by the Regional Board under an individual NPDES permit. The second term permit required the permittees to prepare an Environmental Performance Reporting Program to identify significant issues and to implement corrective actions at municipal facilities and activities. Most of this work has been completed. However, this is a continuing process and this order requires the permittees to continue this process at least on an annual basis.

25. Successful implementation of the provisions and limitations in this order will require the cooperation of all the public agency organizations within Orange County having programs/activities that have an impact on storm water quality. A list of these organizations is included in Attachment C. As such, these organizations are expected to actively participate in implementing the Orange County NPDES Storm Water Program. The Regional Board has the discretion and authority to require non-cooperating entities to participate in this areawide permit

or obtain individual storm water discharge permits, pursuant to 40 CFR 122.26(a). The permittees have developed a Storm Water Implementation Agreement among the County, the cities and the Orange County Flood Control District. The Implementation Agreement establishes the responsibilities of each party and a funding mechanism for the shared costs, and recognizes the Technical Advisory Committee (TAC).

26. The major focus of storm water pollution prevention is the development and implementation of an appropriate DAMP, including best management practices (BMPs). The ultimate goal of the urban storm water management program is to support attainment of water quality objectives for the receiving waters and to protect beneficial uses through the implementation of the DAMP. The permittees developed and submitted a DAMP.

27. The DAMP is a dynamic document and the permittees have implemented, or are in the process of implementing, the various elements of the DAMP. A revised DAMP was included with the NPDES permit renewal application. This order requires the permittees to continue to implement the BMPs listed in the revised DAMP; update or modify the DAMP, when appropriate, consistent with the MEP and other applicable standards; and to effectively prohibit illegal and illicit discharges to the storm drain system.

28. Urban runoff contains pollutants from privately owned and operated facilities, such as residences, businesses, private and/or public institutions, and commercial establishments. Therefore, a successful storm water management plan should include the participation and cooperation of the public, businesses, the permittees and the regulators. The DAMP has a strong emphasis on public education.

29. The Orange County DAMP defined: (1) a management structure for the permittees' compliance effort; (2) a formal agreement to underpin cooperation; and (3) a detailed municipal effort to develop, implement, and evaluate various BMPs or control programs in the areas of public agency activities, public information, new development and construction, public works construction, industrial discharger identification, and illicit discharger/connection identification and elimination.

30. In order to characterize storm water discharges, to identify problem areas, to determine the impact of urban runoff on receiving waters, and to determine the effectiveness of the various BMPs, an effective monitoring program is critical. The principal permittee administers the monitoring program for the permittees. This program included storm water monitoring, receiving water monitoring, dry weather monitoring and sediment monitoring. The monitoring data indicate some spatial differences in water quality among Orange County's major watersheds. Based on these monitoring data, the monitoring program was revised in 1998 to focus on "warm spots" (areas where the pollutant concentrations were above the average for the watershed) and "special value" areas (critical aquatic resources). Another element of the monitoring program is the Reconnaissance and Source Identification component that targets areas that are known to exhibit unusually high levels of storm water pollutants. The 1998 monitoring program was approved and the data collection under this program will be completed by July 1, 2003. By January 1, 2003, the State Board is required by SB 72 (Water Code Section 13383.5) to develop a statewide municipal strom water monitoring program. By July 1, 2003, the permittees are required to develop a revised monitoring program as specified in the

monitoring and reporting program and consistent with any new requirements developed by the State Board.

31. In accordance with the Strategic Plan and Initiatives for the State and Regional Boards (June 22, 1995), the Regional Board recognizes the importance of an integrated watershed management approach. The Regional Board also recognizes that a watershed management program should integrate all related programs, including the storm water program and TMDL processes. Consistent with this approach, some of the municipal storm water monitoring programs have already been integrated into regional monitoring programs.

32. Illegal discharges to the storm drains can contribute to storm water and other surface water contamination. A reconnaissance survey of the municipal storm drain systems (open channels and underground storm drains) was completed by the permittees. The permittees also developed a program to prohibit illegal/illicit discharges to their storm drains and flood control facilities. Continued surveillance and enforcement of these programs are required to eliminate illicit discharges. The permittees have a number of mechanisms in place to eliminate illicit discharges to the MS4s, including construction, commercial, and industrial facility inspections, drainage facility inspections, water quality monitoring programs, and public education. The permittees also established a 24-hour water pollution problem reporting hotline. In February 1997, the permittees certified that they had completed a reconnaissance survey of the MS4s to detect and eliminate any illegal connections (undocumented or unpermitted connections to the MS4s). A reconnaissance survey is now being conducted as a part of the routine inspections of all MS4s.

33. The permittees have the authority to control pollutants in storm water discharges, to prohibit illegal connections and illicit discharges, to control spills, and to require compliance and carry out inspections of the storm drain systems within their jurisdictions. The permittees have various forms of legal authority in place, such as charters, State Code provisions for General Law cities, city ordinances, and applicable portions of municipal codes and the State Water Code, to regulate storm water/urban runoff discharges. In order to insure countywide consistency and to provide a legal underpinning to the entire Orange County storm water program, a model water quality ordinance was completed on August 15, 1994 and was adopted by all the permittees. The permittees are required by this order to review their existing enforcement authority to determine whether any additional legal authority is needed in order for permittees to administer civil and/or criminal penalties in enforcement actions for violations of the Water Quality Ordinance.

34. Pollution prevention techniques, appropriate planning processes and early identification of potential storm water impacts and mitigation measures can significantly reduce storm water pollution problems. The permittees should consider these impacts and appropriate mitigation measures in the planning procedures and in the California Environmental Quality Act (CEQA) review process for specific projects, Master Plans, etc. The permittees already require a Water Quality Management Plan, which addresses permanent post-construction BMPs, in addition to the SWPPP, which is required by the statewide general permit for construction activity. The

permittees are encouraged to propose and participate in watershed wide and/or regional water quality management programs.

35. The permittees have developed inter-departmental training programs and have made commitments to conduct a certain number of these training programs during the term of this permit.

36. In accordance with the Clean Water Act and its implementing regulations, this order requires the permittees to develop and implement programs and policies necessary to reduce the discharge of pollutants in urban runoff to waters of the U. S. to the maximum extent practicable (MEP).

37. The legislative history and the preamble to the federal storm water regulations indicate that the Congress and the U.S. EPA were aware of the difficulties in regulating urban storm water runoff solely through traditional end-of-pipe treatment. However, it is the Regional Board's intent that this order require the implementation of best management practices to reduce to the maximum extent practicable, the discharge of pollutants in storm water from the MS4s in order to support attainment of water quality standards. This order, therefore, includes Receiving Water Limitations[6] based upon water quality objectives, prohibits the creation of nuisance and requires the reduction of water quality impairment in receiving waters. In accordance with Section 402 (p) of the Clean Water Act, this order requires the permittees to implement control measures, in accordance with the DAMP, that will reduce pollutants in storm water discharges to the maximum extent practicable. The Receiving Water Limitations similarly require the implementation of control measures to protect beneficial uses and attain water quality objectives of the receiving waters.

38. The Regional Board finds that the unique aspects of the regulation of storm water discharges through municipal storm sewer systems, including the intermittent nature of discharges, difficulties in monitoring and limited physical control over the discharge, will require adequate time to implement and evaluate the effectiveness of BMPs. Therefore, the order includes a procedure for determining whether storm water discharges are causing exceedances of receiving water limitations and for evaluating whether the DAMP must be revised in order to comply with this aspect of the order. The order establishes an iterative process to maintain compliance with the receiving water limitations.

39. The permittees are required to conduct inspections of construction sites, industrial facilities and commercial establishments. To avoid duplicative efforts, the permittees need not inspect facilities that have been inspected by Regional Board staff, if the inspection was conducted during the specified time period. Regional Board staff inspection data will be posted regularly on its internet site. It is anticipated that many of the inspections required under this order can and will be carried out by inspectors currently conducting inspections for the permittees (i.e., grading, building, code enforcement, etc.), during their normal duties.

---

[6] Receiving Water Limitations are requirements included in the Orders issued by the Board to assure that the regulated discharge does not violate water quality standards established in the Basin Plan at the point of discharge to waters of the State.

40. A revised Water Quality Control Plan (Basin Plan) was adopted by the Regional Board and became effective on January 24, 1995. The Basin Plan contains water quality objectives and beneficial uses for water bodies in the Santa Ana Region. The Basin Plan also incorporates by reference all State Board water quality control plans and policies, including the 1990 Water Quality Control Plan for Ocean Waters of California (Ocean Plan) and the 1974 Water Quality Control Policy for Enclosed Bays and Estuaries of California (Enclosed Bays and Estuaries Plan).

41. The requirements contained in this order are necessary to implement the plans and policies described in Finding 40, above. These plans and policies contain numeric and narrative water quality standards for the water bodies in this Region. This order requires permittees to comply with load allocations for constituents with established load allocations for urban runoff, by implementing the necessary BMPs. Continuation of water quality/biota monitoring and analysis of the data are essential to better understand the impacts of storm water discharges on the water quality of the receiving water. The existing Basin Plan, or any further changes to the Basin Plan, may be grounds for the permittees to revise some or all of the DAMP and/or the ROWD.

42. Permittees will be required to comply with any applicable future water quality standards or discharge requirements that may be imposed by the EPA or State of California prior to the expiration of this order. This order may be reopened to include TMDLs and/or other requirements developed and adopted by the Regional Board.

43. The permittees may petition the Regional Board to issue a separate NPDES permit to any discharger of non-storm water into storm drain systems that they own or operate.

44. The permittees under the aegis of the TAC, and in collaboration with the City and County Attorneys, Orange County Sanitation District, the Orange County Building Industry Association, the Food Sanitation Advisory Council, and Western States Petroleum Association, developed an Enforcement Consistency Guide and a Water Quality Ordinance. All of the permittees adopted the Enforcement Consistency Guide and the Water Quality Ordinance. These documents establish legal authority for enforcing storm water ordinances and countywide uniformity in the enforcement actions.

45. It is important to control litter to eliminate trash and other materials in storm water runoff. In addition to the municipal ordinances prohibiting litter, the permittees participate or organize a number of other programs such as "Coastal Cleanup Day", "Pride Days", "Volunteer Connection Day", etc. The permittees also organize solid waste collection programs, household hazardous waste collections, and recycling programs to reduce litter and illegal discharges. Additionally, the permittees have installed debris booms at a number of locations.

46. The permittees are required to continue their drainage system inspection and maintenance program.

47. At a number of locations along the Orange County coast, elevated bacterial levels were detected during the summer of 1999 and 2000. One of the studies conducted to determine the source of bacterial contamination indicated that there is only a minor contribution to the bacterial problems from urban runoff. The permittees currently divert dry weather low flows from some of these areas to sanitary sewer systems on a temporary basis to address this bacterial problem.

A number of studies have been initiated to determine the source of this microbial contamination and to develop permanent remedial measures. This order requires the permittees to further investigate and address the coastal bacterial problems.

48. The sampling data indicate the presence of elevated levels of pesticides in storm water runoff from urban areas. The permittees have developed and implemented a model plan entitled, "Management Guidelines for Use of Fertilizers and Pesticides". The permittees are required to review this plan to determine its effectiveness and to make any needed changes. TMDLs are being developed for some of these pesticides for the Newport Bay watershed.

49. Public education is an important part of storm water pollution prevention. The permittees have employed a variety of means to educate the public, business and commercial establishments, industrial facilities and construction sites, and in 1999 developed a long term public education strategy. The permittees are required to continue their efforts in public education programs.

50. The permittees established a taskforce consisting of the principal permittee, Building Industry Association, Association of General Contractors and Civil Engineers and Land Surveyors of California and developed "Best Management Practices for New Development Including Non-Residential Construction Projects (1-5 acres)". The permittees are implementing the BMPs from this guidance document and are requiring new developments and significant redevelopments to develop and implement appropriate Water Quality Management Plans. This order requires structural and non-structural BMPs for new developments and significant redevelopments, only if adequate regional and/or watershed wide management programs are not being implemented.

51. The Regional Board and the permittees recognize the importance of watershed management initiatives and regional planning and coordination in the development and implementation of programs and policies related to water quality protection. A number of such efforts are underway in which the permittees are active participants. This order encourages continued participation in such programs and policies. The Regional Board also recognizes that, in certain cases, diversion of funds targeted for certain monitoring programs to regional monitoring programs may be necessary. The Executive Officer is authorized to approve, after proper public notification and consideration of all comments received, the watershed management initiatives and regional planning and coordination programs and regional monitoring programs. The permittees are required to submit all documents, where appropriate, in an electronic format. All such documents will be posted at the Regional Board's website and all interested parties will be notified. In addition, the website will include the administrative and civil procedures for appealing any decision made by the Executive Officer.

52. The storm water regulations require public participation in the development and implementation of the storm water management program. As such, the permittees are required to solicit and consider all comments received from the public and submit copies of the comments to the Executive Officer of the Regional Board with the annual reports due on November 15. In response to public comments, the permittees may modify reports, plans, or schedules prior to submittal to the Executive Officer.

53. In accordance with California Water Code Section 13389, the issuance of waste discharge requirements for this discharge is exempt from those provisions of the California

Environmental Quality Act contained in Chapter 3 (commencing with Section 21100), Division 13 of the Public Resources Code.

54. The permitted discharge is consistent with the anti-degradation provisions of 40 CFR 131.12 and the State Board Resolution 68-16. This order requires implementation of programs (i.e., BMPs) to reduce the level of pollutants in the storm water discharges. The combination of programs and policies required to be implemented under this order for new and existing developmens are designed to improve urban storm water quality.

55. The Regional Board has notified the permittees and interested parties of its intent to issue waste discharge requirements for this discharge and has provided them with an opportunity to submit their written views and recommendations.

56. The Regional Board, in a public hearing, heard and considered all comments pertaining to the discharge and to the tentative requirements.

IT IS HEREBY ORDERED that the permittees, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, and the provisions of the Clean Water Act, as amended, and regulations and guidelines adopted thereunder, shall comply with the following:

I. RESPONSIBILITIES OF PRINCIPAL PERMITTEE

The principal permittee shall be responsible for the overall program management and shall:

1. Conduct chemical and biological water quality monitoring, as required by the Executive Officer of the Regional Board.
2. Conduct inspections and maintain the storm drain systems within its jurisdiction.
3. Review and revise, if necessary, policies/ordinances necessary to establish legal authority as required by the Federal Storm Water Regulations.
4. Respond and/or arrange for responding to emergency situations, such as accidental spills, leaks, illicit discharges and illegal connections, etc., to prevent or reduce the discharge of pollutants to storm drain systems and waters of the U.S. within its jurisdiction.
5. Take appropriate enforcement actions for illicit discharges to the MS4 systems owned or controlled by the principal permittee.
6. Prepare and submit to the Executive Officer of the Regional Board unified reports, plans, and programs as required by this order, including the annual report.

The activities of the principal permittee shall include, but not be limited to, the following:

1. Coordinate and conduct Management Committee meetings on an as needed basis. The principal permittee will take the lead role in initiating and developing area-wide programs and activities necessary to comply with the NPDES Permit.
2. Coordinate permit activities and participate in any subcommittees formed as necessary to coordinate compliance activities with this order.

3. Provide technical and administrative support and inform the co-permittees of the progress of other pertinent municipal programs, pilot projects, research studies, etc.
4. Coordinate the implementation of area-wide storm water quality management activities such as public education, pollution prevention, household hazardous waste collection, etc.
5. Develop and implement mechanisms, performance standards, etc., to promote uniform and consistent implementation of BMPs among the permittees.
6. Pursue enforcement actions as necessary within its jurisdiction to ensure compliance with storm water management programs, ordinances and implementation plans, including physical elimination of undocumented connections and illicit discharges.
7. In conjunction with the other permittees, implement the BMPs listed in the DAMP, and take such other actions as may be necessary to meet the MEP standard.
8. Monitor the implementation of the plans and programs required by this order and determine their effectiveness in protecting beneficial uses.
9. Coordinate all the activities with the Regional Board, including the submittal of all reports, plans, and programs, as required under this order.
10. Obtain public input for any proposed management and implementation plans, where applicable.
11. Cooperate in watershed management programs and regional and/or statewide monitoring programs.

II. RESPONSIBILITIES OF THE CO-PERMITTEES

The co-permittees shall be responsible for the management of storm drain systems within their jurisdictions and shall:

1. Implement management programs, monitoring programs, implementation plans and all BMPs outlined in the DAMP within each respective jurisdiction, and take any other actions as may be necessary to meet the MEP standard.
2. Coordinate among their internal departments and agencies, as appropriate, to facilitate the implementation of this Order and the DAMP.
3. Establish and maintain adequate legal authority, as required by the Federal Storm Water Regulations.
4. Conduct storm drain system inspections and maintenance in accordance with the criteria developed by the principal permittee.
5. Take appropriate enforcement actions for illicit discharges to the MS4 system owned or controlled by the co-permittee.

The co-permittees' activities shall include, but not be limited to, the following:

1. Participate in a Management Committee comprised of the principal permittee and one representative of each co-permittee. The principal permittee will take the lead role in

initiating and developing area-wide programs activities necessary to comply with the NPDES Permit. The committee will meet on a regular basis (at least six times per year). Each permittee shall designate one official representative to the Management Committee.

2. Review, approve, implement, and comment on all plans, strategies, management programs, and monitoring programs, as developed by the principal permittee or any permittee subcommittee to comply with this order.
3. Pursue enforcement actions as necessary to ensure compliance with the storm water management programs, ordinances and implementation plans, including physical elimination of undocumented connections and illicit discharges.
4. Conduct and coordinate with the principal permittee any surveys and characterizations needed to identify the pollutant sources and drainage areas.
5. Submit storm drain system maps with periodic revisions, as necessary.
6. Respond to emergency situations, such as accidental spills, leaks, illicit discharges and illegal connections, etc., to prevent or reduce the discharge of pollutants to storm drain systems and waters of the U.S.
7. Prepare and submit all required reports to the principal permittee in a timely manner.

III. DISCHARGE LIMITATIONS/PROHIBITIONS

1. In accordance with the requirements of 40 CFR 122.26(d)(2)(i)(B) and 40 CFR 122.26(d)(2)(i)(F), the permittees shall prohibit illicit/illegal discharges (non-storm water) from entering into the municipal separate storm sewer systems.
2. The discharge of storm water from the MS4s to waters of the United States containing pollutants that have not been reduced to the maximum extent practicable is prohibited.
3. The permittees shall effectively prohibit the discharge of non-storm water into the MS4s, unless such discharges are authorized by a separate NPDES permit or as otherwise specified in this provision. Certain discharges identified below need not be prohibited by the permittees. If, however, any of these discharges are identified by the permittees or the Executive Officer as a significant source of pollutants, coverage under the Regional Board's De Minimus permit may be required.
    a. Discharges composed entirely of storm water,
    b. Potable water line flushing and other potable water sources,
    c. Air conditioning condensate,
    d. Landscape irrigation, lawn garden watering and other irrigation waters,
    e. Passive foundation drains,
    f. Passive footing drains,
    g. Water from crawl space pumps,
    h. Dechlorinated swimming pool discharges,

i. Non-commercial vehicle washing,

j. Diverted stream flows,

k. Rising ground waters and natural springs,

l. Ground water infiltration as defined in 40 CFR 35.2005 (20) and uncontaminated pumped groundwater,

m. Flows from riparian habitats and wetlands,

n. Emergency fire fighting flows (i.e., flows necessary for the protection of life and property) do not require BMPs and need not be prohibited. However, where possible, when not interferring with health and safety issues, BMPs should be considered (also see Section XIX, Provision 4),

o. Waters not otherwise containing wastes as defined in California Water Code Section 13050 (d), and

p. Other types of discharges identified and recommended by the permittees and approved by the Regional Board.

The Regional Board may add categories of non-storm water discharges that are not significant sources of pollutants or remove categories of non-storm water discharges listed above based upon a finding that the discharges are a significant source of pollutants.

4. For purposes of this order, a discharge may include storm water or other types of discharges, identified in Section III.3.

5. Non-storm water discharges from public agency activities into waters of the U.S. are prohibited unless the non-storm water discharges are permitted by an NPDES permit or are included in Section III.3. If permitting or immediate elimination of the non-storm water discharges is impractical, the permittees shall include in the Environmental Performance Report, a proposed plan to eliminate the non-storm water discharges in a timely manner.

6. The permittees shall reduce the discharge of pollutants, including trash and debris, from the storm water conveyance systems to the maximum extent practicable.

7. Discharges from the MS4s shall be in compliance with the applicable discharge prohibitions contained in Chapter 5 of the Basin Plan.

8. Discharges from the MS4s of storm water or non-storm water, for which a Permittee is responsible, shall not cause or contribute to a condition of nuisance, as that term is defined in Section 13050 of the Water Code.

IV. RECEIVING WATER LIMITATIONS

1. Discharges from the MS4s shall not cause or contribute to exceedances of receiving water quality standards (designated beneficial uses and water quality objectives) for surface waters or groundwaters.

2. The DAMP and its components shall be designed to achieve compliance with receiving water limitations. It is expected that compliance with receiving water limitations will be achieved through an iterative process and the application of increasingly more effective BMPs. The permittees shall comply with Sections III.2 and IV of this order through timely implementation of control measures and other actions to reduce pollutants in urban storm water runoff in accordance with the DAMP and other requirements of this order, including any modifications thereto.

3. If permittees continue to cause or contribute to an exceedance of water quality standards, notwithstanding implementation of the DAMP and other requirements of this order, the permittees shall assure compliance with Sections III.2 and IV of this order by complying with the following procedure:

   a. Upon a determination by either the permittees or the Executive Officer that the discharges from the MS4 systems are causing or contributing to an exceedance of an applicable water quality standard, the permittees shall promptly notify and thereafter submit a report to the Executive Officer that describes BMPs that are currently being implemented and additional BMPs that will be implemented to prevent or reduce any pollutants that are causing or contributing to the exceedance of water quality standards. The report may be incorporated in the annual update to the DAMP, unless the Executive Officer directs an earlier submittal. The report shall include an implementation schedule. The Executive Officer may require modifications to the report;

   b. Submit any modifications to the report required by the Executive Officer within 30 days of notification;

   c. Within 30 days following approval by the Executive Officer of the report described above, the permittees shall revise the DAMP and monitoring program to incorporate the approved modified BMPs that have been and will be implemented, the implementation schedule, and any additional monitoring required; and,

   d. Implement the revised DAMP and monitoring program in accordance with the approved schedule.

   So long as the permittees have complied with the procedures set forth above and are implementing the revised DAMP, the permittees do not have to repeat the same procedure for continuing or recurring exceedances of the same receiving water limitations unless the Executive Officer determines it is necessary to develop additional BMPs.

V. IMPLEMENTATION AGREEMENT

1. By July 1, 2002, the existing Implementation Agreement shall be revised to include the cities that were not signatories to this agreement. A copy of the signature page and any revisions to the Agreement shall be included in the annual report.

2. By July 1, 2002, the permittees shall evaluate the storm water management structure and the Implementation Agreement and determine the need for any revision. The corresponding annual report shall include the findings of this review and a schedule for any needed revisions.

VI. LEGAL AUTHORITY/ENFORCEMENT

1. The permittees shall maintain adequate legal authority to control the contribution of pollutants to the MS4 by storm water discharges and enforce those authorities.
2. The permittees shall take appropriate enforcement actions against any violators of their Water Quality Ordinance, in accordance with the adopted/established guidelines and procedures. All enforcement actions shall be consistent with the Enforcement Consistency Guide.
3. Permittees' ordinances or other local regulatory mechanisms shall include sanctions to ensure compliance. Sanctions shall include but are not limited to: monetary penalties, non-monetary penalties, bonding requirements, and/or permit denials/revocations/stays for non-compliance. If the permittees' current ordinances do not have a provision for civil or criminal penalties for violations of their water quality ordinances, the permittees shall enact such ordinances by November 15, 2003.
4. By November 15, 2003, each permittee shall submit a statement, signed by legal counsel, that the permittee has obtained all necessary legal authority to comply with this Order through adoption of ordinances and/or municipal code modifications.
5. The permittees shall continue to provide notification to Regional Board staff regarding storm water related information gathered during site inspections of industrial and construction sites regulated by the Statewide General Storm Water Permits and at sites that should be regulated under the State's General Permits. The notification should include any observed violations of the General Permits, prior history of violations, any enforcement actions taken by the permittee, and any other relevant information.
6. By November 15, 2003, the permittees shall review their water quality ordinances and provide a report on the effectiveness of these ordinances and associated enforcement programs, in prohibiting the following types of discharges to the MS4s (the permittees may propose appropriate control measures in lieu of prohibiting these discharges, where the permittees are responsible for ensuring that dischargers adequately maintain those control measures):
   a. Sewage, where a co-permittee operates the sewage collection system;
   b. Wash water resulting from the hosing or cleaning of gas stations, auto repair garages, and other types of automobile service stations;
   c. Discharges resulting from the cleaning, repair, or maintenance of any type of equipment, machinery, or facility, including motor vehicles, concrete mixing equipment, portable toilet servicing, etc.;
   d. Wash water from mobile auto detailing and washing, steam and pressure cleaning, carpet cleaning, and other such mobile commercial and industrial activities;
   e. Water from cleaning of municipal, industrial, and commercial sites, including parking lots, streets, sidewalks, driveways, patios, plazas, work yards and outdoor eating or drinking areas, etc.;

f. Runoff from material storage areas or uncovered receptacles that contain chemicals, fuels, grease, oil, or other hazardous materials[7];

g. Discharges of runoff from the washing of toxic materials[8] from paved or unpaved areas;

h. Discharges of pool or fountain water containing chlorine, biocides, or other chemicals; pool filter backwash containing debris and chlorine;

i. Pet waste, yard waste, litter, debris, sediment, etc.; and,

j. Restaurant or food processing facility wastes such as grease, floor mat and trash bin wash water, food waste, etc.

7. The Principal Permittee shall, on or before July 1, 2002, develop a restaurant inspection program which shall, at a minimum, address:

   a. Oil and grease disposal to verify that these wastes are not poured onto a parking lot, street or adjacent catch basin;

   b. Trash bin areas to verify that these areas are clean, the bin lids are closed, the bins are not filled with liquid and the bins have not been washed out;

   c. Parking lot, alley, sidewalk and street areas to verify that floormats, filters and garbage containers are not washed in those areas and that no washwater is poured in those areas;

   d. Parking lot areas to verify that they are cleaned by sweeping, not by hosing down and that the facility operator uses dry methods for spill cleanup; and,

   e. Inspection of existing devices designed to separate grease from wastewater (e.g., grease traps or interceptors) to ensure adequate capacity and proper maintenance.

VII. ILLEGAL CONNECTIONS; LITTER, DEBRIS AND TRASH CONTROL

1. The permittees shall continue to prohibit all illegal connections to the MS4s through their ordinances, inspections, and monitoring programs. If routine inspections or dry weather monitoring indicate any illegal connections, they shall be investigated and eliminated or permitted within 120 days of discovery and identification.

2. All reports of spills, leaks, and/or illegal dumping shall be promptly investigated and, where appropriate, reported to the Executive Officer within 24 hours (those incidents which may pose an immediate threat to human health or the environment, e.g., sewage spills that could impact water contact recreation, an oil spill that could impact wild life, a hazardous substance spill where residents are evacuated, etc.) by phone or e-mail, with a written report within 5 days. At a minimum, all sewage spills above 1,000 gallons and all reportable quantities of hazardous waste spills as per 40CFR 117 and 302 shall be reported within 24 hours and all other spill incidents shall be included in the annual report. The permittees

[7] Hazardous Material is defined as any substrate that poses a threat to human health or the environment due to its toxicity, corrosiveness, ignitability, explosive nature or chemical reactivity. These also include materials named by EPA to be reported if a designed quantity of the material is spilled into the waters of the United States or emitted into the environment.

[8] Toxic Material is a chemical or a mixture that may present an unreasonable risk of injury to health or the environment.

may propose a reporting program, including reportable incidents and quantities, jointly with other agencies, such as the County Health Care Agency, for approval by the Executive Officer.

3. The permittees shall continue to implement appropriate control measures to reduce and/or to eliminate the discharge of trash and debris to waters of the U.S. These control measures shall be reported in the annual report.
4. By July 1, 2003, the permittees shall review their litter/trash control ordinances to determine the need for any revision. The permittees are encouraged to characterize trash, determine its main source(s) and develop and implement appropriate BMPs to control trash in urban runoff. The findings of this review shall be included in the annual report for 2002-2003.
5. By July 1, 2003, the permittees shall determine the need for any additional debris control measures. The findings shall be included in the annual report for 2002-2003.

VIII. MUNICIPAL INSPECTIONS OF CONSTRUCTION SITES

1. Each permittee shall develop by October 15, 2002, an inventory of all construction sites within its jurisdiction for which building or grading permits are issued and activities at the site include: soil movement; uncovered storage of materials or wastes, such as dirt, sand or fertilizer; or exterior mixing of cementaceous products, such as concrete, mortar or stucco. Sites will be included regardless of whether the construction site is subject to the California Statewide General NPDES Permit for Storm Water Discharges Associated with Construction Activities (General Permit) or other individual NPDES permit. This database shall be updated prior to each rainy season thereafter. This inventory shall be maintained in a computer-based database system and shall include relevant information on site ownership, General Permit WDID # (if any), size, location, etc. Inclusion of a Geographical Information System (GIS) is recommended but not required.
2. To establish priorities for inspection requirements under this Order, the permittees shall prioritize construction sites within their jurisdiction as a high, medium or low threat to water quality. Evaluation of construction sites should be based on such factors as soil erosion potential, project size, proximity and sensitivity of receiving waters and any other relevant factors. At a minimum, high priority construction sites shall include: sites over 50 acres; sites over 5 acres that are tributary to Clean Water Act section 303(d) waters listed for sediment or turbidity impairments; and sites that are tributary to and within 500 feet of an area defined by the Ocean Plan as an Area of Special Biological Significance (ASBS).
3. Each permittee shall conduct construction site inspections for compliance with its ordinances (grading, Water Quality Management Plans, etc.) and local permits (construction, grading, etc.). Inspections shall include a review of erosion control and BMP implementation plans and an evaluation of the effectiveness and maintenance of the BMPs identified. Inspection frequency will, at a minimum, include the following:
   a. During the wet season (i.e., October 1 through April 30 of each year), all high priority sites are to be inspected, in their entirety, once a month. All medium priority sites are to be inspected at least twice during the wet season. All low priority sites are to be

inspected at least once during the wet season. When BMPs or BMP maintenance is deemed inadequate or out of compliance, an inspection frequency of once every week will be maintained until BMPs and BMP maintenance are brought into compliance. During the 2001-2002 wet season, prior to the development of the inventory database, all construction sites must be visited at least twice. If a site is deemed out of compliance, an inspection frequency adequate to bring the site into compliance must be maintained;

b. During the dry season (i.e., May 1 through September 30 of each year), all construction sites shall be inspected at a frequency sufficient to ensure that sediment and other pollutants are properly controlled and that unauthorized, non-storm water discharges are prevented; and,

c. Information including, at a minimum, inspection dates, inspectors present and the results of the inspection, must be maintained in the database identified in Section VIII.1 or must be linked to that database. A copy of this database must be provided to the Regional Board with each annual report.

