# Preliminary Water Quality Management Plan (WQMP)

## Project Name:

The Paseos at Foothill Ranch Village

**Prepared for:**

**Trumark Companies**

**9911 Irvine Center Drive Suite 150**

**Laguna Hills, CA 92653**

**(949) 788-1990**

**Prepared by:**

**RBF Consulting**

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**Irvine, CA 92619**

**(949) 472-3505**

**August 2012**

# Project Owner's Certification

| | | | |
|---|---|---|---|
| Permit/Application No. | | Grading Permit No. | |
| Tract/Parcel Map No. | 17439 | Building Permit No. | |
| CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract) | | | |

This Water Quality Management Plan (WQMP) has been prepared for Trumark Companies by RBF Consulting. The WQMP is intended to comply with the requirements of the local NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for 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. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

| **Owner: James O'Malley** | | | |
|---|---|---|---|
| Title | Executive Vice President | | |
| Company | Trumark Companies | | |
| Address | 9911 Irvine Center Dr., Suite 150, Irvine, CA 92618 | | |
| Email | jomalley@trumark-co.com | | |
| Telephone # | (949) 202-5782 | | |
| Signature | | Date | |

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# Attachments

**Attachment A. .....Summary Table and Sample Worksheets A and D**

**Attachment B. ..... Drainage Maps**

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**Attachment D. .....Educational Materials**

**Attachment E . .....BMP Details**

**Attachment F . .....Volume and Time of Concentration Calculations**

**Attachment G. ..... Infiltration BMP Feasibility Worksheet**

# Section I Discretionary Permit(s) and Water Quality Conditions

| Project Infomation | | | |
|---|---|---|---|
| Permit/Application No. | | Tract/Parcel Map No. | 17439 |
| Additional Information/ Comments: | | | |
| **Water Quality Conditions** | | | |
| Water Quality Conditions (list verbatim) | The environmental document is not currently ready at this time. The City requires the Tentative Map prior to releasing the environmental document. | | |
| **Watershed-Based Plan Conditions** | | | |
| Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS. | The Project is within the San Diego Creek/Newport Bay Watershed, which has TMDLs for Pesticides, Fecal Coliform, Metal, Nutrients, and Turbidity/Siltation. When considering Treatment BMPs, these pollutants will be reviewed as part of the selection process. | | |

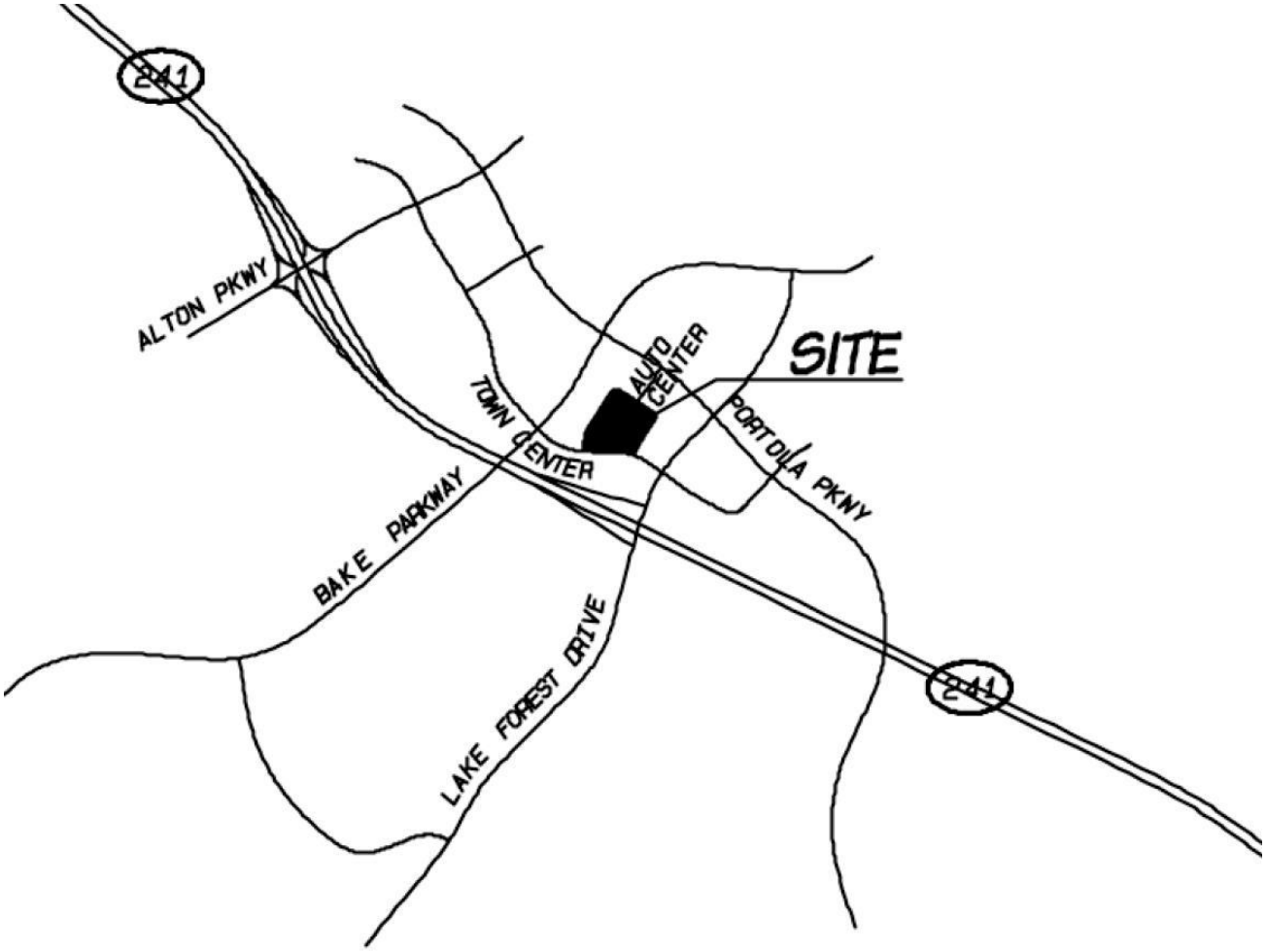
# Section II Project Description

## II.1 Project Description