4. Each permittee shall enforce its ordinances and permits at all construction sites, as necessary, to maintain compliance with this Order. Sanctions for non-compliance must include: monetary penalties, bonding requirements and/or permit denial or revocation.

5. Within 24 hours of discovery, each permittee shall provide oral or e-mail notification to the Santa Ana Regional Water Quality Control Board of non-compliant sites within their jurisdiction that are determined to pose a threat to human health or the environment (e.g., sewage spills that could impact water contact recreation, an oil spill that could impact wildlife, a hazardous substance spill where residents are evacuated, etc.). Following oral notification, a written report must be submitted to the Santa Ana Regional Water Quality Control Board within 10 days, detailing the nature of the non-compliance, any corrective action taken by the site owner, other relevant information (e.g., past history of non-compliance, environmental damage resulting from the non-compliance, site owner responsiveness) and the type of enforcement that will be carried out by the permittee. Further, incidences of non-compliance shall be recorded along with the information noted in the written report and the final outcome/enforcement for the incident in the database identified in Sections VIII.1 and 3.c or must be linked to these databases.

6. The inspectors responsible for ensuring compliance at construction sites shall be trained in and have an understanding of: federal, state and local water quality laws and regulations as they apply to construction and grading activities; the potential effects of construction and urbanization on water quality; and implementation and maintenance of erosion control BMPs and sediment control BMPs and the applicable use of both. Each permittee shall have adequately trained its inspection staff by October 15, 2002, and on an annual basis, prior to the rainy season, thereafter. Training programs should be coordinated with the Santa Ana Regional Water Quality Control Board and prior notification of training shall be provided to Regional Board staff. New hires or transfers that will be performing construction inspections for the permittees must be trained within one month of starting inspection duties.

7. The permittees need not inspect facilities already inspected by Regional Board staff if the inspection was conducted within the specified time period.

IX. MUNICIPAL INSPECTIONS OF INDUSTRIAL FACILTIES

1. Each permittee shall develop by July 1, 2003, an inventory of industrial facilities within its jurisdiction with business permits or other authorization by permittees, that have the potential to discharge pollutants to the MS4. Facilities will be listed, regardless of whether the facility is subject to the California Statewide General NPDES Permit for Storm Water Discharges Associated with Industrial Activities (General Industrial Permit) or other individual NPDES permit. This database must be updated on an annual basis. This inventory must be maintained in a computer-based database system and must include relevant information on ownership, SIC code(s), General Industrial Permit WDID # (if any), size, location, etc. Inclusion of a Geographical Information System (GIS) is recommended but not required.
2. To establish priorities for inspection requirements under this Order, the permittees shall prioritize industrial facilities within their jurisdiction as a high, medium or low threat to water quality. Evaluation of these facilities should be based on such factors as type of industrial activities (SIC codes), materials or wastes used or stored outside, pollutant discharge potential, facility size, proximity and sensitivity of receiving waters and any other relevant factors. At a minimum, a high priority shall be assigned to: facilities subject to section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA); facilities requiring coverage under the General Industrial Permit; facilities with a high potential for, or history of, unauthorized, non-storm water discharges; and facilities that are tributary to, and within 500 feet of, an area defined by the Ocean Plan as an Area of Special Biological Significance (ASBS).
3. Each permittee shall conduct industrial facility inspections for compliance with its ordinances and permits. Inspections shall include a review of material and waste handling and storage practices, pollutant control BMP implementation and maintenance and evidence of past or present unauthorized, non-storm water discharges. All high priority facilities identified in IX.2 shall be inspected and a report on these inspections shall be submitted by November 15, 2003 and a report of inspections during subsequent years shall be included in the annual report for that year.
4. After July 1, 2003, all high priority sites are to be inspected at least once a year; all medium priority sites are to be inspected at least once every two years; and all low priority sites are to be inspected at least once per permit cycle. In the event that inappropriate material or waste handling or storage practices are observed or there is evidence of past or present unauthorized, non-storm water discharges, an inspection frequency adequate to bring the site into compliance must be maintained (at a minimum, once a month). Once compliance is achieved, a minimum inspection frequency of once every four months will be maintained for the next calendar year.
5. By July 1, 2005, each permittee shall identify the remaining industrial facilities that do not have business permits or other authorization by the permittees. These facilities shall be

added to the database identified in Section IX.1 and shall be prioritized in accordance with the specifications identified in Section IX.2.

6. Information including, at a minimum, inspection dates, inspectors present and the results of the inspection must be maintained in the database identified in Section IX.1 or must be linked to that database. A copy of this database must be provided to the Regional Board with each annual report.

7. Each permittee shall enforce its ordinances and permits at all industrial facilities as necessary to maintain compliance with this Order. Sanctions for non-compliance must include: monetary penalties, bonding requirements and/or permit denial or revocation.

8. Within 24 hours, each permittee shall provide oral or e-mail notification to the Santa Ana Regional Water Quality Control Board of non-compliant facilities within their jurisdiction that are determined to pose a threat to human health or the environment (e.g., sewage spills that could impact water contact recreation, an oil spill that could impact wildlife, a hazardous substance spill where residents are evacuated, etc.). Following oral notification, a written report must be submitted to the Santa Ana Regional Water Quality Control Board within 10 days, detailing the nature of the non-compliance, any corrective action taken by the site owner, other relevant information (e.g., past history of non-compliance, environmental damage resulting from the non-compliance, facility owner responsiveness) and the type of enforcement that will be carried out by the permittee. Further, incidences of non-compliance shall be recorded along with the information noted in the written report and the final outcome/enforcement for the incident, in the database identified in Section IX.1.

9. The inspectors responsible for ensuring compliance at industrial facilities shall be trained in and have an understanding of: federal, state and local water quality laws and regulations as they apply to industrial activities; the potential effects of industrial discharges and urbanization on water quality; and implementation and maintenance of pollutant control BMPs. Each permittee shall have adequately trained their inspection staff by July 1, 2003, and on an annual basis thereafter. Training programs should be coordinated with the Santa Ana Regional Water Quality Control Board and prior notification of training shall be provided to Regional Board staff. New hires or transfers that will be performing industrial inspections for the permittees must be trained within one month of starting inspection duties.

10. The permittees need not inspect facilities already inspected by Regional Board staff, if the inspection was conducted within the specified time period.

X. MUNICIPAL INSPECTIONS OF COMMERCIAL FACILITIES

1. Each permittee shall develop by July 1, 2003, an inventory of the following commercial facilities/companies listed below within its jurisdiction. This database must be updated on an annual basis. This inventory must be maintained in a computer-based database system and must include relevant information on ownership, size, location, etc. Inclusion of a Geographical Information System (GIS) is recommended but not required.

a. Automobile mechanical repair, maintenance, fueling or cleaning;

b. Automobile and other vehicle body repair or painting;

c. Mobile automobile or other vehicle washing;

d. Mobile carpet, drape or furniture cleaning;

e. Mobile high pressure or steam cleaning;

f. Painting and coating;

g. Nurseries and greenhouses;

h. Landscape and hardscape installation;

i. Pool, lake and fountain cleaning;

j. Other commercial sites/sources that the Permittee determines may contribute a significant pollutant load to the MS4; and,

k. Any commercial sites or sources that are tributary to and within 500 feet of an area defined by the Ocean Plan as an Area of Special Biological Significance (ASBS).

2. To establish priorities for inspection requirements under this Order, the permittees shall prioritize commercial facilities/companies within their jurisdiction as a high, medium or low threat to water quality based on such factors as the type, magnitude and location of the commercial activity, potential for discharge of pollutants to the MS4 and any history of unauthorized, non-storm water discharges.

3. Each permittee shall conduct commercial facility inspections for compliance with its ordinances and permits. Inspections shall include a review of material and waste handling and storage practices, pollutant control BMP implementation and maintenance and evidence of past or present unauthorized, non-storm water discharges.

4. After July 1, 2003, each permittee shall establish inspection frequencies and priorities as determined by the threat to water quality prioritization described in X.2. In the event that inappropriate material or waste handling or storage practices are observed, or there is evidence of past or present unauthorized, non-storm water discharges, an inspection frequency adequate to bring the site into compliance must be maintained.

5. By July 1, 2004, all high priority sites shall be inspected at least once.

6. Information including, at a minimum, inspection dates, inspectors present and the results of the inspection must be maintained in the database identified in Section X.1 or must be linked to that database. A copy of this database must be provided to the Regional Board with each annual report.

7. Each permittee shall enforce its ordinances and permits at commercial facilities. Sanctions for non-compliance must include: monetary penalties, bonding requirements and/or permit denial or revocation.

8. Within 24 hours, each permittee shall provide oral or e-mail notification to the Santa Ana Regional Water Quality Control Board of non-compliant facilities within their jurisdiction, that are determined to pose a threat to human health or the environment (e.g., sewage spills that could impact water contact recreation, an oil spill that could impact wildlife, a hazardous substance spill where residents are evacuated, etc.). Following oral notification, a written report must be submitted to the Santa Ana Regional Water Quality Control Board within 5 days. For incidents that do not pose a threat to human or environmental health, the permittees shall submit a written report within 30 days of the incident. All written reports shall detail the nature of the non-compliance, identify any corrective action taken by the site owner, note other relevant information (e.g., past history of non-compliance, environmental damage resulting from the non-compliance, facility owner responsiveness) and the type of enforcement that will be carried out by the permittee. Further, incidences of non-compliance shall be recorded along with the information noted in the written report and the final outcome/enforcement for the incident in the database identified in Section X.1.

9. The inspectors responsible for ensuring compliance at commercial facilities shall be trained in, and have an understanding of, Federal, State and local water quality laws and regulations as they apply to industrial and commercial activities; the potential effects of industrial discharge and urbanization on water quality; and implementation and maintenance of pollutant control BMPs. Each permittee shall have adequately trained their inspection staff by July 1, 2003 and on an annual basis thereafter. Training programs should be coordinated with the Santa Ana Regional Water Quality Control Board and prior notification of training shall be provided to Regional Board staff. New hires or transfers that will be performing commercial inspections for the permittees must be trained within one month of starting inspection duties.

10. The permittees need not inspect facilities already inspected by Regional Board staff if the inspection was conducted within the specified time period.

XI. SEPTIC SYSTEM FAILURES AND PORTABLE TOILET DISCHARGES

1. By July 1, 2003, the permittees, whose jurisdictions have 50 or more septic tank or sub-surface disposal systems in use, shall identify with the appropriate governing agency, a mechanism to determine the effect of septic system failures on storm water quality and a mechanism to address such failures.

2. By July 1, 2003, the principal permittee shall review the permittees' current oversight programs for portable toilets to determine the need for any revision.

XII. NEW DEVELOPMENT (INCLUDING SIGNIFICANT RE-DEVELOPMENT)

A. GENERAL REQUIREMENTS:

1. By July 1, 2002, the permittees shall establish a mechanism to ensure (prior to issuance of any local permits or other approvals) that all construction sites that are required to obtain coverage under the State's General Storm Water Permit for construction sites have filed with the State Board a Notice of Intent to be covered by the relevant general permit.
2. Each permittee shall minimize the short and long-term impacts on receiving water quality from new developments and re-developments, as required in Section XII.B.1., below. In order to reduce pollutants and runoff flows from new developments and re-developments to the maximum extent practicable, permittees should, at a minimum:
   a. Review General Plan/CEQA Processes
   b. Modify the Project Approval Process
   c. Conduct Public/Business Education
3. By December 19, 2002, the permittees shall review their planning procedures and CEQA document preparation processes to ensure that urban runoff-related issues are properly considered and addressed. If necessary, these processes should be revised by that date to consider and mitigate impacts to storm water quality. These changes may include revising the General Plan, modifying the project approval processes, including a section on urban runoff related water quality issues in an addendum CEQA checklist, and conducting training for project proponents. The findings of this review and the actions taken by the permittees shall be reported to the Regional Board by January 2, 2003. The following potential impacts shall be considered during CEQA review:
   a. Potential impact of project construction on storm water runoff;
   b. Potential impact of project's post-construction activity on storm water runoff;
   c. Potential for discharge of storm water pollutants from areas of material storage, vehicle or equipment fueling, vehicle or equipment maintenance (including washing), waste handling, hazardous materials handling or storage, delivery areas. loading docks or other outdoor work areas;
   d. Potential for discharge of storm water to affect the beneficial uses of the receiving waters;
   e. Potential for significant changes in the flow velocity or volume of storm water runoff to cause environmental harm; and,
   f. Potential for significant increases in erosion of the project site or surrounding areas.

4. By July 1, 2004, the permittees shall review their watershed protection principles and policies in their General Plan or related documents (such as Development Standards, Zoning Codes, Conditions of Approval, Development Project Guidance) to ensure that these principals and policies are properly considered and are incorporated into these documents. The findings of this review and the actions taken by the permittees shall be reported to the Regional Board by November 15, 2004. These principles and policies should include, but not be limited to, the following considerations:

   a. Limit disturbance of natural water bodies and drainage systems; conserve natural areas; protect slopes and channels; and minimize impacts from storm water and urban runoff on the biological integrity of natural drainage systems and water bodies;

   b. Minimize changes in hydrology and pollutant loading; require incorporation of controls, including structural and non-structural BMPs, to mitigate the projected increases in pollutant loads and flows; ensure that post-development runoff rates and velocities from a site have no significant adverse impact on downstream erosion and stream habitat; minimize the quantity of storm water directed to impermeable surfaces and the MS4s; and maximize the percentage of permeable surfaces to allow more percolation of storm water into the ground;

   c. Preserve wetlands, riparian corridors, and buffer zones and establish reasonable limits on the clearing of vegetation from the project site;

   d. Encourage the use of water quality wetlands, biofiltration swales, watershed-scale retrofits, etc., where such measures are likely to be effective and technically and economically feasible;

   e. Provide for appropriate permanent measures to reduce storm water pollutant loads in storm water from the development site; and,

   f. Establish development guidelines for areas particularly susceptible to erosion and sediment loss.

5. Each permittee shall provide the Regional Board with the draft amendment or revision when a pertinent General Plan element or the General Plan is noticed for comment in accordance with Govt. Code § 65350 et seq.

6. By July 1, 2003, the permittees shall review and, as necessary, revise their current grading/erosion control ordinances in order to reduce erosion caused by new development or significant re-development projects.

7. The permittees shall, through conditions of approval, ensure proper maintenance and operation of any permanent flood control structures installed in new developments. The parties responsible for the maintenance and operation of the facilities and a funding mechanism for operation and maintenance, shall be identified prior to approval of the project.

8. By November 15, 2003, the principal permittee shall submit a proposal for a study to evaluate the effectiveness of a group of selected BMPs for controlling erosion during

new development. Based on the results of this study, one or more BMPs will be identified as (a) County-preferred BMP(s) for erosion control during new development. This proposal shall include details of the new development project site, the BMPs selected for the study, and a proposed schedule. The proposed and final BMP selection shall be approved by the Regional Board Executive Officer and the study shall be completed by the end of this permit term.

9. The permittees shall continue to implement the new development BMPs (DAMP, Appendix G) and BMPs for public works construction (DAMP, Appendix H).

10. Within six months of adoption of this order, the permittees shall review their DAMP to determine the need for:

    a. Re-establishing the New Development Task Force

    b. Establishing a Water Quality Plan verification program.

B. WATER QUALITY MANAGEMENT PLAN (WQMP) FOR URBAN RUNOFF (FOR NEW DEVELOPMENT/SIGNIFICANT REDEVELOPMENT):

1. By March 1, 2003, the permittees shall review their existing BMPs for New Developments (Appendix G of the DAMP) and submit for review and approval by the Executive Officer, a revised WQMP for urban runoff from new developments/ significant re-developments for the type of projects listed below:

    a. All significant re-development projects, where significant re-development is defined as the addition of 5,000 or more square feet of impervious surface on an already developed site. This includes additional buildings and/or structures, extension of existing footprint of a building, construction of parking lots, etc.

    b. Home subdivisions of 10 units or more. This includes single family residences, multi-family residences, condominiums, apartments, etc.

    c. Commercial and industrial developments of 100,000 square feet or more. This includes non-residential developments such as hospitals, educational institutions (to the extent the permittees have authority to regulate these developments), recreational facilities, mini-malls, hotels, office buildings, warehouses, and light & heavy industrial facilities.

    d. Automotive repair shops (with SIC codes 5013, 5014, 5541, 7532-7534, 7536-7539).

    e. Restaurants where the land area of development is 5,000 square feet or more.

    f. All hillside developments on 10,000 square feet or more, which are located on areas with known erosive soil conditions or where the natural slope is twenty-five percent or more.

    g. Developments of 2,500 square feet of impervious surface or more adjacent to (within 200 feet) or discharging directly into environmentally sensitive areas, such

as areas designated in the Ocean Plan as areas of special biological significance or waterbodies listed on the CWA Section 303(d) list of impaired waters.

h. Parking lots of 5,000 square feet or more exposed to storm water. Parking lot is defined as a land area or facility for the temporary storage of motor vehicles.

2. The permittees are encouraged to include in the WQMP the development and implementation of regional and/or watershed management programs that address runoff from new development and significant re-development. The WQMP shall include BMPs for source control, pollution prevention, and/or structural treatment BMPs. For all structural treatment controls, the WQMP shall identify the responsible party for maintenance of the treatment system, and a funding source or sources for its operation and maintenance. The goal of the WQMP is to develop and implement practicable programs and policies to minimize the effects of urbanization on site hydrology, urban runoff flow rates or velocities and pollutant loads. This goal may be achieved through watershed-based structural treatment controls, in combination with site-specific BMPs. The WQMP shall reflect consideration of the following goals, which may be addressed through on-site-and/or watershed-based BMPs.

   a. The pollutants in post-development runoff shall be reduced using controls that utilize best available technology (BAT) and best conventional tecnology (BCT).

   b. The discharge of any listed pollutant to an impaired waterbody on the 303(d) list shall not cause an exceedence of receiving water quality objectives.

3. During the time that the WQMP is being revised, the permittees shall implement their existing requirements for new development (Appendix G of the DAMP). If the Executive Officer does not approve the revised WQMP by October 1, 2003, as meeting the goals proposed in XII.B.2, above and providing an equivalent or superior degree of treatment as the sized criteria outlined in XII.B.3.A, B and C, below, structural BMPs shall be required for all new development and significant redevelopment[2]. Minimum structural BMPs must either be sized to comply with one of the following numeric sizing criteria or be deemed by the Principal Permittee to provide equivalent or superior treament, either on a site basis or a watershed basis:

   A. Volume

   Volume–based BMPs shall be designed to infiltrate, filter, or treat either:

   1. The volume of runoff produced from a 24-hour, 85th percentile storm event, as determined from the local historical rainfall record; or,

   2. The volume of annual runoff produced by the 85th percentile, 24-hour rainfall event, determined as the maximized capture storm water volume for

[2] Where new development is defined as projects for which tentative tract or parcel map approval was not received by July 1, 2003 and new re-development is defined as projects for which all necessary permits were not issued by July 1, 2003. New development does not include projects receiving map approvals after July 1, 2003 that are proceeding under a common scheme of development that was the subject of a tentative tract or parcel map approval that occurred prior to July 1, 2003.

the area, from the formula recommended in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ASCE Manual of Practice No. 87 (1998); or,

3. The volume of annual runoff based on unit basin storage volume, to achieve 80% or more volume treatment by the method recommended in California Stormwater Best Management Practices Handbook – Industrial/Commercial (1993); or,

4. The volume of runoff, as determined from the local historical rainfall record, that achieves approximately the same reduction in pollutant loads and flows as achieved by mitigation of the 85th percentile, 24-hour runoff event;

OR

B. Flow

Flow-based BMPs shall be designed to infiltrate, filter, or treat either:

1. The maximum flow rate of runoff produced from a rainfall intensity of 0.2 inch of rainfall per hour; or,

2. The maximum flow rate of runoff produced by the 85th percentile hourly rainfall intensity, as determined from the local historical rainfall record, multiplied by a factor of two; or,

3. The maximum flow rate of runoff, as determined from the local historical rainfall record, that achieves approximately the same reduction in pollutant loads and flows as achieved by mitigation of the 85th percentile hourly rainfall intensity multiplied by a factor of two.

C. Groundwater Protection

Any structural infiltration BMPs shall meet the following minimum requirements:

1. Use of structural infiltration treatment BMPs shall not cause or contribute to an exceedance of groundwater water quality objectives.

2. Source control and pollution prevention control BMPs shall be implemented to protect groundwater quality.

3. Structural infiltration treatment BMPs shall not cause a nuisance or pollution, as defined in Water Code Section 13050 .

4. The permittees may propose any equivalent sizing criteria for treatment BMPs or other controls that will achieve greater or substantially similar pollution control benefits. In the absence of approved equivalent sizing criteria, the permittees shall implement the above stated sizing criteria.

5. If a particular BMP is not technically feasible, other BMPs should be implemented to achieve the same level of compliance, or if the cost of BMP implementation greatly outweighs the pollution control benefits, the permittees may grant a waiver of the numeric sizing criteria. All waivers, along with waiver justification documentation,

must be reported to the Regional Board in writing within 30 days. The permittees may propose to establish an urban runoff fund to be used for urban water quality improvement projects within the same watershed that is funded by contributions from developers granted waivers. If it is determined by the Regional Board that waivers are being inappropriately granted, this Order may be reopened to modify these waiver conditions.

6. The obligation to install minimum structural BMPs at new development is met if, for a common scheme of development, BMPs are constructed with the requisite capacity to serve the entire common scheme, even if cerain phases of the common scheme may not have BMP capacity located on that phase in accordance with the requirements specified above.

XIII. PUBLIC EDUCATION AND OUTREACH

1. The permittees shall continue to implement the public education efforts already underway and shall implement the most effective elements of the comprehensive public and business education strategy contained in the Report of Waste Discharge/DAMP. By July 1, 2002, the permittees shall complete a public awareness survey to determine the effectiveness of the current public and business education strategy and provide a future action plan.
2. When feasible, the permittees shall participate in joint outreach with other programs including, but not limited to, the State of California Storm Water Quality Task Force, Caltrans and other municipal storm water programs to ensure that a consistent message on storm water pollution prevention is disseminated to the public. The permittees shall sponsor or staff a storm water table or booth at community, regiona, and/or countywide events to distribute public education materials to the public. Each permittee shall participate in at least one event per year.
3. By March 1, 2002, the permittees shall establish a Public Education Committee to provide oversight and guidance for the implementation of the public education program. The Public Education Committee shall meet at least twice per year. The Public Education Committee shall make recommendations for any changes to the public and business education program. The goal of the public and business education program shall be to target 100% of the residents, including businesses, commercial and industrial establishments. Through use of local print, radio and television, the permittees must ensure that the public and business education program makes a minimum of 10 million impressions per year and that those impressions measurably increase the knowledge and measurably change the behavior of the targeted groups. By November 15, 2002, the Public Education Committee shall propose a study for measuring changes in knowledge and behavior as a result of the education program. Upon approval by the Regional Board Executive Officer, the study shall be completed by the end of the permit cycle. By July 1, 2002, the Public Education Committee shall develop BMP guidance for restaurants, automotive service centers and gasoline service stations for the industrial facility inspectors to distribute to these facilities during inspections. Further, for restaurant, automotive service centers and gasoline service station corporate chains, information is to be developed that will be provided to corporate

environmental managers during outreach visits that will take place twice during the permit term.

4. By July 1, 2002, the permittees shall develop public education materials to encourage the public to report (including a hotline number and web site to report) illegal dumping and unauthorized, non-storm water discharges from residential, industrial, construction and commercial sites into public streets, storm drains and other waterbodies; clogged storm drains; faded or missing catch basin stencils and general storm water and BMP information. This hotline and web site shall be included in the public and business education program and shall be listed in the governmental pages of all regional phone books.
5. By July 1, 2003, the permittees shall develop BMP guidance for the control of those potentially polluting activities not otherwise regulated by any agency including guidelines for the household use of fertilizers, pesticides, herbicides and other chemicals, and guidance for mobile vehicle maintenance, carpet cleaners, commercial landscape maintenance, and pavement cutting. These guidance documents shall be distributed to the public, trade associations, etc., through participation in community events, trade association meetings and/or mail.
6. By July 1, 2003, the permittees shall conduct an evaluation to determine the best method of establishing a mechanism(s) for providing educational and General Industrial Permit materials to businesses within their jurisdiction.

XIV. MUNICIPAL FACILITIES/ACTIVITIES

1. Each permittee shall implement the recommendations in the Environmental Performance Report to ensure that public agency facilities and activities do not cause or contribute to a pollution or nuisance in receiving waters. By July 1 of each year, the permittees shall review all their activities and facilities to determine the need for any revisions to the Environmental Performance Reports. The annual report shall include the findings of this review and a schedule for any needed revisions. All revisions should consider a pollution prevention strategy to ensure that the public agency facilities and/or activities that are currently not required to obtain coverage under the State's general storm water permits reduce the discharge of pollutants into the waters of the U.S. to the maximum extent practicable.
2. By July 1, 2003, the permittees shall complete an assessment of their flood control facilities to evaluate opportunities to configure and/or to reconfigure channel segments to function as pollution control devices and to optimize beneficial uses. These modifications may include in-channel sediment basins, bank stabilization, water treatment wetlands, etc. This shall be reported in the 2002-2003 annual report.
3. By July 1, 2002, the principal permittee shall develop and distribute model maintenance procedures for public agency activities such as street sweeping; catch basin stenciling; drainage facility inspection, cleaning and maintenance, etc. This shall be reported in the 2001-2002 annual report.

4. By July 1, 2002, the principal permittee shall develop and distribute BMP guidance for public agency and contract field operations and maintenance staff to provide guidance in appropriate pollution control measures, how to respond to spills and reports of illegal discharges, etc. This shall be reported in the 2001-2002 annual report.
5. At least on an annual basis, the principal permittee shall provide training to public agency staff and to contract field operations staff on fertilizer and pesticide management, model maintenance procedures, implementation of environmental performance reporting program and other pollution control measures. Each permittee shall attend at least three of these training sessions during the five year term of this permit (from 2001 to 2006).
6. By July 1, 2002, the principal permittee shall develop a model maintenance procedure for drainage facilities. This shall be included in the 2001-2002 annual report. Each permittee shall inspect, clean and maintain at least 80% of its drainage facilities on an annual basis, with 100% of the facilities included in a two-year period, using the model maintenance procedures developed by the principal permittee. This shall be included in the annual report.
7. By July 1, 2004, the permittees shall develop and submit for approval by the Executive Officer, a more aggressive program for cleaning out drainage facilities, including catch basins. This program should be based on a list of drainage facilities, prioritized on such factors as distance to receiving water, receiving water beneficial uses and impairments of beneficial uses, historical pollutant types and loads from past inspections/cleanings and the presence of downstream regional facilities that would remove the types of pollutants found in the drainage facility. Using this list, the permittees shall propose clean out schedules for all drainage facilities with a minimum frequency of once a year and a maximum frequency of monthly, during the storm season. The permittees should be prepared to implement the approved clean out program beginning with the 2004-2005 storm season.
8. By July 1, 2002, the permittees shall evaluate the applicability of the Environmental Performance Program to municipal maintenance contracts, contract for field maintenance operations, and leases. This shall be included in the 2001-2002 annual report.

XV. MUNICIPAL CONSTRUCTION PROJECTS/ACTIVITIES

1. This order authorizes the discharge of storm water runoff from construction projects that may result in land disturbance of five (5) acres or more (or less than five acres, if it is part of a larger common plan of development or sale which is five acres or more) that are under ownership and/or direct responsibility of any of the permittees. All permittee construction activities shall be in accordance with DAMP, Appendix H.
2. Prior to commencement of construction activities, the permittees shall notify the Executive Officer of the Regional Board of the proposed construction project. Upon completion of the construction project, the Executive Officer shall be notified of the completion of the project.
3. The permittees shall develop and implement a storm water pollution prevention plan (SWPPP) and a monitoring program that is specific for the construction project, prior to the

commencement of any of the construction activities. The SWPPP shall be kept at the construction site and released to the public and/or Regional Board staff upon request.

4. The SWPPP and the monitoring program for the construction projects shall be consistent with the requirements of the latest version of the State's General Construction Activity Storm Water Permit.
5. The permittees shall give advance notice to the Executive Officer of the Regional Board of any planned changes in the construction activity, which may result in non-compliance with the latest version of the State's General Construction Activity Storm Water Permit.
6. All other terms and conditions of the latest version of the State's General Construction Activity Storm Water Permit shall be applicable.

XVI. SUB-WATERSHEDS AND TMDL IMPLEMENTATION

1. The permittees shall meet the following target load allocations for nutrients in urban runoff by implementing the BMPs contained in Appendix N (DAMP, Section 12) and in accordance with the approved TMDL implementation plan incorporated in the Basin Plan.

(This section intentionally left blank.)

Table 1. Seasonal Load Allocations of Total Nitrogen for the Newport Bay Watershed

Nutrient TMDL	1990-1997 Loading	2002 Summer Allocation (Apr-Sept)[5]	2007 Summer Allocation (Apr-Sept)[5]	2012 Winter Allocation (Oct-Mar)[4, 5, 6]
Newport Bay Watershed	lbs/year TN[1,2]	lbs/season TN	lbs/season TN	lbs/season TN
Wasteload Allocation				
Urban runoff	277,131[3]	20,785	16,628	55,442
		5 year target	10 year target	15 year target

1 TIN = (NO3+NH3).
2 TN = (TIN + Organic N).
3 Estimated annual average (summer and winter loading).
4 Total nitrogen winter loading limit applies between October 1 and March 31 when the mean daily flow rate at San Diego Creek at Campus Drive is below 50 cubic feet per second (cfs), and when the mean daily flow rate in San Diego Creek at Campus Drive is above 50 cubic feet per second (cfs), but not as the result of precipitation.
5 Compliance to be achieved no later than this date. The Regional Board may require earlier compliance with these targets when it is feasible and reasonable.
6 Assumes 67 non-storm days.

Table 2. Annual Total Phosphorous Load Allocations For The Newport Bay Watershed

	2002 Allocation lbs/year TP[1]	2007 Allocation lbs/year TP[1]
TMDL	86,912	62,080
Urban areas	4,102	2,960

1 Compliance to be achieved no later than this date. The Regional Board may require earlier compliance with these targets when it is feasible and reasonable.

Table 3. Annual Total Nitrogen Load Allocations For San Diego Creek, Reach 2 During Non-Storm Conditions.[1]

	2012 Allocation lbs/day TN[2]
TMDL	14 lbs/day (TN)
Waste Load Allocation (Urban runoff)	5.5 lbs/day (TN)

[1] Total nitrogen loading limit applies when the mean daily flow rate at San Diego Creek at Culver Drive is below 25 cubic feet per second (cfs), and when the mean daily flow rate in San Diego Creek at Culver Drive is above 25 cubic feet per second (cfs), but not as the result of precipitation.

[2] Compliance to be achieved no later than this date. The Regional Board may require earlier compliance with these targets when it is feasible and reasonable.

2. The permittees shall meet the following target load allocations for sediment in urban runoff by implementing the BMPs contained in Appendix N of the DAMP and the "March 1999 Technical Report on the Implementation of the TMDL for Sediment in the Newport Bay Watershed, the October 1999 Preliminary Sediment Load Allocation Analysis for San Diego Creek and Newport Bay, and the February 2000 Sediment Yield and Transport Investigation for San Diego Creek and Newport Bay".
    a. The load allocations for sediment discharges to Newport Bay from urban areas shall not exceed 2,500 tons per year, implemented as a 10-year running annual average.
    b. The load allocations for sediment discharges to San Diego Creek and its tributaries from urban areas shall not exceed 2,500 tons per year, implemented as a 10-year running annual average.
3. The permittees shall revise Appendix N of the DAMP to include implementation measures and schedules for further studies related to the TMDL for fecal coliform in Newport Bay, as set fourth in the January 2000, March 2000 and April 2000 Newport Bay Fecal Coliform TMDL Technical Reports submitted by the permittees.
4. This order may be reopened to include additional requirements based on new or revised TMDLs.

XVII. PROGRAM MANAGEMENT/DAMP REVIEW

1. By July 1 of each year, the permittees shall evaluate the DAMP to determine whether any revisions are necessary in order to reduce pollutants in MS4 discharges to the maximum extent practicable. In addition, the first annual review after adoption of this order shall include the following:
    a. Review of the formal training needs of municipal employees
    b. Review of coordinating meeting/training for the designated NPDES inspectors.
2. The annual report shall include the findings of this review and a schedule for any needed revisions or a copy of the amended DAMP with the proposed changes.

3. The permittees shall modify the DAMP, at the direction of the Regional Board Executive Officer, to, as necessary, incorporate additional provisions. Such provisions may include regional and watershed-specific requirements and/or waste load allocations developed and approved pursuant to the TMDL process.
4. The Permittee Committee shall meet at least six times a year to discuss issues related to permit implementation and regional and statewide issues. Each permittee's designated representative or a designated alternate should attend at least 75% of these meetings.

XVIII. FISCAL RESOURCES

1. The permittees shall prepare and submit a unified fiscal analysis to the Executive Officer of the Regional Board. The fiscal analysis shall be submitted with the Annual Report document no later than November 15th of each year and shall, at a minimum, include the following:
    a. Each permittee's expenditures for the previous fiscal year,
    b. Each permittee's budget for the current fiscal year,
    c. A description of the source of funds, and
    d. Each permittee's estimated budget for the next fiscal year.

XIX. PROVISIONS

1. All reports submitted by the permittees as per the requirements in this Order for the approval of the Executive Officer shall be publicly noticed and made available on the Regional Board's website, or through other means, for public review and comments. The Executive Officer shall consider all comments received prior to approval of the reports. Any unresolved significant issues shall be scheduled for a public hearing at a Regional Board meeting prior to approval by the Executive Officer.
2. The purpose of this Order is to require the implementation of best management practices to reduce, to the maximum extent practicable, the discharge of pollutants from the MS4 in order to support reasonable further progress towards attainment of water quality objectives.

    Permittees shall demonstrate compliance with all the requirements in this order and specifically with Section III.2 Discharge Limitations and Section IV. Receiving Water Limitations, through timely implementation of their DAMP and any modifications, revisions, or amendments developed pursuant to this order approved by the Executive Officer or determined by the permittee to be necessary to meet the requirements of this order. The DAMP, as included in the Report of Waste Discharge, including any approved amendments thereto, is hereby made an enforceable component of this order.
3. The permittees shall, at a minimum, implement all elements of the DAMP. Where the dates in the DAMP are different than those of this order, the dates in this order shall prevail. Any proposed revisions to the DAMP shall be submitted with the Annual

Report to the Executive Officer of the Regional Board for review and approval. All approved revisions to the DAMP shall be implemented as per the time schedules approved by the Executive Officer. In addition to those specific controls and actions required by (1) the terms of this Order and (2) the DAMP, each permittee shall implement additional controls, if any are necessary, to reduce the discharge of pollutants in storm water to the maximum extent practicable as required by this Order.

4. The permittees shall comply with Monitoring and Reporting Program No. R8-2002-0010, and any revisions thereto, which is hereby made a part of this order. The Executive Officer is authorized to revise the Monitoring and Reporting Program to allow the permittees to participate in regional, statewide, national or other monitoring programs in lieu of or in addition to Monitoring and Reporting Program No. R8-2002-0010.

5. By November 15, 2002, the permittees, in coordination with the Orange County Fire Chiefs Association, shall develop a list of appropriate BMPs to be implemented to reduce pollutants from training activities, fire hydrant/sprinkler testing or flushing, non-emergency fire fighting and any BMPs feasible for emergency fire fighting flows.

6. The permittees should consult the Orange County Vector Control District to ensure that structural treament systems are designed to minimize the potential for vector breeding.

7. Upon approval by the Executive Officer of the Regional Board, all plans, reports and subsequent amendments required by this order shall be implemented and shall become an enforceable part of this order. Prior to approval by the Executive Officer, these plans, reports and amendments shall not be considered as an enforceable part of this order.

8. The permittees shall report to the Executive Officer of the Regional Board:

   a. Any enforcement actions and discharges of storm or non-storm water, known to the permittees, which may have an impact on human health or the environment,

   b. Any suspected or reported activities on federal, state, or other entity's land or facilities, where the permittees do not have any jurisdiction, and where the suspected or reported activities may be contributing pollutants to waters of the US.

   (Also see reporting requirements in Monitoring and Reporting Program No. R8-2002-0010)

9. The permit application and special NPDES program requirements contained in 40 CFR 122.21 (a), (b), (d)(2), (f), (p); 122.41 (a), (b), (c), (d), (e), (f), (g), (h), (i), (j), (k), (l); and 122.42 (c) are incorporated into this order by reference.

XX. PERMIT EXPIRATION AND RENEWAL

1. This order expires on January 18, 2007 and the permittees must file a Report of Waste Discharge (permit application) no later than 180 days in advance of such expiration date as application for issuance of new waste discharge requirements. The Report of Waste Discharge shall, at a minimum, include the following:

a. Any revisions to the Drainage Area Management Plan including, but not limited to, all the activities the permittees propose to undertake during the next permit term, goals and objectives of such activities, an evaluation of the need for additional source control and/or structural BMPs, any proposed pilot studies, etc.;

b. Changes in land use and/or population including land use map updates;

c. Any significant changes to the storm drain systems, outfalls, detention or retention basins or dams and other controls including map updates of the storm drain systems; and,

d. Any new or revised program elements and compliance schedule(s) necessary to comply with Section IV of this order.

2. This Order may be modified, revoked or reissued prior to its expiration date for the following reasons:

   a. To address significant changes in conditions identified in the technical reports required by the Regional Board which were unknown at the time of the issuance of this order;

   b. To incorporate applicable requirements of statewide water quality control plans adopted by the State Water Resources Control Board or any amendments to the Basin Plan approved by the Regional Board, the State Board and, if necessary, by the Office of Administrative Law;

   c. To comply with any applicable requirements, guidelines, or regulations issued or approved under the Clean Water Act, if the requirements, guidelines, or regulations contain different conditions or additional requirements than those included in this order; or,

   d. To incorporate any requirements imposed upon the permittees through the TMDL process.

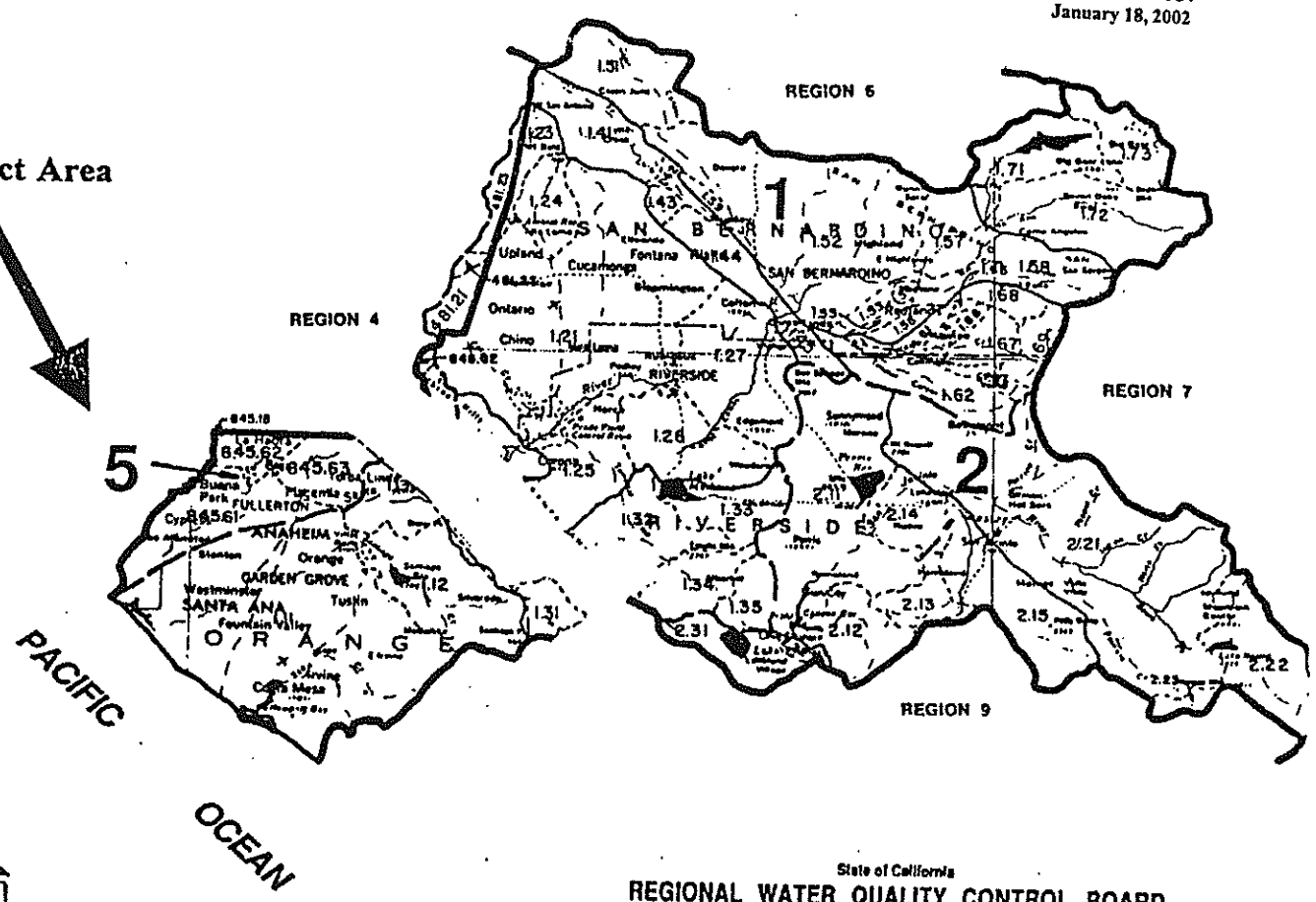
3. This order shall serve as a National Pollutant Discharge Elimination System (NPDES) Permit pursuant to Section 402 (p) of the Clean Water Act, or amendments thereto, and shall become effective ten days after the date of its adoption, provided the Regional Administrator of the U. S. EPA has no objections. If the Regional Administrator objects to its issuance, the permit shall not become effective until such objection is withdrawn.

4. Order No. 96-31 is hereby rescinded.

I, Gerard Thibeault, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an order adopted by the California Regional Water Quality Control Board, Santa Ana Region, on January 18, 2002.

_____

Gerard J. Thibeault
Executive Officer



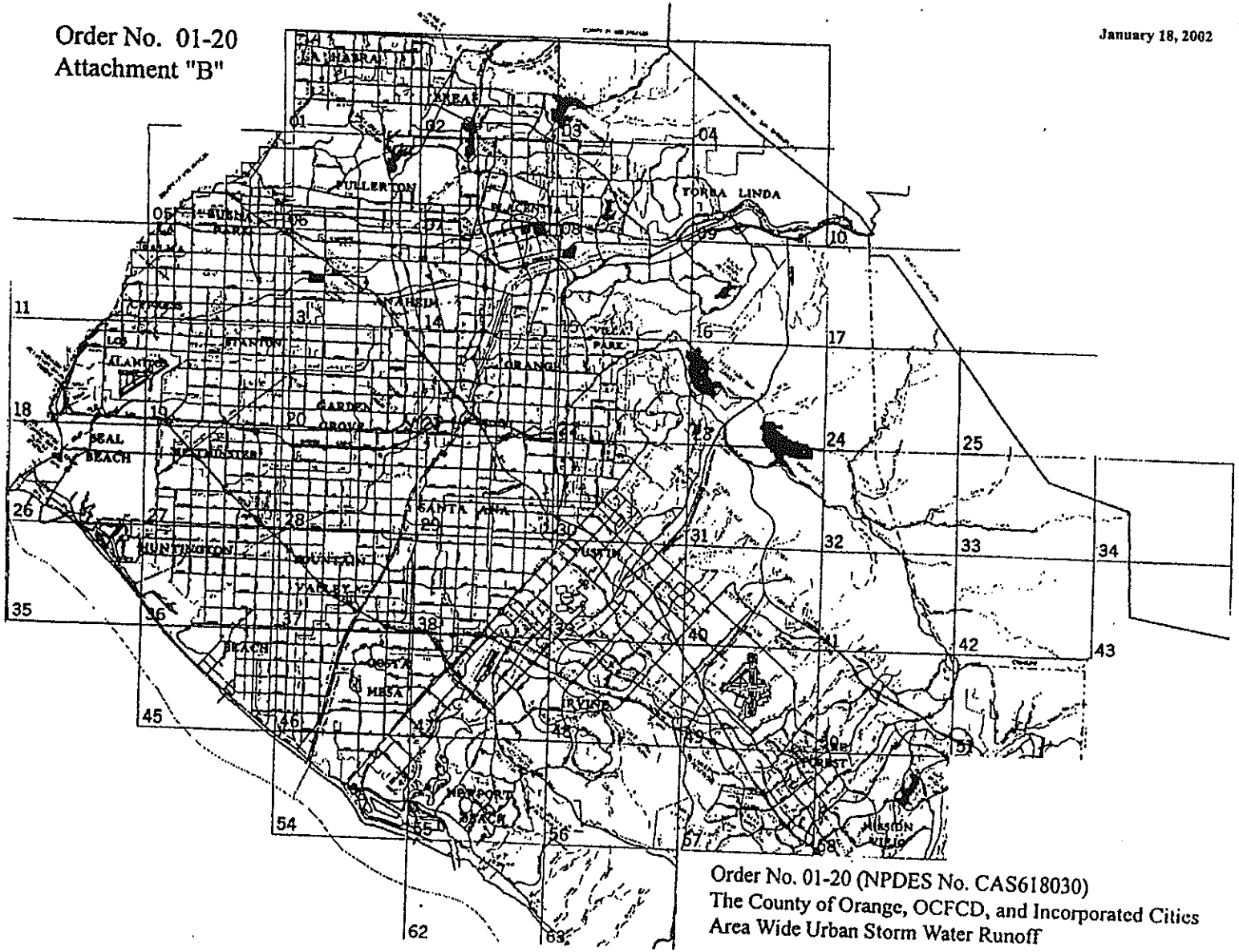
April 1973
Revised: July 1976
Revised: August 1986

State of California
REGIONAL WATER QUALITY CONTROL BOARD
Santa Ana Region (8)
SANTA ANA HYDROLOGIC BASIN PLANNING AREA (SA)

Scale in miles
0 6 12 24 36
Scale 1:500,000

Order No. 01-20
Attachment "B"

January 18, 2002



Order No. 01-20 (NPDES No. CAS618030)
The County of Orange, OCFCD, and Incorporated Cities
Area Wide Urban Storm Water Runoff

Order No. R8-2002-0010
Attachment "C"
LIST OF OTHER ENTITIES WITH THE POTENTIAL TO DISCHARGE POLLUTANTS TO THE ORANGE COUNTY STORM WATER SYSTEM

California Department of Transportation (Caltrans), District 12
Southern Pacific Railroad
Atchison, Topeka & Santa Fe Railway Company
Seal Beach Naval Weapons Station
Seal Beach Naval Reserve Center, Los Alamitos
U. S. Marine Corps Air Station, El Toro
National Forest Service

Universities and Colleges

University of California, Irvine
California State University, Fullerton
Chapman College
Coastline College
Cypress College
Fullerton College
Irvine Valley College
Golden West College
Orange Coast College
Rancho Santiago College

School Districts

Anaheim Elementary School District
Anaheim Union High School District
Brea-Olinda Unified School District
Buena Park Joint Union High School District
Centralia Elementary School District
Cypress Elementary School District
Fountain Valley Union High School District
Fullerton Joint Union High School District
Garden Grove Unified School District
Huntington Beach Elementary School District
Huntington Beach Union High School District
Irvine Unified Union High School District
La Habra Joint Union High School District
Los Alamitos Unified School District
Lowell Joint Union High School District
Magnolia Elementary School District
Newport-Mesa Unified School District

Ocean View Union High School District
Orange Unified School District
Placentia Unified School District
Santa Ana Unified School District
Savanna Union High School District
Tustin Unified School District
Westminster Union High School District
Yorba Linda Joint Union High School District

Hospitals

Anaheim General Hospital
Brea Community Hospital
Chapman General Hospital
Children's Hospital of Orange County, Orange
Coastal Communities Hospital, Santa Ana
Fairview Hospital
FHP Hospital, Fountain Valley
Fountain Valley Regional Hospital and Medical Center
Hoag Hospital, Newport Beach
Kaiser Foundation Hospital, Anaheim
Orange County Community Hospital, Buena Park
Pacifica Community Hospital, Huntington Beach
Placentia Linda Community Hospital
Santa Ana Hospital and Medical Center
St. Joseph's Hospital, Orange
U.C. Irvine Medical Center
Vencor Hospital of Orange County, Westminster
Whittier Hospital and Medical Center, Buena Park

Water/Wastewater Agencies

Santa Ana Watershed Project Authority
Irvine Ranch Water District
Los Aliso Water District
El Toro Water District
San Bernardino County Flood Control District
Riverside County Flood Control & Water Conservation District
L.A. County Department of Public Works
County Sanitation Districts of Orange County
Orange County Water District
Metropolitan Water District

California Regional Water Quality Control Board
Santa Ana Region

Monitoring and Reporting Program No. R8-2002-0010
NPDES No. CAS618030

for
the County of Orange, Orange County Flood Control District,
and
Incorporated Cities of Orange County Within the Santa Ana Region
Areawide Urban Storm Water Runoff

I. GENERAL

1. Revisions of the monitoring and reporting program are appropriate to ensure that the permittees are in compliance with requirements and provisions contained in this order. Revisions may be made under the direction of the Executive Officer at any time during the term, and may include a reduction or increase in the number of parameters to be monitored, the frequency of monitoring, or the number and size of samples collected.

2. The Executive Officer is authorized to allow the permittees to participate in statewide, national, or other monitoring programs in lieu of this monitoring program.

3. All sample collection, handling, storage, and analysis shall be in accordance with 40 CFR Part 136 or other methods approved by the Executive Officer.

4. The permittees are authorized to complement their monitoring data with other monitoring sources, provided the monitoring conditions and sources are similar to those in the Santa Ana Watershed.

II. OBJECTIVES

The 1999 Water Quality Monitoring Program prioritized selected monitoring locations in Orange County based on a list of Critical Aquatic Resources and "Warm Spots". This prioritization is based on an analysis of prior years' monitoring data and other available data. It is expected that data collection for the 1999 monitoring program will be completed by July 1, 2003. The permittees also participate in the Regional Monitoring Program for San Diego Creek Nutrient TMDL and other regional monitoring programs, such as those conducted by the Southern California Coastal Water Research Project. The overall goal of these monitoring programs is to develop and support an effective watershed management program. The following are the major objectives:

1. To develop and support an effective municipal urban runoff and non-point source control program.

2. To define water quality status, trends, and pollutants of concern associated with urban storm water and non-storm water discharges and their impact on the beneficial uses of the receiving waters.

3. To characterize pollutants associated with urban storm water and non-storm water discharges and to assess the influence of urban land uses on water quality and the beneficial uses of receiving waters.

4. To identify significant water quality problems related to urban storm water and non-storm water discharges.

5. To identify other sources of pollutants in storm water and non-storm water runoff to the maximum extent possible (e.g., atmospheric deposition, contaminated sediments, other non-point sources, etc.)

6. To identify and prohibit illicit discharges.

7. To identify those waters, which without additional action to control pollution from urban storm water discharges, cannot reasonably be expected to attain or maintain applicable water quality standards required to sustain the beneficial uses in the Basin Plan (TMDL monitoring).

8. To evaluate the effectiveness of existing municipal storm water quality management programs, including an estimate of pollutant reductions achieved by the structural and nonstructural BMPs implemented by the permittees.

9. To evaluate costs and benefits of proposed municipal storm water quality control programs to the stakeholders, including the public.

The Regional Board recognizes that these objectives may not be attainable during this permit period and authorizes the Executive Officer to evaluate and to determine adequate progress toward meeting each objective.

III. MONITORING PROGRAM REQUIREMENTS

1. The permittees shall complete the 1999 Water Quality Monitoring Program.

2. The permittees shall revise, by July 1, 2003, their Water Quality Monitoring Program to include, at a minimum, the following monitoring components or their equivalence:

   A. Mass Emissions Monitoring.

      (1) The principal permittee shall monitor mass emissions in order to: (a) estimate the total mass emissions from the MS4; (b) assess trends in mass emissions over time; and (c) to determine if the MS4 is contributing to exceedances of water quality objectives or beneficial uses, by comparing results to the California Toxics Rule (CTR), Basin Plan, Ocean Plan and/or other relevant standards.

(2) A minimum of seven mass emissions stations shall be placed at locations to include coastal outfalls at Huntington Harbor/Anaheim Bay, the coastline between Huntington Harbor and Newport Bay, Upper/Lower Newport Bay, the Crystal Cove Area of Special Biological Significance (ASBS), and north Orange County where surface flows have not been well-characterized (e.g., Fullerton Creek Channel, Carbon Creek Channel, or Coyote Creek). Additional locations should be based on large discharge volumes, large subwatershed drainage areas, and/or land use distribution.

(3) Autosamplers shall be programmed to collect representative samples from the first storm event and two more storm events during the rainy season. A minimum of three dry-weather samples shall also be collected. Samples from the first rain event each year shall be analyzed for the entire suite of priority pollutants. All samples must be analyzed for metals, pH, TSS, TOC, pesticides/herbicides, and constituents which are known to have contributed to impairment of local receiving waters. Dry weather samples should also include an analysis for oil and grease. Sediments associated with mass emissions should be analyzed for constituents of concern.

B. Estuary/Wetlands Monitoring

(1) The permittees shall monitor the Upper Newport estuary, Talbert Marsh, and Bolsa Chica wetlands areas to determine the effects of storm water and non-storm water runoff associated with increased urbanization on these systems.

(2) Monitoring locations shall include representative areas surrounding channel outfalls and areas away from channel outfalls. Sampling strategies shall be designed to enable the determination of storm water and non-storm water effects on sediment chemistry, toxicity, benthic communities, nutrient status, and spatial extent of sediment fate within the estuarine environment. Additionally, other indicators of biological integrity should be evaluated, such as bird populations or endangered plant/animal species.

C. Water Column Toxicity Monitoring

(1) Analyses for toxicity to freshwater and marine species shall be performed on mass emissions samples to determine the impacts of storm water and non-storm water runoff on toxicity of receiving waters.

(2) *Ceriodaphnia dubia* and *Strongylocentrotus purpuratus* fertilization shall be used to evaluate toxicity on the sample from the first rain event, plus one other wet weather sample and two dry weather samples.

(3) Criteria shall be identified which will trigger the initiation of Toxicity Identification Evaluations (TIEs) and Toxicity Reduction Evaluations (TREs).

D. Bacteriological/Pathogen Monitoring

(1) The permittees shall obtain monitoring data from other entities (such as the Orange County Health Care Agency) and/or monitor representative areas along the Orange County coastline, as well as a minimum of six inland water bodies/channels, for total coliform, fecal coliform, and Enterococcus in order to determine the impacts of storm water and non-storm water runoff on loss of beneficial uses to receiving waters. Inland monitoring stations shall be located to include channels/creeks which are currently impaired for pathogens.

(2) Where possible, data shall be obtained from monitoring efforts of Orange County Health Care Agency, POTWs, and/or other public or private agencies/entities. Monitoring shall be conducted directly by the permittees only to the extent that data gaps exist.

E. Bioassessment

(1) The permittees shall cooperate with the Southern California Coastal Water Research Project (SCCWRP) in efforts to evaluate the biological index approach for Southern California and to design a research project for developing an Index of Biological Integrity (IBI) for the region.

(2) The permittees shall coordinate with SCCWRP and the Regional Board to identify appropriate bioassessment station locations. Station selection and sampling scheme shall be identified in the revised Monitoring Program, and sampling should commence no later than October 2003.

F. Reconnaissance

(1) The permittees shall develop new reconnaissance strategies to identify and prohibit illicit discharges. Where possible, the use of GIS to identify geographic areas with a high density of industries associated with gross pollution (e.g. electroplating industries, auto dismantlers) and/or locations subject to maximum sediment loss (e.g. new development) may be used to determine areas for intensive monitoring efforts. Additionally, the permittees shall coordinate with the Regional Board to develop a comprehensive database to include all enforcement actions for storm water violations and unauthorized, non-storm water discharges, that can then be used to more effectively target reconnaissance efforts.

G. Land Use Correlations

(1) The permittees shall develop and implement strategies for determining the effects of land use on the quality of receiving waters. While it is recognized that a wide range of land uses exist across the region and within each subwatershed, one relationship that may be easily determined is the impact of development on sediment loading within receiving waters, since developed areas contribute relatively little sediment loading compared to areas under construction. Consequently, the permittees shall, at a minimum, analyze the impacts of increasing development and the conversion of agricultural land to the sediment loading of the Upper Newport Bay.

(2) Where possible, data shall be obtained from monitoring efforts of other public or private agencies/entities (e.g., Caltrans, The Irvine Company).

H. TMDL/303(d) Listed Waterbody Monitoring

The Permittees shall continue to participate in the Regional Monitoring Program for the San Diego Creek Nutrient TMDL. In addition, strategies must be revised/developed to evaluate the impacts of storm water or non-storm water runoff on all impairments within the Newport Bay watershed and other 303(d) listed waterbodies. Since the 303(d) listing is dynamic, with new waterbodies and new impairments being identified over time, the permittees shall revise their monitoring plan to incorporate new information as it becomes available.

3. By July 1, 2003, the permittees shall develop and submit for approval of the Executive Officer, their revised Water Quality Monitoring Program, which should yield an integrated watershed-monitoring approach capable, to the maximum extent possible, of achieving the above-stated goals. In order to minimize cost and maximize benefits, it is highly recommended that this program be developed in cooperation with the SCCRWP, the Orange County Health Care Agency, neighboring coastal regions and/or other public or private agencies/entities. The development and implementation of the monitoring program shall be in accordance with the time schedules prescribed by the Executive Officer. At a minimum, the program shall include the following and any requirements developed by the State Board in accordance with Water Code Section 13383.5:

A. Uniform guidelines for quality control, quality assurance, data collection and data analysis that conform to current US EPA standards.

B. A mechanism for the collection, analysis and interpretation of existing data from local, regional or national monitoring programs. These data sources may be utilized to characterize different storm water sources; to determine pollutant generation, transport and fate; to develop a relationship between land use, development size, storm size and the event mean concentration of pollutants; to determine spatial and temporal variances in storm water quality and seasonal and other bias in the

collected data; and to identify any unique features of the Santa Ana Watershed. The permittees are encouraged to use data from similar studies, if available.

C. A description of the monitoring program, including:

(1) The number of monitoring stations;

(2) Monitoring locations within flood control channels, bays and estuaries, coastal areas, major outfalls, and other receiving waters;

(3) Environmental indicators (e.g., ecosystem, biological, habitat, chemical, sediment, stream health, etc.) chosen for monitoring;

(4) Parameters selected for field screening and for laboratory work;

(5) Total number of samples to be collected from each station, frequency of sampling during wet and dry weather, short duration or long duration storm events, type of samples (grab, 24-hour composite, etc.), justification for composite versus discrete sampling, type of sampling equipment, quality assurance/quality control procedures followed during sampling and analysis, analysis protocols to be followed (including sample preparation and maximum reporting limits), and identity and qualifications of laboratories performing analyses;

(6) A mechanism for analyzing the collected data and interpreting the results including protocols for handling of non-detects and 'outliers', an evaluation of the effectiveness of the management practices, and need for refinement of the management practices; and,

(7) A description of the responsibilities of all the participants in this program including cost sharing.

IV. REPORTING

1. All progress reports and proposed strategies and plans required by this order shall be signed by the principal permittee, and copies shall be submitted to the Executive Officer of the Regional Board under penalty of perjury.

2. The permittees shall submit an **ANNUAL PROGRESS REPORT** to the Executive Officer of the Regional Board and to the Regional Administrator of the U.S. EPA, Region 9, no later than November 15th, of each year. This progress report may be submitted in a mutually agreeable electronic format. At a minimum, annual progress report shall include the following:

A. A review of the status of program implementation and compliance (or non-compliance) with the schedules contained in this order;

B. An assessment of the effectiveness of control measures established under the illicit discharge elimination program and the Drainage Area Management Plan. The effectiveness may be measured in terms of how successful the program has been in eliminating illicit/illegal discharges and reducing pollutant loads in storm water discharges;

C. An assessment of any storm water management program modifications made to comply with Clean Water Act requirements to reduce the discharge of pollutants to the maximum extent practicable;

D. A summary and analysis of monitoring results from the previous year and any changes to the monitoring program for the following year;

E. A fiscal analysis progress report as described in Section V., Provision, 25., of this order;

F. A draft workplan which describes the proposed implementation of the DAMP for next fiscal year. The workplan shall include clearly defined tasks, responsibilities, and schedules for implementation of the storm water program and each permittee actions for the next fiscal year;

G. Major changes in any previously submitted plans/policies; and

H. An assessment of the permittees compliance status with the Receiving Water Limitations, Section IV of the Order, including any proposed modifications to the DAMP if the Receiving Water Limitations are not fully achieved.

3. The permittees shall be responsible for the submittal to the principal permittee of all required information/materials needed to comply with this order in a timely manner. All such submittals shall be signed by a duly authorized representative of the permittee under penalty of perjury.

(This section intentionally left blank.)

V. REPORTING SCHEDULE

All reports required by this order shall be submitted to the Executive Officer of the Regional Board in accordance with the following schedule:

ITEM	COMPLETION DATE	REPORT DUE DATE
Review planning procedures and CEQA document preparation processes	December 19, 2002	January 2, 2003
Establish Public Education Committee	March 1, 2002	Nov 15, 2002
Review DAMP	July 1, 2003	Nov 15, 2003
Develop public education materials including reporting hot-line and web site	July 1, 2002	Nov 15, 2002
Develop and update construction site, including site information, priority, and inspection information	October 1, 2002	Nov 15, 2003
Establish mechanism to ensure local permits for proposed construction sites and industrial facilities are conditioned upon proof of obtaining coverage under the state General Permit	July 1, 2002	Nov 15, 2002
Develop and distribute model maintenance procedures for public agency activities	July 1, 2002	Nov 15, 2002
Develop and distribute BMP guidance for public agency and contract field operations and maintenance staff	July 1, 2002	Nov 15, 2002
Develop model maintenance procedures for drainage facilities	July 1, 2002	Nov 15, 2002
Evaluate Environmental Performance Program applicability to municipal maintenance contracts, contract for field maintenance operations, and leases	July 1, 2002	Nov 15, 2002
Review and revise current grading/erosion control ordinances	July 1, 2003	Nov 15, 2003

Implementation Agreement Revision	July 1, 2002	Nov 15, 2002
Litter/Trash Control Ordinance review	July 1, 2003	Nov 15, 2003
Additional Debris Control Measures Determination	July 1, 2003	Nov 15, 2003
Complete Public Awareness Survey	July 1, 2002	Nov 15, 2002
Proposed Monitoring Program	July 1, 2003	July 1, 2003
Develop restaurant inspections program, which includes runoff, grease blockage and spill reduction aspects	July 1, 2002	Nov 15, 2002
Legal Authority & Enforcement Strategy Certification	November 1, 2003	Nov 15, 2003
Review effectiveness of ordinances in prohibiting discharges to MS4's as listed in Section 7.	July 1, 2003	Nov 15, 2003
Develop and update an industrial site database, including facility information, priority, and inspection information	July 1, 2003	Nov 15, 2003
Develop and update a commercial site database, including facility information, priority, and inspection information	July 1, 2003	Nov 15, 2003
Propose mechanism to determine effect of septic system failures on storm water quality and a mechanism to address failures	July 1, 2003	Nov 15, 2003
Review oversight of portable toilets to determine need for any revision	July 1, 2003	Nov 15, 2003
BMP Guidance for Restaurants, Automotive Service Centers, and Gasoline Service Stations, developed by Public Education Committee	July 1, 2002	Nov 15, 2002
BMP Guidance for Control of Potential Polluting Activities not otherwise regulated	July 1, 2003	Nov 15, 2003

Review existing BMPs for New Developments and Water Quality Management Plan to determine need for development of Water Quality Protection Plan	July 1, 2003	Nov 15, 2003
Propose study of erosion control BMPs for new development	November 15, 2003	Nov 15, 2003
Incorporate watershed protection principles and policies into the General Plan	July 1, 2004	Nov 15, 2004
Report of Waste Discharge	180 days before permit expires	Dec. 1, 2005
Annual Report/Fiscal Analysis	November 15th of each year	Nov 15
Evaluate Storm Water Management structure and Implementation Agreement	July 1st of each year	Nov 15
Review Environmental Performance Reports	July 1st of each year	Nov 15
Provide training to public agency staff and to contract field operations staff	Annually	Nov 15
Re-evaluate monitoring program priorities based on previous year's data	Annually	Nov 15
Evaluate the DAMP	July 1st of each year	Nov 15
Permittee Committee meetings to discuss permit implementation and regional and state-wide issues	Held at least 6 times each year	Nov 15

Ordered by_____

Gerard J. Thibeault
Executive Officer
January 18, 2002

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD LETTER TO THE COUNTY OF ORANGE

California Regional Water Quality Control Board
Santa Ana Region

Winston H. Hickox
Secretary for Environmental Protection

Internet Address: http://www.swrcb.ca.gov/rwqcb8
3737 Main Street, Suite 500, Riverside, California 92501-3348
Phone (909) 782-4130 - FAX (909) 781-6288

Gray Davis
Governor

September 29, 2000

Mr. Chris Crompton
County of Orange
Public Facilities & Resources Department
300 N. Flower Street
Santa Ana, CA 92415-0835

WASTE DISCHARGE REQUIREMENTS FOR ORANGE COUNTY, AREA-WIDE MUNICIPAL STORM WATER PERMIT, ORDER NO. 96-31, NPDES NO. CAS618030

Dear Mr. Crompton:

On September 1, 2000, we received the NPDES renewal application pertaining to the above-referenced discharge. While the application submitted by the County of Orange has been accepted, it is important to note that the draft Drainage Area Management Plan (DAMP) needs further revision. We are encouraged by the fact that a meeting between County staff and Regional Board staff has been scheduled to discuss issues related to the DAMP and renewal of the Permit. We are hopeful that most of the issues discussed below can be resolved at that time. The DAMP needs to present specific objectives, enforceable goals and commitments, evaluations of current Best Management Practices (BMPs) and proposed new BMPs, and discharge characterization based on existing data.

Therefore, while the Report of Waste Discharge (ROWD) is accepted as the NPDES renewal application, the current draft DAMP will not be used as the foundation of the new permit as staff prepares the revised waste discharge requirements and tentative order for the County of Orange and the incorporated cities. Further, during permit renewal, Order No. 96-31 requires the permittees to provide updated maps showing current land uses and populations as well as the current storm drain systems, outfalls, detention or retention basins or dams, and other controls of the storm drain system with the ROWD[Items 29 (b) &(c)]. Those maps have not been included in the renewal package. Further, recent requests by Regional Board staff for storm drain maps of unincorporated areas in the Newport Coast area have shown that those maps are seriously out of date (more than 8 years). The permittees have until March 1, 2001 to update these maps and submit hard copies and electronic copies to Regional Board staff.

Given the overall lack of specificity, it is difficult to point out all of the deficiencies in the ROWD and DAMP. However, what follows is a general list of observations. It should be noted that the following list is not complete and is presented here to help guide the County if it decides to resubmit a revised DAMP. Please note the following:

ROWD - Section 2.0 (Detection/Elimination of Illegal Discharges and Illicit Connections)

Although all of the Permittees have adopted the Water Quality Ordinance and corresponding Enforcement Consistency Guide, there does not appear to be an effective or consistent enforcement policy throughout the county, particularly with regards to non-'public education'-type enforcement. There is a lack of information regarding the number of water pollution investigations conducted during the past permit period and there appears to be a negligible number of enforcement activities that resulted in administrative fines. There is no evidence that any of the enforcement activity has resulted from observations made during a municipality's regular inspections, such as code enforcement or hazardous waste storage inspections. Rather, it appears that all enforcement activities are the result of response to citizen complaints. In this case, it is very doubtful that repeat offenders will receive progressive penalties, as there does not appear to be follow-up inspections by the municipalities.

ROWD - Section 3.0 (Status of BMP Implementation)

It is apparent that all permittees are not implementing even the simple BMPs that are currently required by the existing DAMP. For example, three cities apparently do not track solid waste numbers. Three cities did not report the removal of debris from the storm drains and of the 21 cities and county that did report catch basin clean outs, five cities and the county cleaned out less than half of their storm drains. Finally, it should be noted that three cities still, have not stenciled all of their catch basins with the universal "No Dumping – Drains to Ocean".

Subsection 3.2.9 states that "Careful fertilizer application and management is the most effective means of controlling nutrient loss from landscaped areas". Yet, 11 cities and the county have not conducted soil compatibility tests to determine optimum fertilizer application rates and 20 cities and the county have not conducted soil compatibility tests for pesticides. Well over 22 tons of various pesticides were applied by the 24 cities and county (many amounts were not reported or were given as application rates, not total amount applied), yet only 4 cities have tested the soils for compatibility.

ROWD – Section 5.0 (Measuring Program Effectiveness)

This section lacks any specificity as to the effectiveness of any general programs or individual BMPs implemented to reduce pollutant loading to the municipal storm drain systems and receiving waters. What is present in this section are various reasons why the municipalities feel they are unable to evaluate BMPs and a list of studies, many conducted by non-municipal entities. Nowhere within this section are any measurements or evaluations of the programs or the BMPs being implemented by the municipalities.

The draft of the DAMP indicates that the majority of the new commitments are studies to be performed over the next five years to evaluate whether current management measures are sufficiently effective. The following examples of noted deficiencies should not be taken as a complete list, but should be used as general guidelines should the permittees choose to revise and resubmit the DAMP:

Section 1.4.3 (Third Term Permit: DAMP Emphasis) states that monitoring will be performed to ensure that BMPs are being correctly applied and are effective, yet throughout the ROWD, the inability of the municipalities to monitor or assess the effectiveness of BMPs is repeatedly stated. This section further states that there would be "... possible adjustment of water quality standards if they are not appropriate." It is not clear from this statement whether the municipalities are intending to conduct Use Attainability Analyses to remove beneficial uses from the Basin Plan or conduct studies to support the setting of Site Specific Objectives for any of the Region's waters. Finally, a review of the 'key performance commitments" listed at the end of the section reveals that most of these commitments consist of evaluations, re-evaluations, and items which should have been completed in the previous ten years of the permit, such as the implementation of a public and business education strategy, the development of formalized training elements, and an evaluation of the need for a Model Erosion Control Ordinance.

Section 3.5 states that the DAMP will be revised and submitted with the ROWD at the end of each permit cycle. The DAMP must be revised as needed. If developments take place over the next 5 years that require a modification to the DAMP, those changes must be made and not left until the expiration of the current permit. The next item lists a cycle by which watersheds within the county will be evaluated to assess the impacts of urban development on water quality. It should be noted that current and future TMDL requirements placed on the permittees as well as unanticipated environmental problems might override that priority cycle. The third item states that the permittees will wait until the California Storm Water Best Management Practices Handbooks are revised before the permittees will assess candidate BMPs for inclusion in the NPDES Storm Water Program. The requirement to assess BMPs and update the permittees NPDES program should have been and should continue to be a continuing process and cannot be postponed indefinitely until the completion of other entity's programs. Finally, it is repeated that the permittees shall "...assess and evaluate the data from site specific BMPs...", a detailed description of the methodologies to be used by the permittees in evaluating BMPs is required given the permittees reported past inability to assess BMP effectiveness.

Section 5.4 lists the new commitments for public agency activities. Again, most of the commitments presented here are things that should have been initiated in the past ten years of the permit including training of public agency staff in the implementation of model maintenance procedures, training public agency staff in pollution prevention, the updating of storm water facility maps, training staff on fertilizer and pesticide usage, or the commitments are evaluations to

determine the need to perform an activity and in all cases, the evaluation results would not be reported until November 2002 or later.

Section 7.4 lists new commitments for developments and significant redevelopment projects and Section 8.7 lists new commitments for construction. Again, the majority of the commitments are either the evaluation of the need to revise the development BMP appendix in the DAMP based on the update of the California Storm Water BMP Manuals or tasks that will only take place if the evaluation results in the need to update that appendix. Clearly, evaluation of the BMP requirements for new development is a major component of the permittees area-wide permit and cannot be delayed until the generation of a document outside the control of the permittees. The evaluation of the effectiveness of currently required BMPs as well as new BMPs must be a continual process and that process should be clear and well-defined given that this is the tenth year of this permit. Additionally, permittees should be actively conducting training sessions for the developers, not just documenting these activities if they happen to take place. It must be recognized that the permittees determine land use designations, approve new developments and redevelopment projects, set local BMP requirements, approve plans, inspect projects during construction and approve certificates of occupancy. The permittees must therefore ensure that these projects do not contribute to violations of water quality standards and the education and oversight of developers operating within a municipality is ultimately the responsibility of the municipality.

Section 9.4 lists the one new commitment for industrial discharger identification and it's an evaluation to determine the feasibility of establishing a mechanism to ensure compliance with the State's Industrial General Permit prior to issuing a business license. As stated, this is similar to the mechanism already in place for construction permits, yet the feasibility study results won't be made available until November 2003.

Section 10.5 lists new commitments for detection/elimination of illegal discharges and illicit connections. Again, most of these commitments are either a commitment to review and revise as necessary existing programs or programs which should have been established during the first two permit cycles, such as the training of industrial inspection staff on storm water quality awareness. Further the 'draft' DAMP states that this training will include information on BMP guidance developed for restaurants, automotive service centers and gasoline stations. While these are important potential sources for pollutant loading, it should be evident that the training should cover all aspects of industrial storm water BMPs and the elimination of unauthorized, non-storm discharges.

Section 12.0 addresses the Newport Bay Watershed with respect to its status as a 303(d) listed "Impaired Waterbody" and the Total Maximum Daily Load (TMDL) process resulting from that designation. It is important to note that implementation of the TMDLs for the Newport Bay

Watershed will require the setting of numeric water quality limits for all discharges to the bay, including storm water and non-storm water discharges (a.k.a. nuisance flows). Also, with regards to other impaired waters for which TMDLs have not been established, Federal regulations prohibit the Regional Board from allowing additional loading of those pollutants responsible for impairment. Therefore, procedures should be established by the permittees to either require BMPs in new developments and redevelopment projects that will result in pollutant loads equal to current loading or establish a program to enable developers to establish offsets equivalent to the resulting increased load.

As previously stated, the above review is not complete and is intended only to provide direction to the permittees in the event that the permittees decide to resubmit the DAMP. You are reminded that at this time, the DAMP will not be used as the foundation of the new permit as staff prepares the revised waste discharge requirements and tentative order. Order No. 96-31, NPDES No. CAS618030, will expire on March 1, 2001. Revised waste discharge requirements will be developed and a tentative order will be forwarded to you prior to this expiration date. The Report of Waste Discharge, submitted September 1, 2000, as well as any future submittals clarifying issues raised in this letter and in future discussions will be taken into account during the preparation of the revised requirements.

If you have any questions, please contact me at (909) 782-4998.

Sincerely,

Original signed by Robert Whitaker for Mark E. Smythe

Mark E. Smythe, Chief
Storm Water Unit

cc:

U.S. Environmental Protection Agency, Permits Issuance Section - Terry Oda (WTR-5)
State Water Resources Control Board, Division of Water Quality - James Kassel

DRAFT ORANGE COUNTY DRAINAGE AREA MANAGEMENT PLAN

COUNTY OF ORANGE

PUBLIC FACILITIES & RESOURCES DEPARTMENT

REPORT OF WASTE DISCHARGE
Volume 2 of 2

PROPOSED PLAN
DRAFT DRAINAGE AREA MANAGEMENT PLAN
Second Edition

September 2000

(Revision to First Edition Dated April 1993)

VICKI L. WILSON
Director

ORANGE COUNTY BOARD OF SUPERVISORS

CHARLES V. SMITH
First District

TODD SPITZER
Third District

JAMES W. SILVA
Second District

CYNTHIA P. COAD
Fourth District

THOMAS W. WILSON
Fifth District

TABLE OF CONTENTS

ACRONYMS AND GLOSSARY

EXECUTIVE SUMMARY

1.0 Introduction
- 1.1 Description of Drainage Area and Climate
- 1.2 Regulatory Requirements
- 1.3 Objectives of the Drainage Area Management Plan
- 1.4 Development of the DAMP
  - 1.4.1 First Term Permit: DAMP Emphasis and Accomplishments
  - 1.4.2 Second Term Permit: DAMP Emphasis and Accomplishments
  - 1.4.3 Third Term Permit: DAMP Emphasis

2.0 Program Management
- 2.1 Introduction
- 2.2 Major Management Activities
  - 2.2.1 Decision Making
  - 2.2.2 Agreement For Program Implementation
  - 2.2.3 NPDES Permit Responsibilities
  - 2.2.4 NPDES Permit Reporting Requirements
  - 2.2.5 Budget
  - 2.2.6 Program Representation
  - 2.2.7 Planning
  - 2.2.8 Permittees Having Watershed Boundaries Outside Those Covered By Santa Ana And San Diego Region NPDES Permits
  - 2.2.9 Coordination With Other Agencies
- 2.3 New Commitments

3.0 Plan Development
- 3.1 Introduction
- 3.2 Regulatory Requirements
- 3.3 Plan Development
  - 3.3.1 Approach to Plan Development
  - 3.3.2 BMP Selection and Implementation
  - 3.3.3 Plan Revision
  - 3.3.4 Public Participation
- 3.4 Plan Financing
  - 3.4.1 Permittee Funding
  - 3.4.2 New Development BMPs
  - 3.4.3 Watershed Structural BMPs
- 3.5 New Commitments

TABLE OF CONTENTS (cont'd)

4.0 Legal Authority
- 4.1 Introduction
- 4.2 Regulatory Requirements
- 4.3 Authority to Control Pollutant Discharge
- 4.4 New Commitments

5.0 Public Agency Activities
- 5.1 Introduction
- 5.2 Regulatory Requirements
- 5.3 Municipal Government Activities
  - 5.3.1 Litter Control
  - 5.3.2 Solid Waste Collection/Recycling
  - 5.3.3 Drainage Facility and Infrastructure Maintenance
  - 5.3.4 Catch Basin Stenciling
  - 5.3.5 Street Sweeping
  - 5.3.6 Hazardous Materials Management/Environmental Performance Reporting
  - 5.3.7 Household Hazardous Waste Collection
  - 5.3.8 Emergency Spill Response
  - 5.3.9 Fertilizer and Pesticide Management
- 5.4 New Commitments

6.0 Public Education
- 6.1 Introduction
- 6.2 Regulatory Requirements
- 6.3 Public Information and Education Program
  - 6.3.1 Program Development
  - 6.3.2 Long-Term Strategy and Implementation
- 6.4 New Commitments

7.0 New Development/Significant Redevelopment
- 7.1 Regulatory Requirements
- 7.2 Program Development
- 7.3 Program Implementation
- 7.4 New Commitments

8.0 Construction
- 8.1 Introduction
- 8.2 Regulatory Requirements
- 8.3 Public Works Construction Practices
- 8.4 Permittee Oversight of Private Construction Practices
- 8.5 Newport Bay/San Diego Creek Sediment Control Programs
- 8.6 Program Development

8.7 New Commitments

TABLE OF CONTENTS (cont'd)

9.0 Industrial Discharger Identification
- 9.1 Introduction
- 9.2 Regulatory Requirements
- 9.3 Program Implementation
- 9.4 New Commitments

10.0 Detection/Elimination of Illegal Discharges and Illicit Connections
- 10.1 Introduction
- 10.2 Regulatory Requirements
- 10.3 Detection/Elimination of Illegal Discharges
  - 10.3.1 Detection
  - 10.3.2 Elimination
- 10.4 Detection/Elimination of Illicit Connections
  - 10.4.1 Detection
  - 10.4.2 Elimination
- 10.5 New Commitments

11.0 Water Quality Monitoring
- 11.1 Introduction
- 11.2 Regulatory Requirements
- 11.3 Program Development
  - 11.3.1 Pre-NPDES Water Quality Monitoring
  - 11.3.2 First Term Permit Water Quality Monitoring
  - 11.3.3 Second Term Permit Water Quality Monitoring
- 11.4 Water Quality Planning Initiatives
  - 11.4.1 Newport Bay/San Diego Creek Watershed
  - 11.4.2 Talbert/Lower Santa Ana River Watershed
  - 11.4.3 Aliso Creek Watershed
- 11.5 New Commitments

12.0 Newport Bay Watershed
- 12.1 Introduction
- 12.2 Regulatory Requirements
- 12.3 Sediment Control Programs
  - 12.3.1 Grading and Erosion Control Codes
  - 12.3.2 "208" Program
  - 12.3.3 Agricultural Erosion and Sediment Control
  - 12.3.4 Urban Sediment TMDL Allocations
- 12.4 Nutrient Control Programs
- 12.5 Fecal Control Programs
- 12.6 Toxicity Control Programs
- 12.7 New Commitments

TABLE OF CONTENTS (cont'd)

APPENDICES

Appendix A	Performance Commitment Schedule
Appendix B	Annual NPDES Status Report Questionnaire
Appendix C	NPDES Permit Implementation Agreement
Appendix D	Amendment No. 1 to Implementation Agreement
Appendix E1	Model Water Quality Ordinance
Appendix E2	Enforcement Consistency Guide
Appendix F	Management Guidelines For The Use of Fertilizers and Pesticides
Appendix G	BMPs for New Development Including Non-Residential Construction Projects (1-5 Acres)
Appendix H	Public Works Construction BMP Report
Appendix I	Industrial Discharger Identification
Appendix J	Manual for Eliminating Illegal Discharges
Appendix K	Orange County Water Quality Monitoring Program
Appendix L	Long Term Public and Business Education Strategy
Appendix M	Environmental Performance Report
Appendix N	Newport Bay Watershed Urban Nutrient TMDL Compliance Evaluation

ACRONYMS

AB	Assembly Bill
APWA	American Public Works Association
BIA	Building Industry Association
BMP	Best Management Practice
CAP	Household Hazardous Waste Community Awareness Program
CAR	Critical Aquatic Resources
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
DAMP	Drainage Area Management Plan
EPA	Environmental Protection Agency
IWMD	Integrated Waste Management Department
MEP	Maximum Extent Practicable
NPDES	National Pollutant Discharge Elimination System
OC	County of Orange
OCC	Orange County Code
ROWD	Report of Waste Discharge
SCAG	Southern California Association of Governments
SCCWRP	Southern California Coastal Waters Research Program
SIC	Standard Industrial Classification Code
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee
TMDL	Total Maximum Daily Load
WQMP	Water Quality Management Plan
WSPA	Western States Petroleum Association

GLOSSARY

1993 DAMP

A document required under the First Term Permits issued by the Santa Ana and San Diego Regional Boards. This document is the principal policy and guidance document for the countywide NPDES Stormwater Program

2000 DAMP

An updated version of the 1993 DAMP. Submitted in draft form as the proposed plan for the 2000 Report of Waste Discharge submittal.

Annual Status Reports

The NPDES Permits require the submittal of an Annual Status Report to the Regional Board and EPA on November 15th of each year.

Best Management Practice

Best practical and economically achievable measures to control the addition of pollutants to the waters of the United States through the application of pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives.

Clean Water Act and Amendments

The Federal Pollution Control Act (Public Law 92-500), as amended (33 U.S.C. 1251 et seq.). Federal regulation mandating a National Pollutant Discharge Elimination System permit for discharges into the Waters of the United States. The goals of the act are to restore and maintain the chemical, physical and biological integrity of the nation's waters.

First Term Permits

The Regional Boards issued Municipal Stormwater Permits No. CA 8000180 and No. CA 0108740 to the Permittees in 1991for the period from 1991 – 1996.

General Construction Permit

The NPDES general permit for stormwater discharges associated with construction activity. SWRCB Order No. 99-08 DWQ, NPDES General Permit No. CAS000002 or its subsequent replacement.

General Industrial Permit

The NPDES general permit for stormwater discharges associated with industrial activity. SWRCB Order No. 97-03 DWQ, NPDES General Permit No. CAS000001 or its subsequent replacement.

Illegal Discharge

Any discharge to a municipal separate storm sewer that is not composed entirely of stormwater and that is not covered by an NPDES permit or identified in the NPDES Stormwater permit as an allowed discharge.

Illicit Connection

Any man –made conveyance or drainage system, pipeline, conduit, inlet or outlet, through which the discharge of any pollutant to the stormwater drainage system occurs or may occur.

Implementation Agreement

The agreement underpinning County and city cooperation and which establishes the responsibilities of each Permittee and a funding mechanism for the shared costs of the Program.

Maximum Extent Practicable

To the maximum extent possible, taking into account equitable consideration of synergistic, additive and competing factors; including, but not limited to, gravity of the problem, fiscal feasibility, public health risks, societal concerns and social benefits.

National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater Permit

A provision of the CWA, section 402, that identifies municipal stormwater as a point source subject to regulation under the NPDES Permits.

NPDES Stormwater Program

The program designed by the Orange County Permittees for compliance with the NPDES permits.

Permittees

The cities of Anaheim, Brea, Buena Park, Costa Mesa, Cypress, Dana Point, FountainValley, Fullerton, Garden Grove, Huntington Beach, Irvine, Laguna Beach, Laguna Hills, Laguna Niguel, Laguna Woods, La Habra, La Palma, Lake Forest, Los Alamitos, Mission Viejo, Newport Beach, Orange, Placentia, Rancho Santa Margarita, San Clemente, San Juan Capistrano, Santa Ana, Seal Beach, Stanton, Tustin, Villa Park, Westminster, and Yorba Linda; the County of Orange; and the Orange County Flood Control District and any subsequently incorporated cities that become subject to the NPDES permit. Each Permittee is individually responsible for the implementation of the program elements within its jurisdiction.

Permittee Committee

The committee made up of representatives from each of the Permittees that provides the overall guidance for the NPDES Stormwater Program.

Point Source

Any discernable, confined, and discrete conveyance, including any conduit pipe, ditch, channel, sewer, tunnel, vessel, or other floating craft from which pollutants are or may be discharged.

Principal Permittee

The County of Orange is the Permittee designated with the responsibility to manage the NPDES Municipal Stormwater Program on behalf of the Permittees.

Regional Water Quality Control Boards

The Santa Ana and San Diego Regional Water Quality Control Boards are agencies that implement and enforce Clean Water Act Section 402(p) NPDES permit requirements, and are issuers and administrators of these permits on behalf of EPA within Orange County.

Report of Waste Discharge

Constitutes the application to the RWQCB for the Third Term NPDES permit. The ROWD presents the compilation of data from the current and previous permit terms and describes the proposed plan for future activities.

Santa Ana Board

The Regional Board that issues the NPDES Municipal Stormwater Permit for Orange County from the northern Los Angeles County border down to approximately El Toro Road. Its jurisdiction includes the cities of Anaheim, Brea, Buena Park , Costa Mesa, Cypress, Fountain Valley, Fullerton, Garden Grove, Huntington Beach, Irvine, La Habra, La Palma, Lake Forest, Los Alamitos, Newport Beach, Orange, Placentia, Santa Ana, Seal Beach, Stanton, Tustin, Villa Park, Westminster, and Yorba Linda.

San Diego Board

The Regional Board that issues the NPDES Municipal Stormwater Permit for Orange County from approximately El Toro Road down south to the San Diego County border. Its jurisdiction includes the cities of Dana Point, Laguna Beach, Laguna Hills, Laguna Niguel, Laguna Woods, Mission Viejo, Rancho Santa Margarita, San Clemente and San Juan Capistrano.

Second Term Permits

The Regional Boards re-issued the Municipal NPDES Stormwater Permits in 1996 Santa Ana Region CAS0108740 and San Diego Region CAS618030, which covered the time period from 1996-2001.

State Water Resources Control Board

State agency that sets statewide policy for the nine Regional Water Quality Control Boards.

Total Maximum Daily Loads (TMDL)

A written, quantitative plan and analysis for attaining and maintaining water quality standards in all seasons for a specific waterbody and pollutant.

Third Term Permits

The Regional Boards will re-issue the NPDES Stormwater Permits in 2001. They will cover the time period from 2001-2006.

Water Quality Planning Process

Systematic and detailed evaluation of the impacts of urban water quality on beneficial uses to determine or validate that actual impairments exist that warrant corrective action.

EXECUTIVE SUMMARY

This document details the Drainage Area Management Plan (DAMP) to be implemented by the County of Orange, Orange County Flood Control District and incorporated cities (Permittees). The 1993 DAMP was updated in order to reflect the current status of the NPDES Stormwater Program within Orange County as well as to provide the future direction to the program for the Third Term Permit (2001-2006).

Since the DAMP is the result of a comprehensive planning process it will continue to undergo revision as new information, particularly water quality data, becomes available. Through this DAMP, the Permittees intend to continue to improve existing stormwater quality management practices and, where necessary, to address identified problems and to implement new practices.

The DAMP revision has been formulated with the following objectives in mind:

- Address the requirements of the Second Term Permits and commitments of the 1994 Report of Waste Discharge;
- Provide the future direction for the program for the Third Term Permit;
- Ensure effective public participation and support;
- Focus on problems identified through monitoring;
- Utilize available resources effectively;
- Implement public education as a central program component;
- Detect and eliminate illicit connections/illegal discharges;
- Evaluate opportunities and implement projects for retrofitting existing structures as identified through the watershed planning process;
- Verify Best Management Practices (BMPs) designs and effectiveness through experience, research and demonstration projects; and
- Develop plans on a watershed basis.

Private and public sector representatives participated in developing the stormwater pollutant control programs described within this DAMP. Throughout the DAMP's evolution, the document will be available for public review and comment. Overall program guidance will be provided by the Permittees.

1.0 INTRODUCTION

This document outlines Orange County's Drainage Area Management Plan (DAMP) to be implemented during the Third Term Permit period (2001 – 2006) by the cities of Anaheim, Brea, Buena Park, Costa Mesa, Cypress, Dana Point, Fountain Valley, Fullerton, Garden Grove, Huntington Beach, Irvine, Laguna Beach, Laguna Hills, Laguna Niguel, Laguna Woods, La Habra, La Palma, Lake Forest, Los Alamitos, Mission Viejo, Newport Beach, Orange, Placentia, Rancho Santa Margarita, San Clemente, San Juan Capistrano, Santa Ana, Seal Beach, Stanton, Tustin, Villa Park, Westminster, and Yorba Linda; the County of Orange; and the Orange County Flood Control District within the Orange County storm water drainage system. Any newly incorporated cities and other agencies will be included in the implementation process if they choose to participate in the Orange County Municipal National Pollutant Discharge Elimination System Stormwater Program (subsequently referred to as the NPDES Stormwater Program).

The stormwater pollution control effort, of which this DAMP is a part, is the result of almost thirty years of legislative effort beginning with the 1972 Federal Water Pollution Control Act, subsequently known as the Clean Water Act (CWA). The CWA established the NPDES Stormwater Program and required the Environmental Protection Agency (EPA) to issue regulations to be effective by 1983 that include stormwater runoff from rainfall.

Due to court decisions and the overriding need to address stormwater, Congress passed a Clean Water Act Amendment in 1987, the Water Quality Act, which brought stormwater discharges into the NPDES Program. Subsequent regulations were issued by EPA on November 16, 1990.

In response to those regulations, in 1990 the County of Orange (subsequently singularly referred to as the Principal Permittee), the Orange County Flood Control District and incorporated cities (all three collectively referred to as Permittees) obtained NPDES Stormwater Permits No. CA 8000180 and No. CA 0108740 (subsequently referred to as the First Term Permits) from the Santa Ana and San Diego Regional Water Quality Control Boards (subsequently referred to as the Santa Ana Board, the San Diego Board or collectively as the Regional Boards). In 1996, the First Term Permits were replaced by Permit Nos. CAS0108740 and CAS618030 (subsequently referred to as the Second Term Permits).

The April 1993 version of the DAMP (subsequently referred to as 1993 DAMP) was prepared in compliance with the specific requirements of the First Term Permit. The September 2000 update of the DAMP (subsequently referred to as 2000 DAMP) has been completed to address the requirements of the Second Term Permits, and to incorporate the programs developed since 1993. The plan proposes a wide range of continuing and enhanced Best Management Practices (BMPs) and control techniques, which will be implemented over the upcoming 2001 – 2006 permit period (subsequently referred to as the Third Term Permit).

The non-topographic boundary between Orange County and adjoining counties could result in certain Permittees being subjected to flows originating from areas that are subject to separate NPDES municipal stormwater permits issued by the Regional Boards. This DAMP is applicable only to stormwater permits issued by the Regional Boards for areas of Orange County, although certain Permittees could be impacted adversely by flows from drainage areas from neighboring counties (Section 2.2.8). The common drainage issues with Orange, Riverside and San Bernardino counties have begun to be addressed during the Second Term Permit period through joint participation in integrated monitoring and research programs (Section 11.3.3).

1.1 Description of Drainage Area and Climate

Orange County has an area of 500,000 acres, beginning on a coastal plain and rising to an elevation of over 5,000 feet in the Puente Hills and Santa Ana Mountains to the north and east. Before urbanization, which began in the early 1950's, Orange County was drained by ephemeral streams and agricultural drainage ditches which were dry most of the year and carried measurable flow primarily during short duration flash floods and longer duration general winter storms.

As urbanization progressed, man-made agricultural drainage ditches were enlarged to flood control channels and the few natural streams such as Santa Ana River, San Diego Creek and San Juan Creek were constrained within levees to provide flood protection. Ephemeral flows in some of the man-made and natural channels have been replaced with continuous low flows from urban and agricultural irrigation.

Orange County's climate has hot dry summers and mild winters. Nearly all the annual precipitation falls in only a few storm events between October and April. During times of drought, it is not unusual for years to pass between major rainfalls. Precipitation results from three distinct mechanisms. The most important is the convergence mechanism associated with general winter storms originating in Alaska and picking up moisture as they travel south and east.

The second major precipitation mechanism is orographic lifting where moist air masses are deflected upward by local mountains, releasing rain. Orographic rainfall is also associated with winter rainfall. The third precipitation mechanism, which can cause extremely intense local precipitation, is the convective thunderstorm. One of the most intense convective rainfall events of record in Southern California dropped 11 inches of rainfall in about 80 minutes. On occasion, unstable tropical air masses move in from the south and produce rainfall. These tropical air masses combine convergence mechanisms with convective mechanisms to produce intense thunderstorms.

It is common for successive storms of varying durations and intensities to compound their effects, with the heavy rainfall of the second or third storm creating the most severe flood conditions. Regardless of the source of precipitation, Orange County only receives an average of 12-13" of rain per year. The present urban and former agricultural lifestyles are made possible only by large quantities of water imported from the Colorado River and Northern California.

Commencing in 99/00 the Permittees report annually on the land use types and percentages of each type within their jurisdiction.

1.2 Regulatory Requirements

Section 402(p) of the CWA, as amended by the Water Quality Act of 1987, required that municipal NPDES Permits include:

1. A requirement to effectively prohibit non-storm water discharges into the storm sewer; and

2. Controls to reduce the discharge of pollutants in storm water discharges to the maximum extent practicable, including management practices, control techniques and system, design and engineering methods and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants.

Regulations, promulgated by EPA on November 16, 1990 (40 CFR 122.26 (d)(2)(iv)) required municipal NPDES Permit applicants to develop a management program to effectively address these requirements.

The federal regulations also indicate that the proposed management program such as the DAMP "shall include a comprehensive planning process which involves public participation and where necessary intergovernmental coordination, to reduce the discharge of pollutants to the maximum extent practicable using management practices, control techniques and systems, design and engineering methods, and such other provisions which are appropriate".

The First Term Permit similarly required the development of a management program to address the regulatory requirements and defined "maximum extent practicable" as follows:

> "Maximum extent practicable (MEP) means to the maximum extent possible, taking into account equitable considerations of synergistic, additive, and competing factors, including but not limited to, gravity of the problem, fiscal feasibility, public health risks, societal concern, and social benefits."

This definition set the foundation for the NPDES Stormwater Program and places upon the Permittees the continuing responsibility of weighing economic, societal, and equity issues as they define the policies and standards to be employed in implementing the program.

1.3 Objectives of the Drainage Area Management Plan

The main objectives of the DAMP are to fulfill the commitment of the Permittees to present a plan that satisfies NPDES permit requirements and to evaluate the impacts of urban stormwater quality on the beneficial uses.

There are a number of important public policy issues which have influenced the Permittees in framing this DAMP and which consequently define the objectives. Resources, both public and private, are limited and public support is essential. In implementing this program it is the intent of the Permittees to proceed in a measured, deliberate way designed to obtain the maximum benefit for the resources expended and to secure maximum public awareness, understanding and support.

The Permittees are aware that a successful stormwater quality management program depends on the awareness, commitment, cooperation and support of the various segments of the public, including businesses, industry, development, utilities, environmental groups, institutions, homeowners and the general public. Accordingly, it is a continuing objective of the plan to assure an open planning process, with ample opportunity for public participation and meaningful consideration of the input obtained. Accomplishment of this objective will be furthered by the management structure provided herein and by public meetings, hearings, workshops as part of the planning and decision making process.

The Permittees are committed to implementing a strategic and comprehensive public education program as a central program component in order to continue to raise the level of public awareness and, at the same time, improve the protection of urban stormwater quality.

The Permittees are committed to maintaining the integrity of the receiving waters and their ability to sustain beneficial uses. As such, the Permittees have designed and implemented a countywide baseline stormwater management program in order to be able to continually re-assess the conditions of the waters within Orange County and help determine the impact, if any, of urban stormwater quality to those beneficial uses.

This baseline effort is complimented by the water quality planning initiative efforts, which focus resources on the impacts of urban stormwater on beneficial uses, to assure that problems receive the available resources and attention. The Permittees have begun to prioritize these initiatives (Section 3.3.1 and 11.4) and will continue to analyze and evaluate the existing and future baseline monitoring program data to identify those watersheds exhibiting the most urgent need for attention.

The Permittees presently own and operate an extensive system of flood control, drainage, recreational, habitat and greenbelt corridor facilities. Some of these have already been modified to yield regional water quality benefits while still safely and reliably performing their primary function. The Permittees will continue to evaluate opportunities to incorporate stormwater quality features into existing flood control structures in each Orange County watershed as they are designed and/or identified through the water quality planning process (Section 3.3.1).

The Permittees have considerable experience and expertise in the planning, design and operation of flood control and drainage systems. They are familiar with the regional watershed approach to drainage planning and they are aware of the economic benefit of regional flood control facilities. The Permittees will continue to approach the runoff water quality management program on the same regional watershed basis, guided by the priorities as identified through the water quality monitoring program.

Research, technical and engineering design data indicate that pollution prevention and removal design parameters for stormwater are still in a developmental phase. The Permittees will continue to investigate and verify the effectiveness of the various treatment BMP designs through experience, research and demonstration projects.

The Permittees will continue to vigorously detect and eliminate illegal discharges and illicit connections into the storm drain system.

Since the majority of the aquatic resources within Orange County are in marine or estuarine habitats, the Permittees are committed to participating in various regional research and/or monitoring programs which provide unique opportunities to gather valuable information about the impact on these habitats and place them in a larger regional context.

The 2000 DAMP is the principal policy and guidance document for the countywide NPDES Stormwater Program. The DAMP describes the programs that will serve to:

1. Provide the framework for the program management activities and plan development (Section 2.0 and Section 3.0);

2. Provide the legal authority for prohibiting unpermitted discharges to the storm drain system and for requiring BMPs in new development and significant redevelopment (Section 4.0);

3. Improve existing pollution prevention and removal BMPs to further reduce the amount of pollutants entering the storm drain system. (Section 5.0);

4. Educate the public about the issue of urban stormwater and non-stormwater pollution and obtain their support in implementing pollution prevention BMPs (Section 6.0);

5. Ensure that all new development and significant redevelopment incorporates appropriate post construction nonstructural and structural BMPs and evaluate "special" structural BMPs to address specific water quality problems as identified through the water quality planning process. (Section 7.0);

6. Ensure that construction sites implement pollutant control practices that address control of construction related pollutants including erosion and sediment control and on-site hazardous materials and waste management (Section 8.0);

7. Identify industrial stormwater dischargers in Orange County and notify them of State Industrial stormwater permit requirements (Section 9.0);

8. Detect and eliminate unpermitted discharges and illegal connections to the municipal storm drain system (Section 10.0);

9. Conduct a stormwater monitoring program to identify areas with water quality problems, to assist in the prioritization of watersheds for analysis and planning, and to assist in the prioritization of pollutants to facilitate the development of specific controls to address these problems (Section 11.0); and

10. Address the special focus within the Newport Bay/San Diego Creek watershed due to its impaired status and the resulting development of TMDLs for sediment, nutrients, bacteria and toxics (Section 12.0).

1.4 Development of the DAMP

The federal regulations (40 CFR 122.26 (d)(2)(iv)(A-D)) require the implementation and maintenance of control measures to reduce pollutants from runoff or urban stormwater discharges from the following areas:

- Runoff from commercial and residential areas;
- Runoff from industrial sites;
- Runoff from construction sites; and
- Non-storm water discharges.

According to the regulations, an overall drainage area management program shall include a comprehensive planning process incorporating public participation and intergovernmental cooperation. The drainage area management program shall also meet the MEP standard of pollutant control, describe priorities for implementing controls on a system wide basis, watershed basis, jurisdiction basis, or on individual outfalls.

The resulting DAMP incorporates a wide range of BMPs, which have been implemented and reported on since the inception of the program in 1990. This section describes the emphasis and development of the NPDES Stormwater Program during each permit term and defines:

- The BMPs that were developed and implemented during the First Term Permit;
- The BMPs that were developed and implemented during the Second Term Permit; and
- The BMPs with ongoing implementation and expanded emphasis during the Third Term Permit.

The BMPs that are listed below include a reference to the section in the DAMP that provides the basis for that activity and where it is further described.

1.4.1 First Term Permit: DAMP Emphasis and Accomplishments

The 1993 DAMP defined a management structure for the Permittees' compliance effort, a formal agreement to underpin cooperation, and detailed municipal efforts to develop, implement, and evaluate various BMPs.

The DAMP was formulated using the accepted framework for water quality planning, specifically, a systematic and iterative process of defining goals, assessing existing conditions, setting priorities, selecting near-term BMPs, implementing near-term program, and assessing program effectiveness. The First Term Permit schedule for completing this process reflected the congressional expectation of expeditious program implementation and was completed in two years resulting in the 1993 DAMP.

The overriding objective of DAMP development was compliance with the federal requirements and the schedule of the NPDES permits. The DAMP was thus the product of an abbreviated water quality planning effort, and control program elements were selected based upon the review of literature and other non-point source control initiatives, rather than an understanding of identified water quality problems.

The specific DAMP accomplishments achieved during the First Term Permit include the following programs which were developed and subsequently implemented. The references at the end of each item refer to the 2000 DAMP unless otherwise noted.

1. Establishment of program management structure and adoption and revision of the Implementation Agreement (Section 2.0 and Appendix C and D);
2. Development of Model Water Quality Ordinance and Enforcement Consistency Guide (Section 4.0 and Appendix E);
3. Development of a Water Pollution Enforcement Implementation Plan (1993 DAMP Appendix E);
4. Development of public agency activity BMP program (Section 5.0);

5. Evaluation of existing litter regulations (Section 5.3.1);
6. Evaluation of existing street sweeping schedules (Section 5.3.5);
7. Development of common public pesticide and fertilizer use guidelines (Section 5.3.9 and **Appendix F**);
8. Development of recommended and extended conditions of approval for BMPs for new development and significant redevelopment and industrial/commercial construction sites of 1-5 acres and initial training of County and city staff in same (Section 7.2 and **Appendix G**). The measures consist of:
    a) Non-structural and structural BMPs on specified new development and significant redevelopment;
    b) Special notes on grading and building plans for industrial/commercial construction operations (1-5 acres); and
    c) Proof of coverage by State General Construction Permit(s) for private grading and building permit applicants (>5 acres);
9. Development and conductance of a workshop for development industry on **Appendix G** implementation (Section 7.2 and **Appendix G**);
10. Development of recommended BMPs for public works construction and initial training of County and city staff in same (Section 8.0 and **Appendix H**). The measures consist of:
    a) Use of "Standard Specifications for Public Works Construction" (the "Green Book") provisions as base-line standards for public new construction less than 5 acres; and
    b) SWPPPs on public new construction and ground surface alteration (>5 acres);
11. Completion of industrial discharger notification (Section 9.3 and **Appendix I**);
12. Development of criteria and conductance of inspections of the separate municipal storm drain systems to identify and eliminate all illegal or illicit storm drain connections. (Section 10.4.1 and **Appendix J**); and
13. Development of a water quality monitoring program (Section 11.0 and 1993 DAMP Appendix K).

1.4.2 Second Term Permit: DAMP Emphasis and Accomplishments

The program management structure and the BMPs developed during the First Term Permit and subsequently incorporated into the 1993 DAMP were the basis of the compliance effort during the Second Term Permit period. In addition, the Permittees also initiated several water quality planning efforts in the Talbert/Lower Santa Ana River, Newport Bay and Aliso Creek watersheds. These priority water quality planning initiatives have helped identify and better understand site-specific urban water quality problems in Newport Bay (nutrients) and Aliso Creek (bacteria) and Talbert/Lower Santa Ana River (bacteria). The Permittees intend to bring the experience that is gained from these initiatives to other watersheds based on a rolling priority list.

Through the ongoing implementation of the DAMP and the initiation of water quality planning efforts, the Permittees continued to improve existing stormwater quality management practices, identify current water quality problems, implement remedial measures and implement new practices preventing future receiving water quality problems.

The specific DAMP accomplishments achieved during the Second Term Permit period are as follows. The references to the DAMP Sections and/or Appendices correspond to the 2000 DAMP unless otherwise noted.

1. Coordination of activities with other public agencies within and adjacent to Orange County having programs or activities that have an impact on stormwater quality (state and regional transportation agencies, cities, counties, flood control districts, water districts, sanitation districts, etc.) (Section 2.2.9);
2. Modification of existing flood control facilities in order to provide additional water quality benefits. Implemented retrofits include channel stabilization, sediment basins and debris booms (Section 3.2 and Section 12.0);
3. Certification that the Permittees have adopted and are implementing the Water Quality Ordinance and accompanying Enforcement Consistency Guide (Section 4.3 and **Appendix E**);
4. Conductance of investigator training on Model Water Quality Ordinance and Enforcement Consistency Guide (**Appendix E**).
5. Conductance of a review of street sweeper effectiveness studies and provided a recommendation that all Permittees apply a standard of pollutant removal effectiveness to the purchase of any new equipment (Section 5.3.5);
6. Development, implementation and provision of training for an environmental performance reporting program for fixed public facilities (initially those facilities whose operations include hazardous materials storage, waste storage and vehicle and equipment maintenance) (Section 5.3.6);
7. Development of a long term public and business education strategy (Section 6.3.2 and **Appendix L**);
8. Development of BMP guidance for the control of those potentially polluting activities not otherwise regulated by any agency (mobile detailing, automotive service centers, restaurants, pool maintenance activities) (Section 6.3.1);
9. Establishment and promotion of a single phone line for all county public water pollution phone calls (Section 6.3.1);
10. Conductance of a joint outreach program with Orange County Sanitation District, Orange County Health Care Agency and Orange County Integrated Waste Management, to ensure that a consistent message on stormwater pollution prevention is brought to the public (Section 6.3.1);
11. Certification that **Appendix G** was implemented (Section 7.0);
12. Development and conductance of training for city planners on **Appendix G** implementation (Section 7.0 & **Appendix G**);
13. Certification that **Appendix H** was implemented (Section 8.0);
14. Development and conductance of training for grading, building and public works construction inspectors (Section 8.0 & **Appendix H**);

15. Submittal of a report of the findings and schedule for elimination for the detection/elimination of illicit connections (Section 10.4.1);
16. Development of a training program for staff of existing industrial inspection programs (Section 10.3.1);
17. Submittal of an evaluation report to the Regional Water Quality Control Board, Santa Ana Region addressing the urban nutrients in the Newport Bay Watershed (Section 12.0 and **Appendix N**);
18. Participation with neighboring counties in the regional Southern California Coastal Water Research Project (SCCWRP) 1998 Southern California Bight Study (Section 11.3.3); and
19. Completion of a revised water quality monitoring program to meet new monitoring objectives (Section 11.3.3 and **Appendix K**).

1.4.3 Third Term Permit: DAMP Emphasis

During the Third Term Permit period the emphasis of the program will continue to provide for equitable consideration of all DAMP objectives. This consideration involves the use of a strategic framework of water quality planning and BMP investigation and is a systematic and iterative process of:

1. Implementing additional BMPs and revising current BMPs based upon site specific urban water quality problems, technical, institutional and economic feasibility and the protection of beneficial uses of the receiving waters;
2. Monitoring to ensure that the BMPs are correctly applied and to determine BMP effectiveness in achieving water quality standards; and
3. Adjustment of BMPs if water quality standards are not being achieved or possible adjustment of water quality standards if they are not appropriate.

This approach is consistent with the intent of the Permittees to reduce the discharge of pollutants to the MEP and that the 2000 DAMP represents a further step in a comprehensive planning process rather than the culmination (**Figure 1**).

By applying this systematic and iterative process, the Permittees intend to further improve existing urban stormwater quality management practices, better understand water quality problems and implement remedial measures in order to protect the existing water quality as well as problem areas. The comprehensive planning approach for the Third Term Permit period therefore consists of:

- Continuing the effective stormwater control programs already established and implemented during the First and Second Term Permits (Section 1.4.1 and 1.4.2);
- Making revisions to specific BMPs that were developed or implemented during the First and Second Term Permits; and
- Developing additional BMPs and/or expanding the emphasis of current BMPs during the Third Term Permit.

Continuation of First and Second Term BMPs

The BMPs that were developed during the First and Second Term Permits that will be carried forth into the Third Term Permit period are as listed below:

1. Coordination of activities with other public agencies within Orange County having programs or activities that have an impact on urban stormwater quality (state and regional transportation agencies, cities, counties, flood control districts, water districts, sanitation districts, etc.) (Section 2.2.9)
2. Evaluation of existing flood control facilities for modification to provide water quality benefits identified through the water quality planning process (Talbert/Lower Santa Ana River, Newport Bay/San Diego Creek, Aliso Creek watersheds) (Section 3.3.1 and Section 11.4);
3. Implementation of the long term public and business education strategy elements (Section 6.3.2);
4. Development of BMP guidance for the control of those potentially polluting activities from non-fixed facility businesses not otherwise regulated by any agency. These businesses include, but are not limited to, mobile detailers, carpet cleaners, commercial landscapers and general contractors (Section 6.3.2);
5. Evaluation of cost-effective "special" structural BMPs that may help further reduce levels of nutrients and bacteriological indicators as identified by the water quality planning initiatives in the Talbert/Lower Santa Ana River, Newport Bay and Aliso Creek watersheds (Section 7.2 and Section 11.4); and
6. Continuing participation in the Regional Research/Monitoring program that is being conducted with the neighboring counties, SCCWRP and three Southern California Regional Boards (Section 11.3.3)

Program Modifications and BMP Emphasis

Within each section of the DAMP, there is a discussion regarding the development of the program and the foundation of each NPDES Stormwater Program element. In order to develop effective program modifications for the Third Term Permit period, careful consideration was given to the objectives of the program and the relative importance of each element.

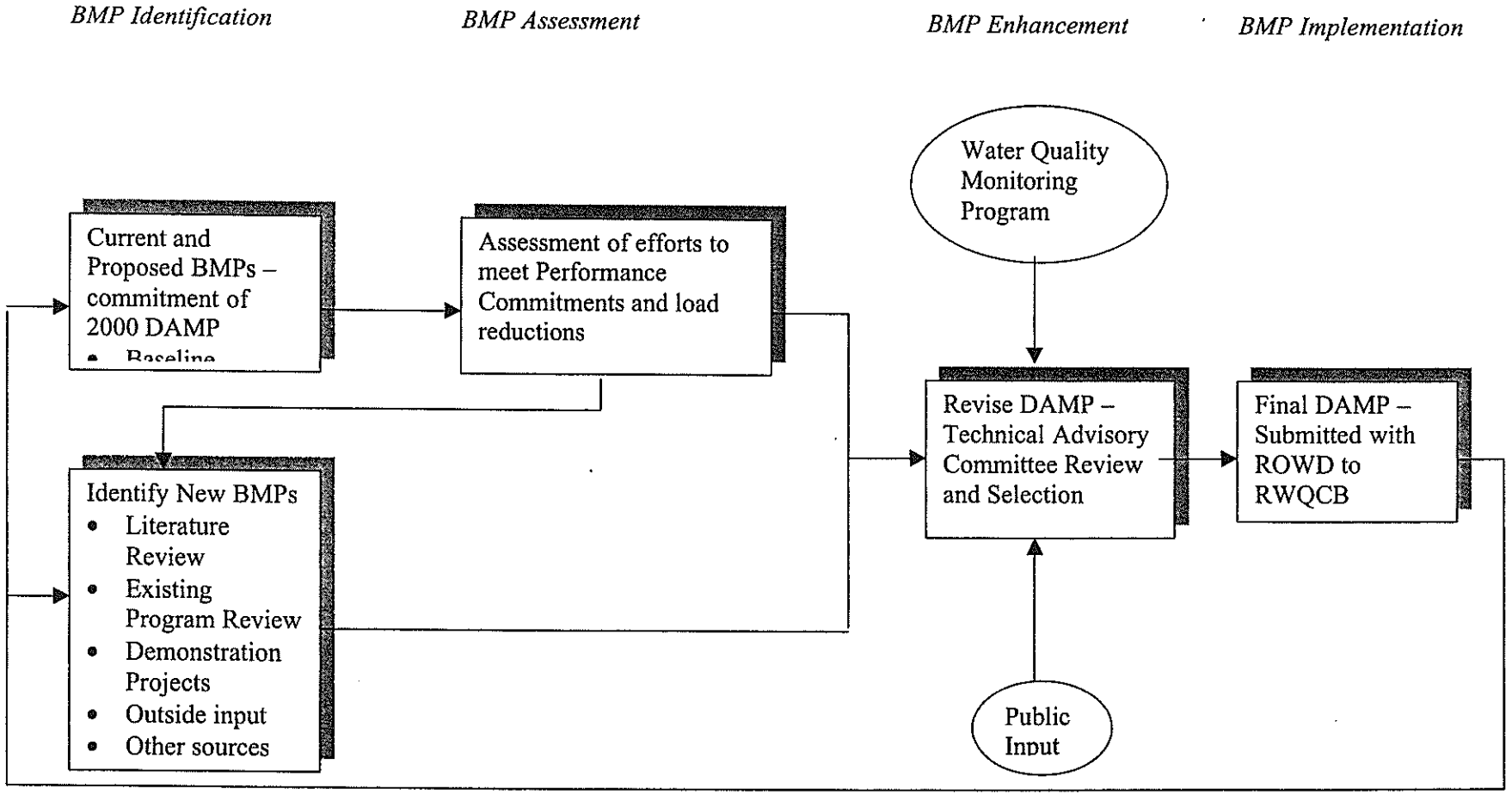
Performance Commitments for each program element were developed and are included within each section of the DAMP to help provide consistency among the programs, define requirements for permit compliance and measure performance. The new or emphasized BMPs and the performance commitments are included at the end of each section. These modifications and commitments are summarized in **Appendix A**. The dates provided within the performance commitments are based upon some elements that may be out of the Permittees' control such as the date of the adoption of the Third Term Permit and the completion of the state BMP manuals. As a result, any necessary modifications to the dates provided herein shall be reported in the Annual Status Reports.

The key performance commitments in the DAMP are:

- An evaluation and revision of the program management structure and Implementation Agreement;
- Systematic watershed assessments to evaluate opportunities to configure or reconfigure channel segments to address the impacts of urban water quality on beneficial uses;
- An evaluation of extending the Environmental Performance Reporting Program into contracts, leases and municipal field operations;
- Formalized training elements;
- The establishment of a public education committee;
- Implementation of the comprehensive public and business education strategy;
- Re-establishment of the New Development Task Force to evaluate the need to revise Appendix G based on the updated California Stormwater BMP Manuals;
- The establishment of a new development/significant redevelopment water quality management plan verification program;
- An evaluation of the need for a Model Erosion Control Ordinance;
- An evaluation of opportunities to outreach to those industrial facilities that need to obtain coverage under the State General Industrial Permit;
- The establishment of authorized inspector quarterly meetings;
- An evaluation of the need to revise the procedures and practices for sewage spill response;
- Future participation in additional regional monitoring and research cooperative programs;
- A re-evaluation and revision of the water quality monitoring program; and
- A modification to the implementation of the Newport Bay/San Diego Creek watershed nutrient program requirements.

Progress and refinement of these modifications and commitments will be reported on in the NPDES Annual Status Reports (subsequently referred to as Annual Status Reports).

Figure 1
Stormwater Program Iterative Process



2.0 PROGRAM MANAGEMENT

2.1 Introduction

The management activities for the NPDES Stormwater Program include providing administrative and technical support for the Permittees and the Technical Advisory Committee (TAC); developing and executing inter-governmental agreements necessary for program implementation; developing reports and other materials required by NPDES permits; developing budgets and fiscal analyses; reviewing and developing policy positions and representing the NDPES Stormwater Program before appropriate agencies; developing BMPs; planning activities needed to direct the program; and program coordination with all affected local government agencies.

A more detailed discussion of these management tasks is provided below. In the Third Term Permit period, annual reporting will additionally include those new commitments in Section 2.3.

2.2 Major Management Activities

2.2.1 Decision Making

During the First and Second Term Permit periods, the designated Permittee representatives provided the overall guidance to the NPDES Stormwater Program, including votes where necessary. During the Third Term Permit period this group will continue to function in the same manner, and will subsequently be referred to as the Permittee Committee. This Committee shall periodically evaluate the need for creating standing sub-committees and ad hoc committees required to accomplish the objectives of the NPDES Stormwater Program.

The Technical Advisory Committee (TAC) will continue as a standing sub-committee for policy direction, program development and implementation. During the first two permit terms, the TAC was comprised of one City Engineer, or selected representative, from each of the County Supervisorial Districts and a representative from the County of Orange.

During the Third Term Permit period, the role and membership of the TAC will be evaluated to determine whether the policy and technical advisory functions should be separated or whether additional membership is required to maintain this dual function. A revised structure may better serve the specific water quality and compliance needs of the Permittees and meet the elevated expectations of water quality improvement in Orange County.

Administrative support for these committees will be provided by the Principal Permittee. This includes the maintenance of mailing lists of participating and interested parties, reserving meeting venues, preparing agendas and notifying participants and preparing meeting minutes.

The Principal Permittee has a Stormwater Section that coordinates the countywide compliance activities and submittals to the Regional Water Quality Control Boards under direction of the Permittees.

2.2.2 Agreement For Program Implementation

The agreement underpinning County and city cooperation is the NPDES Stormwater Permit Implementation Agreement (subsequently referred to as the Implementation Agreement) which establishes the responsibilities of each Permittee with respect to compliance with the NPDES Stormwater Permits issued by the Regional Boards. The Implementation Agreement also establishes a funding mechanism for the shared costs of the NPDES Stormwater Program based on each municipality's area and resident population and includes a provision that allows newly incorporated cities to become additional parties to the Agreement (**Appendix C**) (see also Plan Financing in Section 3.3).

This agreement, originally entered into in December of 1990, was amended in October of 1993 to include two additional Permittees and formally establish the TAC (**Appendix D**). During the next permit term it will be updated to include the newly incorporated cities of Laguna Woods and Rancho Santa Margarita. The Implementation Agreement will be further evaluated at that time to determine whether any changes are appropriate to the decision making committee structure and if the countywide cost shared formula should form the basis for watershed specific planning and improvement programs.

2.2.3 NPDES Permit Responsibilities

The responsibilities of the Principal Permittee and Permittees are defined within the Implementation Agreement, the NPDES Stormwater permits, or as otherwise identified within separate funding Agreements. The Principal Permittee has no regulatory authority over the Permittees. Each Permittee is responsible for implementing the NPDES Stormwater Program within their jurisdiction.

The role of the Principal Permittee is the same as the other Permittees with the addition of certain overall programmatic responsibilities such as program management, budgeting, developing public education materials, conducting water quality monitoring, developing certain program elements for implementation, report coordination, etc.

2.2.4 NPDES Permit Reporting Requirements

All NPDES submittals are produced under the auspices of the Permittee Committee and the TAC before submission to the Regional Boards. The required submittals can include, but are not limited to, Annual Status Reports (**Appendix B**) which are due on November 15 of each year and any other requirements specified by the Regional Boards pursuant to permit conditions, California Water Code Section 13267 or other regulatory provisions.

2.2.5 Budget

The Principal Permittee is responsible for preparing draft annual budgets for shared program costs, to be approved by the Permittees. In addition, the Principal Permittee tracks shared program cost expenditures and prepares financial reports which are distributed to the Permittees.

2.2.6 Program Representation

The Principal Permittee represents the Permittees on the California Storm Water Quality Task Force, the American Public Works Association (APWA) Water Quality Committee and other stormwater forums. The activities of these organizations are provided to the Permittees on a regular basis.

2.2.7 Planning

In accordance with the Implementation Agreement the Principal Permittee administers and coordinates program planning and development.

2.2.8 Permittees Having Watershed Boundaries Outside Those Covered by Santa Ana and San Diego Region NPDES Permits

Those Permittees in compliance with the NPDES Stormwater Permit shall not be responsible for the portions of their drainage areas that extend to other Regional Board jurisdictions.

2.2.9 Coordination With Other Agencies

Successful implementation of the NPDES Stormwater Program requires cooperation and coordination with other public agencies or organizations within and adjacent to Orange County that have programs or activities that have an impact on stormwater quality.

During the Second Term Permit period, a significant example of such an approach was the joint participation with Riverside, Orange and San Bernardino Counties in the Bight 98' regional monitoring program, which was coordinated by SCCWRP. This represented a collective opportunity for the three Counties to cooperatively participate in an integrated watershed monitoring program and meet a common permit objective (Section 11.3.3).

This coordination on monitoring has further developed into a region-wide monitoring and research cooperative program with the neighboring counties, SCCWRP and the three Regional Boards and will be implemented during the Third Term Permit period (Section 11.3.3).

The Principal Permittee has also been actively involved with Cal Trans and has been attending their quarterly NPDES meetings. This joint participation has allowed for the sharing of information and resources and has provided for a greater understanding of the respective programs and challenges.

The Permittees also anticipate that there may be additional opportunities for cooperative efforts with other stormwater dischargers that may be permitted separately under Phase II of the federal stormwater regulations. These dischargers include federal and state lands, including, but not limited to, military bases, national forest, hospitals, colleges and universities, and highways; utilities and special districts; Native American tribal lands; non-urbanized areas; and agricultural lands.

2.3 New Commitments

The Permittees will implement the following performance commitments to help provide consistency among the programs, define requirements for permit compliance and measure performance.

New Commitments:

- The Permittee Committee shall meet at least six times per reporting year during the next five-year permit term.

- Each Permittee shall maintain a representative and alternate to the Permittee Committee, as designated in writing. Any changes in the representatives shall be conveyed to the Principal Permittee within 60 days.

- Each Permittee shall be represented by either the designated representative or alternate at a minimum of eighty (5) percent of the Permittee Committee meetings each year.

- The Implementation Agreement shall be revised to include the newly incorporated cities of Laguna Woods and Rancho Santa Margarita. Additional changes in program funding and management structure will be reviewed concurrently. This shall be completed by December 2001.

- Coordination and common training shall be investigated with other public agencies that have an impact on stormwater quality, including Cal Trans, sanitation agencies and future Phase II Permittees. Progress will be reported in the Annual Status Reports.

3.0 PLAN DEVELOPMENT

3.1 Introduction

The DAMP sets forth a programmatic countywide approach for urban stormwater by which appropriate and cost effective BMPs are implemented in order to maintain existing water quality within Orange County and address any impacts of urban stormwater quality on the beneficial uses of the receiving waters.

The programmatic approach includes utilizing information obtained from the countywide baseline water quality monitoring program (Section 11.0) and from the additional water quality planning initiatives being conducted in several of the watersheds to determine those with beneficial use impairments attributable to urban stormwater (Section 11.4). Once a water quality problem is identified, the Permittees intend to evaluate the need for additional or new BMPs in order to effectively address the problem through the process outlined in this section. Since the field of stormwater quality is a dynamic one, it is necessary for the Permittees to continue this systematic and iterative process of revising, adding or deleting BMPs as necessary in order to maintain a successful and responsive NPDES Stormwater Program.

3.2 Regulatory Requirements

Federal regulations (40 CFR (d)(2)(iv)) require that drainage area management plans include "a comprehensive planning process....to reduce the discharge of pollutants to the maximum extent practicable using management practices, control techniques and systems, design and engineering methods, and such other provisions which are appropriate."

The regulations further state that "proposed programs may impose controls on a system wide basis, a watershed basis, a jurisdiction basis, or on individual outfalls" and "shall describe priorities for implementing controls".

The regulations thus require the development, implementation and prioritization of BMPs to control the discharge of pollutants to waters of the United States. The vehicle for this BMP implementation is the DAMP, which includes new BMPs and modifications to existing BMPs and other stormwater management program elements to reduce pollutants in the stormwater discharges from industrial, commercial, and residential areas to the maximum extent practicable.

3.3 Plan Development

3.3.1 Approach to Plan Development

This DAMP has been developed to accomplish the objectives summarized in the Executive Summary and in Section 1.3. Overall, the DAMP programs fall into two general categories:

1) The prevention-oriented programs addressed in this DAMP include establishing adequate legal authority to control pollutant discharges (Section 4.0), implementing BMPs as part of routine public agency activities (Section 5.0), conducting an effective public and business education program (Section 6.0), implementing routine non-structural and structural BMPs throughout the county in new developments and significant re-developments (Section 7.0), implementing structural and non-structural on-site BMPs for public works construction projects (Section 8.0), and identifying and eliminating illicit connections and illegal discharges (Section 10.0).

2) The removal-oriented programs include structural BMPs identified through the water quality planning process and site specific special BMPs for new developments necessary pursuant to Section 7.0 and Appendix G of this DAMP. Water quality problems will be identified through the baseline countywide water quality monitoring program and other water quality assessments. Watersheds determined to require additional BMPs will be surveyed for potential retrofitting. Existing flood control, retarding, sediment control, water conservation, recreation, habitat, and greenbelt facilities will be evaluated in terms of their potential for modification to provide water quality benefits and in the context of the water quality planning process. Where retrofitting opportunities are not found, new structural BMPs will be considered, using the principles of MEP.

The water quality planning process, referred to throughout this DAMP is a systematic and detailed evaluation of the impacts of urban stormwater quality on beneficial uses to determine or validate that actual impairments exist that warrant corrective action. The water quality planning initiatives that are currently utilizing this process include the Talbert/Lower Santa Ana River, Newport Bay/San Diego Creek, Aliso Creek watersheds (Section 11.4).

The Permittees intend to continue implementing and refining both prevention and removal oriented programs described above utilizing the selection approach outlined in 3.3.2.

3.3.2 BMP Selection and Implementation

Current BMPs

The Permittees have historically conducted activities that provide an ancillary water quality benefit (street sweeping, catch basin cleaning etc.). During the First and Second Term Permits, the Permittees developed and implemented additional BMPs as a result of the commitments within the 1993 DAMP and to meet the objectives of the NPDES Stormwater Program (Executive summary and Section 1.3). These BMPs collectively provide a significant level of pollutant reduction.

These BMPs are largely continued in the 2000 DAMP and are described in more detail in subsequent sections. In many instances changes have been included to further improve their effectiveness over the Third Permit Term and to increase the Permittee commitment to their implementation.

New BMPs

Although the DAMP provides for the implementation of a successful NPDES Stormwater Program through the BMPs that have been developed and implemented, the Permittees recognize that the field of stormwater quality is highly dynamic and that the BMPs within the DAMP must be revised, deleted or added to in order for the program to remain successful. In addition, water quality problems caused by urban stormwater that are identified either through the water quality monitoring program (Section 11.0) or the water quality planning process may elevate the need for additional or new BMPs to be implemented in order to effectively address the problem.

New candidate BMPs can be prevention or removal oriented and are generally identified from:

- A review of technical literature;
- A review of existing control programs;
- Demonstration or research projects;
- Input from consulting firms and municipalities already involved in control program implementation; or
- Other sources.

New structural BMPs will be selected from candidate BMPs that have been field-tested and evaluated as to their pollutant removal efficiency and cost effectiveness. They will also be planned and located to maximize their cost-effectiveness and protect beneficial uses.

Assessment of BMP Effectiveness

There are generally two accepted methodologies for assessing the performance of the BMP effectiveness: conventional monitoring (such as water quality monitoring) and non-conventional monitoring.

The California Stormwater Best Management Practices (BMP) Handbooks (1993) define "non-conventional monitoring" as the enumeration of some indicator other than water quality data to infer pollution reduction or water quality improvement. Examples cited include surveys of public opinion to demonstrate increasing environmental awareness, monitoring of the amount of used oil being delivered to household hazardous waste collection centers, etc.

An accurate, quantifiable assessment of the cumulative effectiveness of current BMPs is difficult for a variety of reasons that include:

1. Non-structural BMPs began to be implemented prior to the stormwater mandate, meaning no "baseline" monitoring data representative of "pre-BMP" conditions can be identified;

2. The BMPs identified in the DAMP are being implemented incrementally on a countywide basis. Since, to date, no watershed has been uniquely subject to a single BMP, the influence of an individual BMP upon the overall surface water quality cannot be readily determined yet;

3. There is considerable variability in water quality data that complicates any statistical correlation of the data with storm frequency, storm length and intensity, land use, or land management practices. This is even more compounded by storm seasons in recent years that have varied much in their intensity, duration and volume;

4. Many of the BMPs identified in the DAMP are implemented to address the issues associated with a specific land use. However, since the land uses are so blended within the watersheds, it has not proven possible to characterize the effects of those specific BMPs; and

5. Factors other than chemical water quality may be more directly responsible for impairment of beneficial uses, yet all these factors combine in their effects and are difficult to separate one from another.

Assessing the cumulative effect of BMPs employed countywide on the water quality of receiving waterbodies may take a number of years. There are however, a number of programs that are currently contributing to the assessment of individual project BMP performance.

The Permittees will continue to assess and evaluate the data from these and other studies in order to try and determine the overall effectiveness of the implementation of the BMPs on the water quality within Orange County.

3.3.3 Plan Revision

The DAMP will be revised and submitted as the proposed plan for each Report of Waste Discharge. The TAC shall review, and submit to the Permittees for local approval, the DAMP and amendments to the DAMP. The documents will then be submitted to the Regional Boards.

3.3.4 Public Participation

Public participation in the preparation and amendment of the DAMP will be encouraged in accordance with the NPDES Stormwater Permits. In the Third Term Permit period, annual reporting will additionally include those new commitments in Section 3.5.

3.4 Plan Financing

The Permittees report each year on their non-shared expenditures for the previous fiscal year, the budget for the current fiscal year and a description of the source of funds.

3.4.1 Permittee Funding

The cost shared portions of the NPDES Stormwater Program are addressed through mechanisms identified within the NPDES Stormwater Implementation Agreement that was entered into in December 1990 and amended in October 1993 (see also Section 2.2.2 Agreement For Program Implementation and **Appendix C and D**). Individual program implementation costs will be borne separately by each Permittee.

In 1994 the Permittees examined long-term financing options for the NPDES Stormwater Program and concluded that the current level of shared expenditures did not justify the start-up difficulties of a new, single funding mechanism. The Permittees will continue to evaluate funding options.

3.4.2 New Development BMPs

Each developer will finance and implement the construction site controls specified in this plan and will institute the appropriate BMPs (Section 7.0 and **Appendix G**). To the extent that the completed area of new development with non-structural BMPs in place can reasonably be expected to contribute to a water quality problem, identified through the water quality monitoring or water quality planning process (applying the criterion of MEP), the developer may be required to contribute to the implementation of watershed structural BMPs. This could be accomplished by establishing a water quality plan and funding program for each affected watershed.

3.4.3 Watershed Structural BMPs

Financial requirements for the construction, operation and maintenance of watershed structural BMPs (water quality wetlands, biofiltration swales) will continue to be evaluated at a watershed scale on a case by case basis. Appropriate financing programs will be proposed, including consideration of means to assure appropriate participation by land developers, project proponents as well as any other local stakeholders.

Those structural BMPs, which are retrofitted existing structures, will continue to be operated and maintained by the present owners for each new structure. The planning process will include consideration and determination of maintenance responsibility for each new structure.

3.5 New Commitments

The Permittees will implement the following performance commitments to help provide consistency among the programs, define requirements for permit compliance and measure performance.

New Commitments:

- The DAMP shall be revised and submitted as the proposed plan for each Report of Waste Discharge. This shall be completed for the next Report of Waste Discharge.

- The Permittees shall assess the watersheds on a rolling priority basis to evaluate the urban impacts on the water quality and the opportunities to configure or reconfigure channel segments in order to optimize beneficial use attainment. The priority list shall be 1) Talbert/Lower Santa Ana River, Newport and Aliso Creek watersheds, 2) San Juan Creek and Huntington watersheds, 3) Middle Santa Ana River, Coyote Creek and small coastal watersheds. The results of these evaluations shall be reported in the Annual Status Reports.

- The Permittees shall contribute to the revision of the California Stormwater Best Management Practices Handbooks (Municipal, Industrial and Construction) through the California Stormwater Quality Task Force BMP Sub-Committee. Following completion of the manuals, the Permittees will assess candidate BMPs in the Handbooks pursuant to Section 3.3.2 for inclusion in the NPDES Stormwater Program and will report on it in the Annual Reports.

- The Permittees shall assess and evaluate the data from site specific BMPs according to Section 3.3.2 in order to try and determine the overall effectiveness of the BMP on water quality and its applicability within other areas of Orange County. Examples of this include BMP evaluations underway in the Talbert and Aliso Creek watersheds for coliform removal and the Newport watershed for nutrient removal (Appendix N). This shall be reported in the Annual Reports.

- The Permittees will continue to assess candidate BMPs pursuant to Section 3.3.2 for inclusion in the NPDES Stormwater Program. This shall be reported on in the Annual Status Reports.

4.0 LEGAL AUTHORITY

4.1 Introduction

The NPDES Permits require implementation of a program to reduce pollutants in storm water discharges from commercial, industrial, and residential areas to the "maximum extent practicable." Central to this program is the establishment, by each municipality, of adequate legal authority to regulate the discharge of pollutants to the municipal separate storm sewer.

Local authority to control discharges to the storm drain system significantly pre-dates the NPDES Stormwater Program. By adopting Ordinance 536, the Orange County Board of Supervisors in 1948 instituted an industrial waste discharge permitting program. This ordinance, amended in 1954 by Ordinance 703, regulated disposal of the by-products of industrial processes, except through sanitary sewers, and provided for the issuance of a permit for discharges into storm drains conditional upon the discharge not causing pollution of ground or surface waters. Twenty of the cities in the County adopted similar ordinances and named the County to enforce the ordinance on their behalf. Other cities chose to adopt their own ordinances (which differed greatly), beginning with the City of Fullerton in 1943.

Other local authorities were separately enacted that included controls for specific discharges to the storm drain system. These provisions, which are still in effect, include:

1) The County Solid Waste Management Ordinance (or comparable City ordinances) regulates where solid and liquid wastes, including hazardous and industrial wastes may and may not be deposited or discharged;

2) The Harbor Sanitation Ordinance of Orange County which prohibits discharge of any refuse matter of any description from shore or sea into the "navigable waters of a harbor,"; and

3) The Uniform Fire Code, which has been adopted into the codified ordinances of the County and the cities and prohibits the discharge of any waste liquid containing crude petroleum or its products "into or upon" any drainage canal or ditch, storm drain, sewer, or upon the ground.".

4.2 Regulatory Requirements

Regulations, promulgated by EPA on November 16, 1990 (40 CFR 122.26 (d)(2)(i)), required municipal NPDES Permit applicants to demonstrate that they had adequate legal authority to:

- Control the contribution of pollutants to the municipal storm drain system by stormwater discharges associated with industrial activity;
- Prohibit illicit discharges to the municipal storm drain system;
- Prohibit spills, dumping or disposal of materials other than stormwater;
- Control through interagency agreements amongst the Permittees, the contribution of pollutants from one municipality into the common combined flood control and stormwater conveyance system managed by the Orange County Flood Control District;
- Require compliance with conditions in ordinances; and
- Carry out all inspections, surveillance and monitoring procedures necessary to determine compliance and noncompliance with permit conditions, and effectively prohibit illicit discharges to the municipal storm drain system.

The Second Term Permits required the Permittees to certify that they had established adequate legal authority to regulate the discharge of pollutants to the municipal system by July 31, 1997.

4.3 Authority To Control Pollutant Discharges

Although adequate legal authority existed for most potential pollutant discharges at the inception of the stormwater program, the Permittees determined in 1993 that a Model Water Quality Ordinance should be prepared to provide a more uniform Countywide approach and to provide a legal underpinning to the entire NPDES Stormwater Program.

A consultant law firm was retained for this purpose, and the Model Water Quality Ordinance (**Appendix E1**) and accompanying Enforcement Consistency Guide (**Appendix E2**) were prepared under the aegis of the TAC and with input from representative City and County Attorneys, Sanitation Districts of Orange County, the Orange County Building Industry Association (BIA), the Food Sanitation Advisory Council, Western States Petroleum Association (WSPA) and the Permittees.

All of the Permittees adopted the Water Quality Ordinance and corresponding Enforcement Consistency Guide and provided certifications regarding this to the Regional Boards in Fiscal Year 1997-98. In addition, each Permittee has designated the Authorized Inspector(s) responsible for enforcing the Ordinance. The Authorized Inspector is the person designated and persons designated by and under his/her instruction and supervision, who are assigned to investigate compliance with, detect violations of and/or take actions pursuant to the Ordinance.

The detection, elimination and enforcement activities undertaken by the Permittees are described further in Section 10.3. In addition to prohibiting unpermitted discharges, the Water Quality Ordinance also provides for requiring BMPs in new development and significant redevelopment (see Section 7.0).

4.4 New Commitments

The Water Quality Ordinance does not require amendment so no further performance commitments are required. Performance commitments pertaining to the detection, investigation and enforcement under the Water Quality Ordinance are addressed in Section 10.5 and erosion and grading control ordinances are addressed in Section 8.7.

5.0 PUBLIC AGENCY ACTIVITIES

5.1 Introduction

All of the Permittees routinely conduct preventive maintenance activities that are widely recognized as effective BMPs for pollutant control. These activities include litter control, solid waste collection/recycling, drainage facility maintenance, catch basin stenciling, street sweeping, hazardous materials management/environmental performance reporting, household hazardous waste collection, emergency spill response and fertilizer and pesticide management.

These public agency activities will be continued in the Third Term Permit period and, where necessary, improvements or new practices will be implemented to reduce the amount of pollutants entering the storm drain system to the maximum extent practicable. Since the Permittees are committed to reducing the impact of their public agency activities on stormwater quality, model maintenance procedures will be developed. Data on the public agency activities and any program improvements will be reported in the Annual Status Report.

5.2 Regulatory Requirements

The federal regulations specifically require, as part of the DAMP, a description of public agency maintenance activities and schedules for structural controls, practices for operating and maintaining public streets and programs to reduce pollutants from the application of fertilizers and pesticides.

The First Term Permit similarly followed federal requirements and specified that the Permittees continue to implement the existing public agency activities, BMPs and stormwater programs and modify them as necessary to reduce the pollutants in the stormwater discharges.

5.3 Municipal Government Activities

5.3.1 Litter Control

Litter control is an important element in the diversion of trash and other materials from the storm drain system. Although most Permittees historically viewed litter control as a public service program (i.e., preventing visual blight, etc.), rather than as a pollution control problem, they now consider it equally important as a visual indicator of water quality. As such, all Permittees now have the legal authority to control littering in public areas either through the Water Quality Ordinance or existing municipal code sections. Littering on private property is usually treated as a nuisance to be corrected by the property owner after notice of complaint is sent.

The Permittees intend to evaluate the efficiency and cost effectiveness of the available BMPs for litter control on an ongoing basis and continue public education outreach that includes trash and debris control as part of a broader stormwater quality educational effort (Section 6.0).

The Permittees report each year on any changes to their legal authority to control littering, the presence of trash receptacles at key locations throughout their jurisdiction, the allocation of staff to litter and debris control, local support of special clean-up or bulky item pickup events and any other miscellaneous activities such as dog waste clean-up programs or holiday collection days. In the Third Term Permit, annual reporting will also include the litter control commitment in Section 5.4.

5.3.2 Solid Waste Collection/Recycling

The Permittees have solid waste collection programs for public, residential, commercial and industrial areas. The Permittees recognize that the public must be encouraged to properly dispose of their trash and educated that the storm drain is not a waste receptacle. The Permittees conduct public education outreach through a variety of methods including community newsletters, radio and television public service announcements, brochures and utility bill inserts. Many Permittees have combined the recycling, litter control and hazardous materials disposal messages (Section 6.0).

During the First Term Permit, the Permittees reported the solid waste collection data that they were separately required to collate under the requirements of Assembly Bill (AB) 939. Since these reporting requirements have changed, the Permittees no longer provide the specific AB 939 information.

The Permittees report each year on the total quantity of solid waste that is collected within their jurisdiction and the types of public education materials and frequencies in which they were distributed or broadcast.

5.3.3 Drainage Facility and Infrastructure Maintenance

During the First and Second Term Permit periods, the Permittees developed and implemented drainage facility inspection and maintenance procedures and created inspection logsheets in order to document the total volume of material removed from their facilities and the percentages of each type of material. Through their routine inspections, the Permittees also notify the appropriate Authorized Inspectors of any evidence of chemical contamination or suspected illegal discharges (Section 10.0).

The Permittees inspect the drainage system within their jurisdictions routinely and clean out accumulated debris on an as-needed basis. Removal of accumulated debris and sediment is carried out either manually or by mechanical methods using flushing in emergency situations only.

The Permittees have implemented a limited number of drainage system diversions for dry weather flows to the sanitary sewer system at several coastal locations. The systems diverted include Aliso Creek, Laguna Channel, Greenville Banning Channel and Talbert Channel/Lower Santa Ana River.

The Permittees report each year on the total volume of materials/debris removed from drainage facilities, the number of drains and length of channel/pipe cleaned, estimates of the percentage of paper, plastic, vegetation, soil and "other" materials removed from the facilities, and the method of removal and the significant changes that occured to their above ground and below ground (> 39") storm drain systems, outfalls, detention or retention basins or dams. In the Third Term Permit period, annual reporting will additionally include those new commitments in Section 5.4.

5.3.4 Catch Basin Stenciling

The goal of the stenciling program is to label and subsequently maintain labels on over 33,300 stormdrain catch basins located throughout Orange County. Initially the label was comprised of "No Dumping - Drains To Ocean" written in 3" black letters on either the top of the curb or the curb face adjacent to the inlet.

This format was later revised to 3" blue letters on a white background. Each Permittee, however, may implement its own version of the catchbasin stenciling program including variations on the phrase or the method of labeling such as the use of hot/tape decals or thermoplastic plaques.

The Permittees report each year on the number of catch basins re-stenciled, any variations in the stencil and any community support in implementing the stenciling program.

5.3.5 Street Sweeping

All Permittees maintain street sweeping programs in residential, commercial and/or industrial areas. In 1993 the Permittees compiled information regarding their existing street sweeping schedules and practices and subsequently changed elements of their programs such as the types of sweepers purchased, the frequency of sweeping, and the use of parking restrictions in order for the street sweeping program to aid in water quality improvements.

During the Second Term Permit period, the Principal Permittee recommended that the Permittees apply a standard of pollutant control removal effectiveness in the purchase of new street sweeper equipment. This recommendation was based upon a preponderance of research literature suggesting that regenerative air sweepers are superior to vacuum and mechanical broom sweepers in performance. The research is not, however, unequivocal.

The Permittees report each year on the quantity and type of street sweepers that they use, the frequency that they sweep residential, commercial and industrial areas, the volume of material collected and the presence/absence of parking restrictions, performance standards or monitoring. In the Third Term Permit period, annual reporting will additionally include those new commitments in Section 5.4.

5.3.6 Hazardous Materials Management/Environmental Performance Reporting

Prior to 1997, the Permittees annually reviewed their hazardous materials management practices. Specific information was submitted in the annual reports regarding product substitution, structural modifications to storage areas, elimination of hazardous waste streams, installation of a clarifier for site drainage, the use of off-site facilities for vehicle cleaning, employee training, and site audits.

The Second Term Permit required the Permittees to prepare an Environmental Performance Reporting Program (**Appendix M**) and include in subsequent Annual Reports a discussion of the actions taken by the Permittees to eliminate pollutant discharges at public agency facilities. This program was implemented in 1997 and was applied to municipal facilities whose operations include hazardous materials storage, waste storage, and vehicle and equipment maintenance. Permittee facility operators were required to:

1. Determine which operations are the most significant contributors to stormwater pollution; and then to
2. Identify significant issues at each facility and develop and implement action plans to control the discharge of pollutants.

The program is iterative, involving an annual evaluation of municipal facility environmental performance and the implementation of corrective actions until all identified significant issues are addressed. The action plans that have been developed by the Permittees to address the significant issues have demonstrated a commitment by the Permittees to implement both structural and non-structural controls.

The Permittees report each year on the status of the action plans submitted the prior year and any new significant issues and corresponding action plans for the current reporting year. In the Third Term Permit period, annual reporting will additionally include those new commitments in Section 5.4.

5.3.7 Household Hazardous Waste Collection

Orange County has an effective household hazardous waste collection program administered by the Integrated Waste Management Department (IWMD). The program comprises four sites (Anaheim, Huntington Beach, San Juan Capistrano, and Irvine) that operate 5 days per week for a total of 259 days per center (excluding partial or full day closures due to rainy weather).

All Permittees and the County's Health Care Agency currently implement used oil recycling programs. These programs involve comprehensive public outreach including television and newspaper advertising, displays at community events, and the distribution, at no cost to residents, of used oil containers (Section 6.0). In addition, some Permittees also conduct household hazardous round ups or drop off events for their residents.

The permittees report each year on the total amount of hazardous waste collected at the four IWMD household hazardous waste collection sites, the total amount of hazardous waste collected from a specific hazardous waste or used oil roundup conducted by a Permittee within its jurisdiction, and any public education material distributed.

5.3.8 Emergency Spill Response

The Orange County Hazardous Materials Area Plan or a city equivalent has been adopted by most of the Permittees. This Plan is a set of planned responses to hazardous materials emergencies, addressing chain-of-command, public agency participation and allocation of authority.

The Permittees have all enacted the authority to control releases to the storm drain system through a common Water Quality Ordinance and each Permittee has designated the Authorized Inspector(s) responsible for enforcing the Ordinance (see also Section 4.0 and 10.0).

The Permittees report each year on the Authorized Inspector designations as well as the quantities, types and notification source for the water pollution incidents that occurred within their jurisdiction. For follow up enforcement information and reporting see Section 10.3.2.

5.3.9 Fertilizer and Pesticide Management

Careful fertilizer application and management is the most effective means of controlling nutrient loss from landscaped areas. Similarly, careful pesticide management addresses both acute toxicity and chronic exposure concerns associated with all insecticides, rodenticides and herbicides.

During the First Term Permit period, a model plan, entitled "Management Guidelines for Use of Fertilizers and Pesticides," (**Appendix F**) was developed to provide guidelines for application methods for fertilizers and pesticides, surface runoff minimization, accident mitigation and Integrated Pest Management. This model was subsequently implemented by the Permittees.

For both fertilizers and pesticides, the Permittees report each year on the number of acres they were applied to, the management and application practices and the types and quantities applied. The permittees also report on any integrated pesticide management techniques that have been implemented. In the Third Term Permit period, annual reporting will additionally include those new commitments in Section 5.4.

5.4 New Commitments

The Permittees propose the following performance commitments to help provide consistency among the programs, define requirements for permit compliance and measure performance.

New Commitments:

General Program

- The Principal Permittee shall develop and distribute model maintenance procedures for public agency activities (such as street sweeping, catch basin stenciling, drainage facility maintenance) by March 1, 2002. This shall be reported on in the 2002 Annual Status Report.

- The Principal Permittee shall develop and distribute BMP guidance for public agency and contract field operations and maintenance staff to ensure that they are familiar with, understand, and implement appropriate pollution prevention measures, react quickly to contain spills and report illegal discharges to the appropriate responder by July 1, 2002. This shall be reported in the 2002 Annual Status Report

- The Principal Permittee shall provide training to the public agency staff implementing the model maintenance procedures. The training shall be held a minimum of three times during the permit period with the first training to be held prior to June 30, 2002. This information shall be reported in the Annual Status Reports.

- Each Permittee adopting the model maintenance procedures shall be represented at a minimum of two of the training sessions. This information shall be reported in the Annual Status Reports.

- The Principal Permittee shall provide pollution prevention training to public agency and contract field operations staff. The training shall be held a minimum of three times during the permit period. This information shall be reported in the Annual Status Reports.

- Each Permittee shall be represented at a minimum of two of the pollution prevention training sessions. This information shall be reported in the Annual Status Reports.

- ❖ Each Permittee shall document any non-Permittee sponsored workshops, training or educational activities undertaken pursuant to the activities listed within this section. This information shall be reported in the Annual Status Reports.

Litter Control

- ❖ The Principal Permittee shall evaluate the efficiency and cost effectiveness of the available BMPs for litter control based on the update of the BMP Handbooks and data from existing demonstration initiatives and provide a recommendation to the Permittees by July 1, 2003. This shall be reported in the 2003 Annual Status Report.

Drainage Facility Maintenance

- ❖ The Permittees shall inspect 80% of the storm drain inlets and catch basins within their jurisdiction at least once per year with 100% cumulative completion every other year and shall subsequently clean those that meet the criteria developed pursuant to the model maintenance procedure commitment (see General Program commitments). The criteria shall be developed by March 1, 2002 and reported on in the 2002 Annual Status Report. The subsequent cleaning based upon the developed criteria shall commence on July 1, 2002 and reported in the Annual Status Reports.

- ❖ The Permittees shall evaluate the need for additional drainage facility diversions for dry weather flows based on data from the water quality monitoring program and water quality planning process. This information shall be reported in the Annual Status Reports.

- ❖ The Permittees shall provide any significant changes to the above ground and below ground (>39" diameter) storm drain systems, outfalls, detention or retention basins or dams and other controls in a mutually acceptable electronic format for inclusion into the countywide drainage maps on an annual basis.

Street Sweeping

- ❖ The Permittees shall consider pollutant removal effectiveness (including macro and particulate pollutant removal information, which may be obtained from manufacturer specifications, technical documents, etc.) when purchasing street sweeping equipment or contracting for these services. The pollutant removal effectiveness of new municipal equipment acquisitions will, at a minimum, meet the criteria developed pursuant to the model maintenance procedure commitment (see General Program commitments). The criteria shall be developed by March 1, 2002 and shall be reported in the Annual Status Reports.

Hazardous Materials Management/Environmental Performance Reporting

- The Permittees' fixed corporation yard facility managers shall conduct quarterly environmental performance reporting program inspections every year beginning July 1, 2001 and report any new findings in the Annual Status Reports.

- The Permittees shall evaluate applying the environmental performance program to municipal maintenance contracts and leases. The evaluation shall be completed by July 1, 2002 and reported in the 2002 Annual Status Report.

- The Permittees shall evaluate applying the environmental performance reporting program to include municipal or contract field maintenance operations. The evaluation shall be completed by July 1, 2002 and reported in the 2002 Annual Status Report.

- Based on the evaluation results, by the end of the permit term, the Permittees shall verify, through inspections, self certifications, surveys or equally effective approaches that at least 90% of the municipal maintenance contractors and lessors that have been newly established or renewed during the permit period are effectively implementing the environmental performance reporting program. The Permittees shall report the verification approach taken, the number of verifications performed and any actions taken in the Annual Status Reports.

- The Principal Permittee shall provide training on implementing the environmental performance reporting program a minimum of three times during the permit period. The training shall be offered to both key line Permittee staff and public agency contract administration staff. This information shall be reported in the Annual Status Reports.

- The Permittees shall be represented at a minimum of two out of the three environmental performance reporting training sessions. This information shall be reported in the Annual Status Reports.

Fertilizer and Pesticide Management

- The Principal Permittee shall evaluate the Management Guidelines for Use of Fertilizers and Pesticides (**Appendix F**) to determine the need for revision. The overall objectives of the Management Guidelines will continue to be to reduce the use of fertilizers and pesticides and/or utilizing less toxic alternatives where possible. This review shall take into account the nutrient and toxicity findings from the Newport Bay watershed. If an update is required, it shall be completed by July 1, 2002 and reported in the 2002 Annual Status Report.

- The Principal Permittee shall provide sufficient training on the Management Guidelines for Use of Fertilizers and Pesticides as the same may be revised. The Permittees who apply fertilizers and pesticides or contract for these services will attend the training. The training shall be completed by July 1, 2003 and reported in the 2003 Annual Status Report.

6.0 PUBLIC INFORMATION

6.1 Introduction

Public education is an essential part of a BMP program. Developing programs to inform and involve the public can be an effective method for controlling nonpoint source pollution. When a community has a clear idea where the pollution comes from, how it can affect them and what they can do to prevent those affects, it will be more willing to support and participate in program implementation.

6.2 Regulatory Requirements

The federal regulations specifically require, as part of the DAMP, a description of educational activities, public information activities, and other appropriate activities to facilitate the proper management and disposal of used oil and toxic materials (Federal Register/Vol. 55, No. 222, p. 48071).

In addition, the regulations also specify education programs for construction site operators and a program to facilitate public reporting of illicit discharges.

The First Term and Second Term Permits similarly followed federal requirements and specified that the Permittees continue to implement the public education efforts already underway, participate in joint outreach efforts to ensure that a consistent message on storm water pollution prevention is brought to the public, encourage the public to report illegal dumpings and develop BMP guidance for the control of those potentially polluting activities not otherwise regulated by any agency.

6.3 Public Information and Education Program

6.3.1 Program Development

The primary goal of the public education program is to inform the community about the origins and causes of stormwater pollution and to constructively involve the public, municipalities, businesses, industries and development community in the NPDES Stormwater Program's objective of controlling pollutants at their source (i.e.: pollution prevention). Achievement of this goal will require development of materials to explain the nature of stormwater pollution and its significant contribution to water quality impairment and to identify and promote behavioral changes that will contribute to controlling pollutants at the source.

During the First and Second Term Permit periods the Principal Permittee, took the lead in developing a regional awareness program and provided the Permittees with copies of educational materials for distribution to the public. The public education program consisted of public, business and household hazardous waste elements. The Permittees were encouraged, but not required, to enhance the information provided with educational efforts more specific to local issues of importance related to water quality.

Public Education

During the First and Second Term Permits, the public education program mainly consisted of: the development and distribution of public service announcements, brochures and other related materials; incorporation of storm water pollution prevention features into community outreach events such as the Orange County Fair; school demonstrations; speaking engagements; monitoring coordination with schools and universities; the development of a 24 hour water pollution problem reporting hotline; and the coordination with other agencies running public information programs such as water districts, sanitation districts, fire departments and community and environmental groups.

Business Education

During the First and Second Term Permits, the business education program mainly consisted of the development and distribution of formal BMP guidance for certain potentially polluting business activities including mobile detailing, pool maintenance activities, automotive service center and restaurant cleaning operations; and outreach to business associations. In 1997-98 and in 1999-00 the Permittees distributed the automotive service center BMP guidance to approximately 120 large auto dealers and 2,000 small to medium businesses, respectively.

Household Hazardous Waste Collection

In addition, the Principal Permittee has an active and effective household hazardous waste collection program. This program is administered by the Orange County Integrated Waste Management Department. The goals of the program are to educate residents about household hazardous materials, influence buying habits to decrease the amount of hazardous materials used, and offer a safe and proper method to dispose of hazardous materials.

The program consists of four fixed collection sites and a Community Awareness Program (CAP). The CAP has made numerous public presentations, by staff and trained volunteers, to schools, civic organizations, and private industries. A "Healthy Home" video and a 24-hour hotline are used to promote program awareness.

In addition, many public information strategies are used to inform the public of the availability of household hazardous materials collection centers. These strategies include fact sheets in utility bills, radio and television public service announcements, and newspaper advertisements.

The Permittees report each year on the public education materials that were additionally developed and/or distributed within their jurisdiction and the events or workshops attended or held to convey the stormwater message. In the Third Term Permit period, annual reporting will additionally include those new commitments in Section 6.4.

6.3.2 Long-Term Strategy and Implementation

In late 1999, the Permittees developed a comprehensive long-term NPDES public and business education strategy (subsequently referred to as the Public Education Program) in order to effectively educate the public and targeted business groups about the effects of stormwater pollution and encourage their participation in the protection of surface waters (**Appendix L**). The Public Education Program includes a comprehensive planning approach and "tool box" of implementable educational elements based upon the desired direction of the program.

While building on the previous public education efforts, the Public Education Program recognizes that the key to a successful, cost-effective, long-term, cohesive, issue-oriented public outreach campaign are: know your audiences, develop messages and outreach activities based on what motivates them; monitor and evaluate success as you go; and redefine messages and target audiences as needed.

The overall program is well-planned, yet flexible so that it can stay responsive to, and reflective of the increasing levels of resident and business owner awareness over the course of the campaign. The merging of similar messages such as proper disposal of household hazardous waste, litter control, recycling, composting, water conservation, etc. will also aid in the public's enhanced awareness of the holistic approach that should be taken when protecting surface waters. The campaign outreach components must be implemented in accordance with a "master timeline" so that they synergistically build upon each other.

The Public Education Program serves as an integral planning tool and presents an overall universal formula for developing and implementing various outreach campaigns. The formula can be applied to multi-year comprehensive outreach programs or a short targeted outreach activities and will be utilized in the following areas:

a) Countywide Public Education Program

This element will address the sources, pathways and impacts of stormwater pollution and provide common-sense BMPs that can be implemented to reduce pollutant discharges.

b) Focus on watershed specific water quality problems

This element will enhance regional information to address specific urban water quality problems within a watershed such as bacteria levels within Aliso Creek and nutrients within the Newport Bay watershed.

c) Focus on particular constituents causing water quality problems countywide

This element will address urban chemicals/materials of concern such as pesticides, fertilizers, automotive fluids, trash and debris, cleaners, solvents, paints, pool chemicals, household hazardous waste, sediment, etc. and will provide BMP guidance for the proper use, clean up and disposal.

d) Focus on business practices or activities causing water quality problems countywide

This element will address targeted businesses of concern such as mobile businesses, gas stations, automotive service centers, restaurants, etc. and will provide BMP guidance for their related business activities.

By applying this strategy and implementing the recommended elements at a macro and focused level, this framework will aid in preventing pollution at its source.

6.4 New Commitments

The Permittees propose the following performance commitments to help provide consistency among the programs, define requirements for permit compliance and measure performance.

New Commitments:

General Program

- A Public Education Committee shall be established by July 1, 2001 to provide oversight and guidance for the implementation of the public education program. The Committee shall assist the Principal Permittee with the review of materials and shall recommend program activities to the Permittee Committee and TAC. The Public Education Committee shall meet a minimum of three times per year

- The Committee members shall attend a minimum of two meetings per year.

- The Permittees shall complete a public awareness survey by December 2001 to determine the effectiveness of the public and business education strategy to date and to provide direction to the overall program education strategy for the Third Term Permit period.

- The Principal Permittee, with Public Education Committee support, shall, based upon the public awareness survey results, identify the goals and audience, develop a "brand" for the program, prepare a master timeline and determine the educational messages by July 1, 2003. This information shall be reported in the Annual Status Reports.

Countywide Public Education Program

- Each Permittee shall conduct a mass distribution, through any appropriate media, of stormwater public educational information to their residents each reporting year so that at least 90% of their residents receive the information by the end of the permit term. This information will be reported on in the Annual Status Reports.

- Each Permittee shall sponsor or staff a stormwater table or booth for at least one community, regional or countywide outreach event (such as a fair, festival or exposition, program or similar event) each reporting year. This information shall be reported in the Annual Status Reports.

- The Principal Permittee, with Public Education Committee support, shall continue to participate in a minimum of three joint outreach efforts during the permit period to ensure that a unified and consistent message on storm water pollution prevention is brought to the public. The joint outreach efforts may include participation with OC/Environmental Health, OC/Integrated Waste Management Department, Fire Departments and sanitation districts. This information shall be reported in the Annual Status Reports.

Focus On Business Practices Or Activities Causing Water Quality Problems Countywide

- Each Permittee shall provide stormwater program outreach to all municipal staff at least once per reporting year. Outreach via a flyer, brochure or newsletter may be distributed with paychecks. This information shall be reported in the Annual Status Reports.

- The Principal Permittee, with Public Education Committee support, shall develop BMP guidance for restaurants, automotive service centers and gasoline stations and provide it to existing industrial facility inspectors (Section 10.3.1) for distribution to the businesses they inspect by July 1, 2002. This shall be reported on in the 2002 Annual Status Report.

- The Principal Permittee, with Public Education Committee support, shall develop BMP guidance for at least three non-fixed facility businesses during the permit period which may include, but are not limited to, mobile vehicle maintenance, carpet cleaners, commercial landscape maintenance and pavement cutting for utilities. This information shall be reported in the Annual Status Reports.

- The Principal Permittee, with Public Education Committee support, shall identify any trade associations, groups, newsletters, etc. that are common to the non-fixed facility businesses for which BMP guidance have been developed and evaluate the opportunity for providing speakers, news articles, etc. so that the industries may be targeted as a whole for additional educational efforts. This information shall be reported in the Annual Status Reports.

7.0 NEW DEVELOPMENT/SIGNIFICANT REDEVELOPMENT

7.1 Regulatory Requirements

The federal regulations specify that drainage area management plans include "a description of planning procedures including a comprehensive master plan to develop, implement, and enforce controls to reduce the discharge of pollutants...from areas of new development and significant redevelopment."

The Regional Boards have identified that the need for individual stormwater quality management plans to apply equally to private and public works projects. Transportation corridors, schools, parks, flood control projects and other public facilities are thus subject to the same requirements as planned communities and mini-malls.

Although there is a provision in State regulations that school districts must obtain municipal approval for "improvements which affect drainage", the Government Code effectively prevents city/county regulation of schools, sanitation, and water districts. The First and Second Term Permits, however, identify these entities as potential dischargers of stormwater to the Orange County drainage area and the expectation is that these entities will work cooperatively with the Permittees to manage urban stormwater runoff. These entities include: Caltrans, universities and colleges, Metropolitan Water District, Department of Defense, school districts, sanitation districts, water districts, and railroads. In the Third Permit Term, regulation of a number of these entities is expected under Phase II of the Federal stormwater regulations.

7.2 Program Development

These regulatory requirements necessitated the development of a program to ensure that storm water quality management is considered during a project's planning phase, implemented during construction, and ultimately maintained for the life of the project.

In 1993, the New Development/Construction Task Force comprising representatives from the Principal Permittee, Building Industry Association (BIA), Association of General Contractors (AGC) and Civil Engineers & Land Surveyors of California (CELSOC), completed a report that provides the basis for requiring the incorporation of structural and non-structural Best Management Practices (BMPs) into new development and significant redevelopment. The report, entitled "Best Management Practices For New Development Including Nonresidential Construction Projects (1-5 acres)" (**Appendix G**), involved additional contributions on specific BMPs from the Western States Petroleum Association (WSPA), Food Sanitation Advisory Council (FSAC), and Orange County's sanitary districts.

In 1997 the Permittees certified that they were implementing **Appendix G**. Since that time, the Permittees and development industry have gained considerable experience in implementing hundreds of Water Quality Management Plans (WQMPs) countywide. **Appendix G** contains the following elements:

- Each new private development and significant redevelopment is required to implement appropriate "routine" non-structural BMPs in keeping with the size and type of development, to minimize the introduction of pollutants into the drainage system (i.e. educational materials, landscape management, spill contingency plans, litter control, employee training, street sweeping).

- Each new private development and significant redevelopment is required to implement appropriate "routine" structural BMPs in keeping with the size and type of development.

"Routine" structural BMP's are economical, practicable, small scale-measures, which can be feasibly applied at the smallest unit of development, using standard plans developed by the New Developments Task Force. Routine structural BMP's may function either to minimize the introduction of pollutants into the drainage system or to remove pollutants from the drainage system and are intended to address drainage water quality impacts inherent in development, and need not be related to any identified water quality problem (i.e. filtration, efficient irrigation, landscape design, car wash racks, trash container areas, motor fuel concrete dispensing areas and canopies, catch basin stenciling, water quality inlets).

- "Special" structural BMPs are to be installed in new development and significant redevelopment to address specific water quality problems identified in the water quality monitoring program or the water quality planning process. This requirement may be addressed by providing an on-site "special" structural BMP, or by contributing to the implementation of a structural BMP specified within a watershed plan.

"Special" structural BMP's are engineered facilities designed to address specific pollutant problems identified in the water quality planning process, runoff management plan, CEQA process, or similar watershed planning. However, it is not the intent of this program to restrict city or county planning commissions or their governing bodies from imposing additional stormwater management requirements as a condition of development (i.e. water quality ponds, dry/wet basins).

- Each new private development or significant redevelopment is required to prepare a WQMP specifying the "routine" structural and non-structural BMPs (and any "special" BMPs) that will be used on site for approval by the Permittee with jurisdiction over the site (single family residences may be exempted from this requirement – see **Appendix G**).

- Each private grading permit applicant with a development greater than five (5) acres is required to provide proof of coverage under Construction Permit

- Each private commercial or industrial project 1-5 acres is required to have special construction notes on the building plans and grading plans

Tables 1 and 2 of **Appendix G** provide a listing of the "routine" site specific structural and non-structural BMPs for new developments including residential, industrial, retail/office centers, restaurants/warehouses/grocery, fuel dispensing areas and vehicle repair/maintenance facilities.

Commencing in 99/00 the Permittees report on the number of WQMPs approved within their jurisdiction, the total acreage covered by the approved WQMPs, the total number of each structural and non-structural control implemented, a summary of any "special" BMPs required and any limitations in providing the information. They also report on any special education initiatives held for developers or contractors to promote awareness of stormwater quality issues and requirements. In the Third Term Permit period, annual reporting will additionally include those new commitments in Section 7.4.

7.3 Program Implementation

The Permittees have developed and implemented an effective and flexible program for new development and significant redevelopment that allows focus to be placed on constituents of concern identified through the monitoring program and water quality planning process.

During the Third Term Permit period, the Permittees intend to further refine the program through the following actions:

- The Permittees are contributing financially to the revision of the California BMP Handbooks;
- Based upon the iterative process described in Section 3.3.2, The New Development/Construction Task Force will be re-established to evaluate the need to revise **Appendix G;**
- The New Development/Construction Task Force group will include additional stakeholders in the evaluation/revision process, beyond those previously involved;
- The Permittees will rescind the requirement for Structural Requirement S11 from the list of "routine" structural BMPs since it is inconsistent with the Best Management Practice Guide for Retail Gasoline Outlets that was produced statewide with Regional Board, municipal and industry input in March 1997 and make other conforming changes between **Appendix G** and the updated BMP Handbooks; and

- The Permittees recognize the importance of a verification element to ensure that the approved structural and non-structural BMPs within the submitted and certified WQMPs are being implemented on an ongoing basis. As such, the Permittees shall verify 90% of the developments with approved WQMPs implemented within their jurisdiction by the end of the permit term to determine if post construction BMPs are implemented and properly maintained through inspections, self certifications, surveys or equally effective approaches.

The verification shall be based on either the total area of approved WQMP projects or the total number of WQMPs approved. Thus, by the end of the five year permit term all projects with WQMPs will have been verified and any notices of non-compliance issued.

7.4 New Commitments

The Permittees propose the following performance commitments to help provide consistency among the programs, define requirements for permit compliance and measure performance.

New Commitments:

❖ The Permittees shall evaluate their current New Development/Significant Redevelopment Program (**Appendix G**) and develop a revised program by November 15, 2002 based upon consideration of the following:

- The current New Development/Significant Redevelopment Program (**Appendix G**) and the available results of the implementation review (7.3);
- The SUSMP requirements in Los Angeles and Ventura counties;
- The Start At The Source design and planning approach utilized in the San Francisco Bay Area; and
- The inclusion of more specificity in non-structural and structural routine BMPs including design criteria/standard plans for some BMPs.

❖ The New Development and Construction Task Force shall be re-established to evaluate the need to revise the routine structural and non-structural BMPs included in **Appendix G**. This shall be completed by November 15, 2002 and reported in the 2002 Annual Status Report.

❖ The Principal Permittee shall develop an education/training program for developers and contractors based on any revisions made to **Appendix G** by the New Development and Construction Task Force.

- By the end of the permit term, the Permittees shall verify, through inspections, self certifications, surveys or equally effective approaches that at least 90% of the developments with approved Water Quality Management Plans within their jurisdiction that have ongoing non-public agency requirements have implemented and are properly maintaining the specified post construction BMPs. The verification threshold of 90% shall be based on either the total area of approved WQMP projects per year or the total number of WQMPs approved. The Permittees shall report the verification approach taken, the number and land area of the verifications performed and any actions taken to enforce BMP implementation and maintenance in the Annual Status Reports.

- The Principal Permittee shall provide training to the Permittees implementing **Appendix G** on revisions made by the New Development and Construction Task Force. The training shall be held a minimum of three times during the permit period. This information shall be reported in the Annual Status Reports.

- Each Permittee shall be represented at a minimum of two of the training sessions on **Appendix G**. This information shall be reported in the Annual Status Reports.

- The Permittees shall, in addition to requiring that developers provide proof of NOI for the General Construction Permit where the development is greater than five (5) acres, communicate to the developer that their Stormwater Pollution Prevention Plan (SWPPP) should be completed and onsite before any activity commences. This shall be reported on in the Annual Status Reports.

- Each Permittee shall document any non-permittee sponsored workshops, training or educational activities undertaken pursuant to the activities listed within this section. This information shall be reported in the Annual Status Reports.

8.0 CONSTRUCTION

8.1 Introduction

Concern over construction sites as a major source of sediment and other pollutants is addressed in the federal regulations, which require a description of a program to implement and maintain structural and nonstructural BMPs to reduce pollutants in storm water runoff from construction sites.

Such a program is to include procedures for site planning that incorporate consideration of potential water-quality impacts; requirements for nonstructural and structural BMPs; procedures for identifying priorities for inspecting sites and enforcing control measures that consider the nature of the construction activity, topography, and the characteristics of soils and receiving water quality; and appropriate educational and training measures.

In addition to sediment, activities and materials used on construction sites may be a source of pollutants such as paints, lacquers, and primers; herbicides and pesticides; landscaping and soil stabilization residues; soaps and detergents; wood preservatives; equipment fuels, lubricants, coolants, and hydraulic fluids; and cleaning solvents.

These pollutants can leak from heavy equipment, be spilled, or can be eroded by rain from exposed stockpiles. Once released, they may adsorb onto sediment particles and can be transported into the aquatic environment, where they may become available to enter aquatic food chains, cause fish toxicity problems, contribute to algal blooms, impair recreational uses, and degrade drinking water sources.

Sediment controls for construction activity directly impacting a watercourse should address sediment transport issues in the watercourse so that the natural quantity of sediment is not significantly changed. Contaminated sediment must be prevented from reaching the watercourse.

8.2 Regulatory Requirements

The First Term Permits stated that ... "industrial/commercial construction operations that result in a disturbance of one acre or more of total land area...and residential construction sites that result in the disturbance of five acres or more...shall be required to develop and implement BMPs to control erosion and siltation and contaminated runoff from the construction sites."

In 1999, the State General Construction Activity Stormwater Permit (subsequently referred to as the Construction Permit) (SWRCB Order No. 99-08 DWQ, NPDES General Permit No. CAS000002) was re-issued. Construction activities disturbing five acres or more of land are required to comply with this permit.

In an April 2, 1992 ruling by the U.S. District Ninth Circuit Court of Appeal, the Court invalidated the exemption granted by EPA for construction activity on less than five (5) acres, and remanded to EPA for further action. In late 1999, EPA issued Phase II of the federal stormwater regulations, which lowers the threshold for construction activities that need to obtain coverage from 5 acres to 1 acre. The Construction Permit may be re-opened, or the State may issue a new permit, as necessary, to accommodate this change to the site size for construction activity.

Although the Regional Boards administer and enforce the Construction Permit, in many cases, violations of the Construction Permit may also result in a violation of the Permittees' Water Quality Ordinance (Section 4.0). When this occurs, the Permittees are expected to coordinate enforcement under their Water Quality Ordinance with the Regional Board. This cooperation and coordinated effort between the Permittees and Regional Board is essential to efficiently implement the stormwater regulations for industries at the State and local level.

8.3. Public Works Construction Practices

All public works construction contracts administered by the Permittees are governed by "Standard Specifications for Public Works Construction" (subsequently referred to as the Green Book). Green Book Section 7 - "Responsibilities of the Contractor" imposes specific construction practices, which are included within **Appendix H** as Best Management Practices for public works construction. In general, the Green Book requires the Contractor has to keep informed of, and at all times observe and comply with state and federal laws and county and municipal ordinances and regulations.

The Green Book requires contractors, among other things, to: keep equipment in good working condition (i.e. no fluid leaks) and insure that equipment and facilities meet requirements of ordinances and laws; keep the work site clean and free from rubbish and debris; use a street sweeper to keep paved areas clean; clear the work site of equipment and unused materials; prevent spillage on haul routes, immediately remove spillage and clean the area; remove excavated material from catch basins or similar structures; comply with air pollution regulations; provide sanitation and control wastewater; provide water pollution, mud, and silt control to protect channels, storm drains, and bodies of water; and maintain drainage within and through the work site.

Certain public works construction contracts administered by the Permittees may include Special Provisions as required by the Permittees and approved municipal sediment control Standard Plans. Applicable Special Provisions and Standard Plans are hereby included as Best Management Practices for public works construction.

In addition, as a result of the Second Term Permits, if the Permittees have construction projects that may result in the land disturbance of five (5) acres or more, the following requirements apply:

- Although the Permittees do not pay fees, they must notify the Executive Officer of the Regional Board when the construction project is proposed by submitting an NOI or similar form;
- The Permittees shall develop a stormwater pollution prevention plan (SWPPP) and monitoring program (consistent with the requirements of the current Construction Permit) prior to the commencement of any construction activities. The SWPPP will be kept on site;
- The Permittees shall give advance notice to the Executive Officer of the Regional Board of any planned changes in the construction activity which may result in non-compliance with the current Construction Permit;
- The Permittees must notify the Executive Officer of the Regional Board when the construction project is completed by submitting a Notice of Termination or similar form; and
- All other terms and conditions of the current Construction Permit shall be applicable.

8.4 Permittee Oversight of Private Construction Practices

The Permittees enforce grading codes on private construction practices designed to protect slopes from erosion and failure. These codes are also designed to protect watercourses and adjacent property from the effects of eroded soil or blowing dust. These codes will be evaluated and revised as needed in the Third Term Permit period to ensure consistency with other regulatory documents such as the Construction Permit and local Water Quality Ordinance. The Permittees also require certain provisions for applicants to provide proof of coverage under the General Construction Permit as well as the inclusion of special construction notes on building and grading plans (Section 7.2 and **Appendix G).**

Grading, construction and building inspectors ensure compliance with local grading codes as part of their present jobs. Inspection program elements specifically addressing stormwater pollution include:

- Inspection at the beginning of construction to verify that required nonstructural or structural stormwater pollution control measures are in place;
- Inspection during storm events; and
- Inspection shortly before notice of termination is filed.

8.5 Newport Bay/San Diego Creek Sediment Control Programs

The Permittees have established programs and practices to control sediment and related pollutants through both source control (erosion control) and treatment control measures (sediment control) at construction sites. A special focus exists in the Newport Bay/San Diego Creek watershed due to its impaired status due to excess sediment (Section 12.0).

8.6 Program Development

The problem of construction site erosion and sediment loss has long been recognized by the Permittees. Consequently Permittee grading ordinances and codes, the Green Book, and Public Works construction specifications already contain requirements for construction practices for erosion and sediment control.

The First Term Permits required changes in grading practices to recognize sediment balance concepts, control of regulated materials used on the job site, and control of sediments polluted by contaminants. The control of stormwater pollution associated with construction is handled through the existing grading; building permit, and public works contracting process.

During the First Term Permit period the Best Management Practices For Public Works Construction report was developed and incorporated as part of the DAMP (**Appendix H**). This Appendix applies to Permittee public works construction projects and requires that such activities will implement non-structural and structural BMPs to control contaminated stormwater run-off.

At a minimum BMP selection for public works projects shall be consistent with the Construction Permit and Green Book standards for site maintenance and environmental protection. In 1997 the Permittees certified to the Regional Boards that the **Appendix H** guidelines or their equivalent were being implemented.

Commencing in 99/00 the Permittees report on the number of grading and building permits issued, the number of construction site greater than five acres, the number of inspections conducted and the number of citations issued as well as any limitations in their ability to provide the information. In the Third Term Permit period, annual reporting will additionally include those new commitments in Section 8.7.

8.7 New Commitments

The Permittees propose the following performance commitments to help provide consistency among the programs, define requirements for permit compliance and measure performance.

New Commitments:

- The Permittees shall review their current grading/erosion control ordinances for consistency with related regulatory documents such as the State General Construction Permit and Permittee Water Quality Ordinance to determine the need for the development of model ordinance language that may be utilized by Permittees whose ordinances require modification. This review shall also consider the authority allowed by the State under the Building Code for the Permittees for make such changes. This shall be completed by July 1, 2002 and reported in the 2002 Annual Status Report.

- The New Development and Construction Task Force shall be re-established to evaluate the need to revise **Appendix H**, the grading and erosion control ordinances, if determined necessary by the Permittees, and special construction site issues in the Newport Bay/San Diego Creek watershed. This shall be completed by July 1, 2002 and reported in the 2002 Annual Status Report.

- The Principal Permittee shall develop and implement an education/training program for developers and contractors based on any revisions made to **Appendix H** by the New Development and Construction Task Force. A minimum of three training sessions shall be conducted during the permit term. This information shall be reported in the Annual Status Reports.

- Each Permittee shall be represented at a minimum of two of the training sessions on **Appendix H**. This information shall be reported in the Annual Status Reports.

- Each Permittee shall document any non-permittee sponsored workshops, training or educational activities undertaken pursuant to the activities listed within this section. This information shall be reported in the Annual Status Reports.

9.0 INDUSTRIAL DISCHARGER IDENTIFICATION

9.1 Introduction

During the First Term Permit, the objective of the Industrial Discharger Identification element are to identify industrial stormwater dischargers in Orange County and to notify them of State industrial stormwater permitting requirements. This element provided coordination between the Permittees and industrial dischargers so that industries may comply with the separate requirements of the local NPDES and Statewide General Industrial (SWRCB Order No. 97-03 DWQ, NPDES General Permit No. CAS000001, subsequently referred to as the Industrial Permit) and General Construction Permits.

9.2 Regulatory Requirements

Code of Federal Regulations Part 40 Section 122.26 (a) (4) requires industrial stormwater dischargers to notify operators of municipal storm drain systems receiving industrial stormwater discharges.

The First Term Permits included a finding that industrial dischargers were required to cooperate with the Permittees and were required to obtain individual industrial stormwater discharge permits from the Regional Boards. However, regulations issued after these permits required industries to apply for coverage under the Industrial Permit rather than separately under the Regional Boards.

Although the Regional Boards administer and enforce the Industrial and Construction Permit, in many cases, discharges in violation of the Industrial and Construction Permit may also be a violation of the Permittees' Water Quality Ordinance. When this occurs, the Permittees coordinate enforcement under their Water Quality Ordinance with the Regional Board. The Second Term Permit included a finding that a cooperative and coordinated effort between the Permittees and Regional Board is essential to efficiently implement the stormwater regulations for industries at the State and local level.

9.3 Program Implementation

In 1992 a central database was developed which consolidated the 40 CFR 122.26 (a) (4) notifications, current NPDES permit holders and industries whose Standard Industrial Classification (SIC) codes were identified by the State Water Resources Control Board as requiring coverage under the Industrial Permit. The database provided the basis for a single notification to all the identified industrial facilities informing the facilities' staff of the existence of the NPDES stormwater program and possible industrial permit application requirements.

This early program commitment was completed in 1992 by the Principal Permittee with the distribution of educational flyers to more than 10,000 potentially-affected industrial businesses in Orange County. More than 7,000 flyers were also sent to construction-related businesses in Orange County to notify them of the obligations under the General Construction Permit **(Appendix I)**.

Subsequently, in 1997-98 and in 1999-00 the Principal Permittee distributed additional guidance for the cleaning of automotive service centers to over 2,100 businesses which included some industrial facilities subject to the Industrial Permit (Section 6.3.1).

Within **Appendix G**, the Permittees established a requirement that applicants for grading permits > 5 acres provide proof of coverage under the Construction Permit. A similar mechanism does not currently exist for the Industrial Permit due to lack of a common permitting trigger.

Commencing in 99/00 the Permittees report on their ability to identify new businesses by SIC code or any limitations in being able to establish a mechanism that would allow them to do this. In the Third Term Permit period, annual reporting will additionally include those new commitments in Section 9.4.

9.4 New Commitments

The Permittees propose the following performance commitments to help provide consistency among the programs, define requirements for permit compliance and measure performance.

New Commitments:

- The Permittees shall conduct an evaluation to determine the best method of establishing a mechanism(s) for providing educational and General Industrial Permit materials to businesses within their jurisdiction. This shall be completed by July 1, 2003 and reported in the 2002/03 Annual Status Report.

10.0 DETECTION/ELIMINATION OF ILLEGAL DISCHARGES AND ILLICIT CONNECTIONS

10.1 Introduction

Illegal discharges and illicit connections can be sources of contamination within municipality stormwater drainage systems.

An illegal discharge is any intentional discharge to a municipal separate storm sewer that is not composed entirely of stormwater and that is not covered by an NPDES permit. An illegal discharge refers to the disposal of non-stormwater materials such as paint or waste oil into the storm drain or the discharge of waste streams containing pollutants to the storm drain.

An illicit connection to the storm drain system is an undocumented and/or unpermitted physical connection from a facility to the storm drain system. The First Term Permit required the Permittees to undertake programs to identify and eliminate illicit connections to the storm drain system. The Permittees developed a facility inspection and documentation program to identify such connections however; almost none were identified during the multi-year effort.

An effective program to reduce or eliminate these types of discharges and connections needs to inform the public of the detrimental effects of illegal discharges on water quality, have a process for detecting and eliminating illicit connections and have a program to respond to, investigate and clean up illegal discharges.

10.2 Regulatory Requirements

The First Term Permit required a facility inspection and documentation program to identify illegal discharges and illicit connections to the storm drain systems. The permit also included requirements for ordinances prohibiting illegal drainage entries and improper disposal and the development of an implementation plan for prosecuting violators and eliminating illegal discharges.

The permits also required the Permittees to certify the completion of the reconnaissance of the storm drain system by February 28, 1997 and, in instances where illicit connections are detected, a schedule be provided for their elimination.

10.3 Detection/Elimination of Illegal Discharges

10.3.1 Detection

The Permittees have a number of programs that have facilitated the detection of sources of illegal discharges. These programs include industrial facility inspection, drainage facility inspection, water quality monitoring, and the wide distribution of public education materials that provide phone numbers and encourage the reporting of spills.

Industrial Facility Inspection

A number of public agencies routinely conduct inspections of industrial facilities in Orange County. These agencies and their areas of responsibility include the following:

- The Orange County Health Care Agency regulates the storage and disposal of hazardous wastes. Approximately 6,339 businesses are inspected annually to ensure proper waste management.

- The Fire Departments in Orange County regulate the storage of hazardous materials through disclosure ordinances such as OCC Sec 4-3-200-300 and Article 80 of the Fire Code. This regulation involves inspection at approximately 7,000 business.

- Agricultural chemicals, notably pesticides, are regulated by the Agriculture Commissioner through the State Agriculture Code (CCR Title 3, Sec. 6000 et seq.). The Commissioner's office performs facility inspections at about 200 facilities/year out of a total of approximately 700 facilities that use/store pesticides. The Commissioners office also initiates enforcement action for non-compliance.

- Discharges to the sanitary sewers are mostly regulated by the Orange County Sanitation District and the Aliso Water Management Agency/South East Regional Reclamation Authority who routinely conduct pre-treatment facility inspections.

Routine coordination with staff of these inspection programs occurs through the Orange County Hazardous Materials Strike Force and the Stormwater Awareness training developed presented by the Principal Permittee. These coordination efforts ensure that the staff of these inspection programs is cognizant of stormwater issues and regularly notify the Principal Permittee of situations that may present a source of water pollution. In the Third Term Permit period, annual reporting will additionally include those new commitments in Section 10.5.

Drainage Facility Inspection

Through routine maintenance activities within the municipal storm drain system, Permittee field personnel continue to report suspected problems and/or discharges to the system (Section 5.3.3).

Countywide Reconnaissance Monitoring

During the First Term Permit and part of the Second Term Permit the Permittees conducted field screening/reconnaissance every year which included conducting a site investigation and chemical analyses once during dry weather and once during storm events. While the primary objective of this component of the water quality monitoring program was to detect gross contamination from illegal discharges through field analyses minimal incidences were detected.

New monitoring program objectives set in the Second Term Permit prompted a re-evaluation of the monitoring program starting in 1997. In May 1999, a final report outlining a new monitoring program that addressed the requirements of this permit was submitted to the Regional Boards (**Appendix K**) and the program was implemented.

The reconnaissance and source identification section of the new water quality monitoring program addresses the need to determine if an identified water quality problem is the result of an illicit connection or illegal discharge through a series of source identification studies. If problems are found they are referred to the Permittees' Authorized Inspectors.

Water Pollution Problem Reporting

The public reporting of spills is facilitated by a listing of:

- Permittee business telephone numbers in materials produced and distributed by the NPDES Stormwater Program's public education activities (brochures and magnets).
- The 24 hour water pollution problem reporting hotline and corresponding e-mail address in materials produced and distributed by the NPDES Stormwater Program's public education activities
- The Principal Permittee's water pollution telephone number in the Orange County "white page" telephone directories

10.3.2 Elimination

Investigations

Investigations of water pollution incidents are routinely undertaken by Permittee Authorized Inspector staff and various fire and police departments. Although investigations may be unilateral efforts, more serious incidents are typically coordinated with federal, state, and local agencies through the Orange County Hazardous Materials Strike Force. The Strike Force is headed by the Orange County District Attorney's Office and includes representatives of a wide variety of local, regional, and state agencies.

In addition, the Permittees also coordinate with Regional Board staff on an ongoing basis with a particular focus on facilities regulated by an NPDES permit.

Enforcement

Enforcement activities are undertaken according to the Water Quality Ordinance and accompanying Enforcement Consistency Guide (Section 4.0 and **Appendix E1 and E2**). Water pollution cases may be handled administratively or in more serious instances, have been prepared for prosecution by the Orange County District Attorney who may prosecute under the applicable sections of the Water Quality Ordinance, State Fish and Game Code, State Water Code, Uniform Fire Code, and Penal Code that address pollutant discharges.

The Permittees have formerly designated the staff responsible for carrying out the enforcement services according to the Enforcement Consistency Guide and update these designations every year in the Annual Status Report. The Permittees will continue to have responsibility for water pollution enforcement within their jurisdiction unless that authority has been designated to the Orange County Flood Control District.

Commencing in 99/00 the Permittees report on the quantities and types of enforcement actions that were taken, the number of repeat violators and the incremental enforcement actions and information regarding current or settled prosecutions. In the Third Term Permit period, annual reporting will additionally include those new commitments in Section 10.5.

10.4 Detection/Elimination of Illicit Connections

10.4.1 Detection/Elimination

The Second Term Permit required the Permittees to certify the completion of the reconnaissance of the storm drain system by February 28, 1997, and, in instances where illicit connections are detected, a schedule be provided for their elimination (Section 10.2). The Reconnaissance Survey Report of February, 1997, reported finding two illicit connections countywide and inspection of drainage facilities is now conducted as part of routine maintenance (**Appendix J**).

Any illicit connection identified during routine inspections is investigated by the affected Permittee. Appropriate actions are then taken to approve undocumented connections by permit procedure and/or pursue removal of those connections that are determined to be illicit connections and not permissible.

Commencing in 99/00 the Permittees report on the number of illicit connections found within their jurisdiction, the type of connection and the resulting actions that were taken to permit or remove it.

10.4.2 Enforcement

Compliance with established regulations on obtaining encroachment permits before installation of drains is enforced. Owners of existing drains without appropriate permits are notified to comply. For those drains where the owner is unresponsive or cannot be identified, each Permittee is responsible for deciding whether to formally accept the connection as part of their public drainage system or cap it off.

10.5 New Commitments

The Permittees propose the following performance commitments to help provide consistency among the programs, define requirements for permit compliance and measure performance.

New Commitments:

- The Principal Permittee shall provide stormwater quality awareness training to the staff of existing industrial inspection programs a minimum of three times during the permit period. The training will include information regarding the BMP guidance developed for restaurants, automotive service centers and gasoline stations per Section 5.0. This shall be reported in the Annual Status Reports.

- Authorized Inspectors shall meet three (3) times per year to coordinate investigations, enforcement and training issues within Orange County. This shall be initiated by July 1, 2001 and shall be reported in the Annual Status Reports.

- Each Permittee shall send an Authorized Inspector to two of the three meetings annually. This shall be reported in the Annual Status Reports.

- The Permittees shall develop recommendations and guidelines for establishing and implementing the criminal citation program provision of the water quality ordinances by July 1, 2002.

- The Principal Permittee shall develop and distribute an electronic database for water pollution incident reporting and tracking to the Permittees Authorized Inspectors by July 1, 2002. This shall be reported in the Annual Status Reports.

- The Permittees, shall, in coordination with the major sewering agencies within Orange County, review and revise, as necessary, the procedures and practices for sewage spill response with the goal of reducing the impacts of sewage releases on receiving waters. Where necessary, written changes may be incorporated into operating procedures or spill response plans and/or cooperative agreements may be developed. Progress shall be reported in the Annual Status Reports.

- Each Permittee shall document any non-Permittee sponsored workshops, training or educational activities undertaken pursuant to the activities listed within this section. This information shall be reported in the Annual Status Reports.

11.0 WATER QUALITY MONITORING PROGRAM

11.1 Introduction

In response to the First Term Permits, the Permittees developed and implemented a water quality monitoring program (1993 DAMP Appendix K) to aid in the detection and control of illicit connections and illegal discharges to the municipal storm drain systems and to meet other program performance objectives. The monitoring program focused on estimating pollutant loads in urban stormwater runoff, tracked compliance with water quality objectives, searched for source of pollutants and addressed impacts on areas of special concern.

In response to the Second Term Permits, the Permittees conducted a two year re-evaluation and revision of the water quality monitoring program in order to re-focus the efforts to determine the role, if any, of urban stormwater discharges to the impairment of beneficial uses and to provide technical information to support an effective urban stormwater management program to reduce the beneficial use impairments determined to be associated with urban stormwater (**Appendix K**).

The Permittees also initiated several water quality planning efforts, conducted additional water quality evaluations in response to technical requests from the Regional Boards and participated in various regional research and/or monitoring programs. The combination of these efforts will aid the Permittees in determining the extent and degree of the relationship between urban stormwater runoff and impairment of beneficial uses within the aquatic resources of Orange County.

11.2 Regulatory Requirements

Federal regulations require operators of municipal storm sewers to develop a "proposed monitoring program for representative data collection for the term of the permit that describes the location of outfalls or field screening points to be sampled (or the location of instream stations), why the location is representative, the frequency of sampling, parameters to be sampled, and a description of sampling equipment."

The objectives of the initial water quality monitoring program as stated in the First Term Permit were:

- To define the type, magnitude and sources of pollutants in the storm water system discharges within each Permittees respective jurisdiction so that appropriate pollution prevention and correction measures can be identified;
- To evaluate the effectiveness of pollution prevention and correction measures; and
- To evaluate the compliance with water quality objectives established for the storm water system or its components.

The objectives for a revised monitoring program as stated in the Second Term Permit were to:

- Develop and support an effective municipal nonpoint source control program;
- Define water quality status, trends, and pollutants of concern associated with municipal stormwater discharges;
- Characterize pollutants associated with municipal stormwater discharges and to assess the influence of urban land uses on water quality and beneficial uses of receiving waters;
- Identify significant water quality problems related to urban stormwater discharges;
- Identify other sources of pollutants in stormwater runoff to the maximum extent possible (e.g. atmospheric deposition, contaminated sediments, other nonpoint sources, etc.);
- Identify and prohibit illicit discharges;
- Identify those waters, which without additional action to control pollution from urban stormwater discharges cannot reasonably be expected to attain or maintain applicable water quality standards required to sustain the beneficial uses in the Basin Plan;
- Evaluate the effectiveness of existing municipal stormwater quality management programs, including an estimate of pollutant reductions achieved by the structural and nonstructural BMPs implemented by the permittees; and
- Evaluate costs and benefits of proposed municipal stormwater quality control programs to the stakeholders including the public.

The main theme underlying the objectives specified by the Regional Boards was maintaining the integrity of receiving waters and their ability to sustain beneficial uses identified in the Water Quality Control Plan (subsequently referred to as the Basin Plan). This parallels the Permittees' long-standing concern with the management of environmental resources. For example, many of the monitoring stations have been sampled since the mid-1970s, and there are many past instances of cooperation with other agencies regarding specific environmental problems and/or areas of concern.

Thus, while the Permittees view compliance with the terms of their stormwater permits as of paramount importance, there is also an underlying role of governmental stewardship for key environmental resources that are highly valued by residents of Orange County. This revised monitoring plan strives to link permit compliance with this larger set of management issues.

11.3 Program Development

11.3.1 Pre-NPDES Water Quality Monitoring

From 1973 to 1990, the Principal Permittee conducted routine water quality monitoring on drainage facilities which are tributary to water bodies identified as waters of the state by the Regional Boards. The receiving waters were also monitored routinely to assess the chronic effects on established beneficial uses.

When the monitoring program was initiated in 1973, monthly nutrient and trace element sampling was performed at several locations. Sediment samples were collected semiannually to assess the impact of contaminant deposition and adsorption. Additional constituents such as mercury, selenium, DDT, PCBs and radioactivity were also evaluated on a semiannual basis to address public concerns regarding the pollution threat from these constituents.

11.3.2 First Term Permit Water Quality Monitoring

In order to bring the pre-NPDES water quality monitoring program into conformance with the 1990 federal NPDES regulations and the First Term Permit objectives (Section 11.2), field screening to detect gross contamination was added to the program and the number of sampling sites in the channels and receiving waters were increased in order to better assess the amount and type of contamination in the storm drain system.

The First Term Permit water quality monitoring program consisted of field screening (channels only); dry-weather and storm sampling and a receiving water program:

- Field screening was used to detect gross contamination, which may be indicative of illegal disposal of pollutants. Monitoring locations were sited on channels which have drainage areas greater than one square mile or which have industrial (manufacturing) land uses in the drainage areas. Reports exhibiting elevated concentrations of field-screening constituents were referred for follow-up pollution investigation, but this occurrence was rare or non-existent in most waterbodies;

- Data from dry-weather and storm sampling was used to estimate the total annual volume of contaminants discharged by each monitored channel. These monitoring locations were in channels which were identified in the First Term Permits as "Waters of the State" or in major tributaries to "Waters of the State". Storm monitoring of channels was also used to evaluate the level of contamination during and after storm events;

- The receiving water monitoring program included stations in the Huntington Harbor; Sunset, Anaheim, and Bolsa Bays; Upper and Lower Newport Bays; and Dana Point Harbor. These stations were monitored during and subsequent to storms for the same contaminants as in the channel monitoring program. In the channel and receiving water monitoring programs, semiannual sampling of bed sediment were also conducted to determine the chronic effects of storm water runoff.

11.3.3 Second Term Permit Water Quality Monitoring

While the First Term Permit monitoring program produced useful information, the Permittees recognized (as has the rest of the nation) the high degree of uncertainty regarding the link between urban stormwater runoff and actual impairment of beneficial uses within the aquatic resources of Orange County.

Therefore, in response to the Second Term Permit objectives (Section 11.2), the Permittees started conducting a systematic re-evaluation of the water quality monitoring program which led to a re-statement of the monitoring program's primary goals. The primary and parallel goals of the monitoring program were re-stated as:

- To determine the role, if any, of urban stormwater discharges in the impairment of beneficial uses; and
- To provide technical information to support effective urban stormwater management program actions to reduce the beneficial use impairment determined to be associated with urban stormwater

In order to organize the vast array of monitoring activities needed to carry out the objectives and goals, the Permittees identified three separate key elements within the Final Monitoring Program (**Appendix K**). These three key elements are:

- A focus on known sites (or "warm spots") where constituents are substantially above system-wide averages;
- A parallel (and somewhat overlapping) focus on areas of critical aquatic concern (herein referred to as "critical aquatic resources" or "CARs"); and
- A countywide reconnaissance program to identify specific sources of contamination from sub-watershed areas as well as specific land use investigations in order to evaluate the effectiveness of a variety of BMPs

The monitoring program includes an underlying rationale for each monitoring element, a discussion of how monitoring data will be used in decision-making, identification of potential links to other relevant monitoring programs being carried out by other agencies, a description of the basic monitoring design, identification of additional study design steps, and a description of anticipated monitoring activities.

These monitoring elements include many locations from the pre-NPDES and First Term Permit water quality monitoring programs that were of value because of the length of their historical record. Each key element of the Final Monitoring Program contains a description of the monitoring activities that are proposed to accomplish the objectives described above, as well as a description of the process for making decisions about how the monitoring program will respond to incoming data over time. This process can be used at any time throughout the life of the monitoring program to re-evaluate the direction of the program, or to reassess the appropriate allocation of resources within the program.

Since the vast majority of the CARs in Orange County are in marine or estuarine habitats, the Permittees participated in the Southern California Bight 1998 Regional Monitoring Project (Bight'98) regional monitoring program (coordinated by SCCWRP) to obtain meaningful information on the ecological effects of stormwater discharges. The Bight 98' program was a continuation of the successful cooperative regional-scale monitoring begun in southern California in 1994 and built upon the previous successes and expanded on the 1994 survey by including more participants, sampling more habitats, and measuring more parameters.

Monitoring in Orange County included a coastal microbiological assessment, monitoring in the Lower Newport Bay, Dana Point Harbor and Huntington Harbor; and monitoring of the impacts of the Santa Ana River and Aliso Creek.

This coordination on monitoring has further developed into a region-wide monitoring and research cooperative program with the neighboring counties, SCCWRP and the three Regional Boards and will be implemented during the Third Term Permit period

The Final Monitoring Program and subsequent elements utilize a five year timeline (1998/99 - 2002/03) for addressing the goals/objectives associated with each task. This timeline is reflective of the dynamic nature of the monitoring program and the fact that many of the objectives will require a substantial investment of resources before they are finalized. The program will form the basis for monitoring during the first three years of the Third Term Permit period.

In the Third Term Permit period, annual reporting will additionally include those new commitments in Section 11.5.

11.4 Water Quality Planning Initiatives

During the Second Term Permit period, the Permittees initiated several water quality planning efforts. These priority water quality planning initiatives are intended to identify and better understand site-specific urban water quality problems in Newport Bay/San Diego Creek Watershed (nutrients), Aliso Creek (bacteria) and Talbert/Lower Santa Ana River (bacteria).

11.4.1 Newport Bay/San Diego Creek Watershed

Newport Bay and certain sections of San Diego Creek have been listed as impaired for the presence of excess levels of fecal coliform, sediment and nutrients as well as toxicity to organisms.

The development of Total Maximum Daily Loads (TMDLs) allocations pursuant to Section 303(d) of the Clean Water Act has imposed additional requirements on the Newport Permittees (The County, Orange County Flood Control District and the cities of Costa Mesa, Irvine, Lake Forest, Laguna Hills, Laguna Woods, Newport Beach, Orange, Santa Ana and Tustin) which include significant additional requirements on these Permittees for monitoring and program development. These issues are addressed in their entirety in Section 12.0.

11.4.2 Talbert/Lower Santa Ana River Watershed

Elevated bacteria indicator levels in the surfzone off Huntington State Beach in 1999 were attributed, in part, to the storm drain system of the Talbert/Lower Santa Ana River Watershed. In response to a Section 13267 letter from the Regional Board, the Talbert/Lower Santa Ana River Watershed Permittees (The County, Orange County Flood Control District, and the cities of Costa Mesa, Fountain Valley, Huntington Beach, Newport Beach and Santa Ana) committed to conducting monitoring investigations and research studies in conjunction with the University of California Irvine and the National Water Research Institute. These studies have been initiated by these Permittees and subsequently expanded to include watershed-scale monitoring and investigations, including extensive dispersion monitoring in the surfzone.

The studies are anticipated to be completed during the renewal process for the Third Term Permit and surfzone fecal coliform impacts attributable to urban sources will be addressed through a revision of current BMPs pursuant to the water quality planning process. As part of an early action plan, all storm drain and pump station discharges in this watershed have been temporarily diverted during the summer months.

11.4.3 Aliso Creek Watershed

The lower mile of Aliso Creek has been listed as impaired for the presence of elevated levels of fecal coliform. Pursuant to a 205(j) grant the County initiated a water quality planning study to compliment ongoing watershed restoration efforts being conducted by the Corps of Engineers in conjunction with watershed cities and special districts.

One of the results of the study was the identification of elevated fecal coliform levels at many points along Aliso Creek and in its tributaries. One storm drain (identified as J03P02) exhibited higher fecal coliform levels than the rest and was issued a Clean Up Abatement Order by the Regional Board pursuant to violations of the NPDES Stormwater Permit. The Order, as one action, assigns additional monitoring requirements to the J03P02 Permittees (The County, Orange County Flood Control District, and City of Laguna Niguel).

The Corps of Engineers Feasibility studies and the 205(j) water quality planning study are anticipated to be completed during the renewal process for the Third Term Permit and will provide the first comprehensive restoration plan for an entire watershed in Orange County with subsequent project implementation over a multi-year period.

As an early action, the flows from Lower Aliso Creek and J03P02 have been temporarily diverted during the summer months to the sanitary sewer.

Commencing in 99/00 the Permittees report on additional technical information requests or special studies that they have been involved with such as the collection of data/information for 13267 letters or clean up and abatement orders.

11.5 New Commitments

The Permittees propose the following performance commitments to help provide consistency among the programs, define requirements for permit compliance and measure performance.

New Commitments:

- The Permittees shall revise the water quality monitoring program and associated timelines annually. These changes may be due to necessary timeline adjustments, newly identified water quality problems or information gained through experience or the research/monitoring programs. The revisions shall be discussed in the Annual Status Reports.

- The Permittees shall participate in future Southern California Bight Regional Monitoring Programs. This shall be reported in the Annual Status Report.

- The Permittees shall participate in the Southern California Stormwater Monitoring/Research Cooperative Program. The key focus of the program is to develop the methodologies and assessment tools to more effectively understand urban municipal stormwater and non-stormwater impacts to receiving waters. This shall be reported in the Annual Status Reports.

- The Permittees shall re-evaluate and revise the elements of the water quality monitoring program in 2003. The revised program shall be submitted with the 2003 Annual Status Report.

12.0 NEWPORT BAY WATERSHED

12.1 Introduction

The Newport Bay watershed has been the focus of local efforts to improve water quality and restore Bay habitat since the late 1970's. Early efforts were initiated under the planning authority of CWA Section 208 to reduce the impacts of excessive sediment on the Bay through the development and implementation of areawide plans (Section 12.3).

Other water quality problems were subsequently identified including an over-abundance of algae attributable to excess nutrients from San Diego Creek, sanitary quality associated with contact recreation and shellfish harvesting, aquatic life toxicity to organisms and excessive bioaccumulation of toxic substances in fish tissues. Based on these identified problems, the Santa Ana Board listed Newport Bay and portions of San Diego Creek as impaired on the CWA 303(d) list.

The Newport Watershed Permittees (comprising all or portions of the County of Orange, the Orange County Flood Control District and the cities of Costa Mesa, Irvine, Laguna Hills, Laguna Woods, Lake Forest, Newport Beach, Orange, Santa Ana and Tustin) have, to different degrees, participated since the late 1970's in cooperative actions with other agency stakeholders and the principal landowner to study and implement solutions to the problems in Newport Bay. A watershed Executive Committee was formed in the mid 1980's comprising representatives from the Newport Watershed Permittees and other stakeholders in order to focus the watershed decision making. This Committee initially had responsibility for sediment control issues and has subsequently broadened its membership and focus to include other water quality and watershed restoration issues.

The commitment of the Executive Committee to solving problems in the Newport Bay watershed lead to the initiation in the late 1990's of planning level reconnaissance and feasibility studies in both the Bay and watershed with the Corps of Engineers. These studies have shown a federal interest in restoring the Bay and watershed and are expected to result in multiple projects over the next permit term that will result in improved habitat and water quality.

Complementary studies have also been undertaken with funding from the California Coastal Conservancy, EPA and the Permittees to further refine the understanding of sediment processes, toxicity sources, nutrient load allocations, and human health risks associated with fecal coliform levels in Newport Bay. These studies, along with others planned, will influence the projects implemented out of the Corps process and represent a significant part of the watershed strategy to address water quality problems and meet TMDL load reduction targets.

12.2 Regulatory Requirements

Section 303(d)(1)(A) of the CWA requires that "Each State shall identify those waters within its boundaries for which effluent limitations...are not stringent enough to implement any water quality standard applicable to such waters." The CWA also requires states to establish a priority ranking for waters on the 303(d) list of impaired waters and establish TMDLs for such waters. As part of the 1996 303(d) list submittal the Santa Ana Board identified the Newport Bay watershed as a high priority for TMDL development and began work on the TMDLs in 1996.

The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and section 303(d) of the CWA, as well as in EPA guidance. A TMDL is defined as "a written, quantitative plan and analysis for attaining and maintaining water quality standards in all seasons for a specific waterbody and pollutant" (40 CFR 130.2, Federal Register July 13, 2000). It is the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background such that the capacity of the waterbody to assimilate pollutant loadings is not exceeded. A TMDL is also required to be developed with seasonal variations and include a margin of safety to address uncertainty in the analysis.

The Santa Ana Board has adopted TMDLs for sediment, nutrients and fecal coliform as amendments to its Water Quality Control Plan attributing in each case part of the load allocation to urban areas. Following state ratification of the amendments, the Santa Ana Board issued requests for monitoring and technical reports to the Newport Watershed Permittees pursuant to its authority under Section 13267 of the State Water Code. In the case of the nutrient TMDL the Santa Ana Board cited the terms of the NPDES Stormwater Permit as the basis of enforcement of the request.

12.3 Sediment Control Programs

The Newport Watershed Permittees, like the Permittees countywide, have established programs and practices to control sediment and related pollutants through both source control (erosion control) and treatment control measures (sediment control) at construction sites. In addition, special programs have been initiated with other stakeholders in the San Diego Creek watershed to control sediment from other sources and to trap the excessive sediment loads.

12.3.1 Grading and Erosion Control Codes

The Permittees enforce strict grading codes designed to protect slopes from erosion and failure. These codes are also designed to protect watercourses and adjacent property from the effects of eroded soil or blowing dust. These codes will be evaluated and revised as needed in the Third Term permit to ensure consistency with other regulatory documents such as the Construction Permit and local Water Quality Ordinances and to address special construction site issues in the Newport Bay/San Diego Creek watershed. This revision is addressed by the existing commitment in section 8.7.

12.3.2 "208" Program

The 208 Areawide Waste Treatment Management Plan, mandated by Section 208 of the Clean Water Act of 1972, was prepared by the Southern California Association of Governments (SCAG), eight participating local agencies, and the Los Angeles, Santa Ana, and San Diego Regional Water Quality Control Boards. The 208 Plan was adopted in 1979 as a management plan for nonpoint source waste and associated water quality degradation.

The Plan addressed nonpoint sources of waste associated with urban, agricultural and construction activities. Agriculture and construction activities were identified as significant sources of sediment to the Upper Newport Bay through direct rainfall and drainage across such lands and established drainage channels. As part of the 208 Plan, the Water Quality Action Plan gives priority to the restoration and protection of the Newport Bay.

Implementation of the Action Plan has involved land management practices to reduce sediment at its source (channel stabilization, agricultural and construction site BMPs) structural controls to localize sediment deposition and facilitate its removal (channel, bay and foothill basins).

12.3.3 Agricultural Erosion and Sediment Control

The Agricultural Best Management Practices (AgBMP) Program is an element of the 208 program intended to reduce the rate of sedimentation in Newport Bay using erosion control measures within the agricultural areas of the Newport Bay/San Diego Creek Watershed. The Principal Permittee ensures the voluntary implementation of erosion control measures by the major landowner, The Irvine Company (TIC), and lessees.

The program was first defined in a Memorandum of Agreement (MOA), of June 1983, between the Principal Permittee and the Regional Board. The MOA obliges the Principal Permittee to request landowners in the unincorporated areas of the watershed to develop and implement Resources Conservation Plans and submit tri-annual reports detailing the status of AgBMP implementation. Since inception of the AgBMP Program, the Riverside-Corona Resource Conservation District has provided technical assistance in program implementation.

As result of this program, soil and water conservation programs are now in effect on agricultural land throughout the Newport Bay/San Diego Creek Watershed.

12.3.4 Urban Sediment TMDL Allocations

The sediment TMDL establishes 10 year load allocation targets for urban areas of 2,500 tons per year to Newport Bay and 2,500 tons per year to San Diego Creek. Sediment load allocation studies conducted (Preliminary Sediment Load Allocation Analysis for San Diego Creek and Newport Bay, Tetra Tech October 1999 and Hydraulic/Sediment Analysis for San Diego Creek Watershed, Tetra Tech, July 2000) indicate a need to focus on construction sites (see commitment in 12.3.1 and 8.7) and identify the difficulty of controlling sediment by land type given the presence of channel erosion as a significant contributor to sediment loads. Continued progress towards TMDL targets will therefore most effectively be achieved on a watershed basis and the comprehensive study approach underway with the Corps of Engineers will form the basis of identifying future implementation projects.

12.4 Nutrient Control Programs

The nutrient TMDL establishes targets for reducing the annual loading of nitrogen and phosphorus to Newport Bay by 50% and meeting the numeric and narrative water quality objectives by 2012. To achieve these targets, the TMDL establishes a number of interim targets requiring a 30% and 50% reduction in nutrients in summer flows by 2002 and 2007, respectively, and a 50% reduction in non-storm winter flows by 2012.

The nutrient TMDL identifies five principal sources of nutrients that are assigned waste load and load allocations:

- Nurseries
- Silverado Constructors ETC
- Urban runoff
- Agricultural discharges
- Undefined sources

The Newport Watershed Permittees have evaluated compliance with the TMDL targets (Newport Bay Watershed Urban TMDL Compliance Evaluation, Tetra Tech, July 2000, **Appendix N).** The report indicates significant compliance with the 2002 targets and slight nutrient loads in excess of the future targets. It is concluded that current programs are working and that further minor program revisions will achieve all TMDL targets.

12.5 Fecal Coliform Control Programs

The fecal coliform TMDL establishes a long-term objective of meeting recreational contact and shellfish harvesting standards in Newport Bay. The Newport Watershed Permittees are currently supporting studies, modeling and monitoring in the Bay with other stakeholders that are expected to result in the development of an implementation plan. No urban area control programs are anticipated until the completion of the current study period although increased public and business education will be implemented in conjunction with the commitments in Section 6.4.

12.6 Toxicity Control Programs

The toxicity TMDL for the watershed is currently being developed, which will address a variety of toxicity and bioaccumulation problems resulting from current and past practices. The Newport Watershed Permittees are currently supporting studies and monitoring in the watershed with other stakeholders that are expected to result in the development of an appropriate TMDL. No urban area control programs are anticipated until the completion of the current period of TMDL development although early public and business education will be implemented in conjunction with the commitments in Section 6.4.

12.7 New Commitments

The Newport Watershed Permittees propose the following performance commitments to help provide consistency among the programs, define requirements for permit compliance and measure performance.

New Commitments:

- The Newport Watershed Permittees shall evaluate and implement where appropriate the suggested BMPs contained in **Appendix N** for nutrient reductions in the Newport Bay watershed.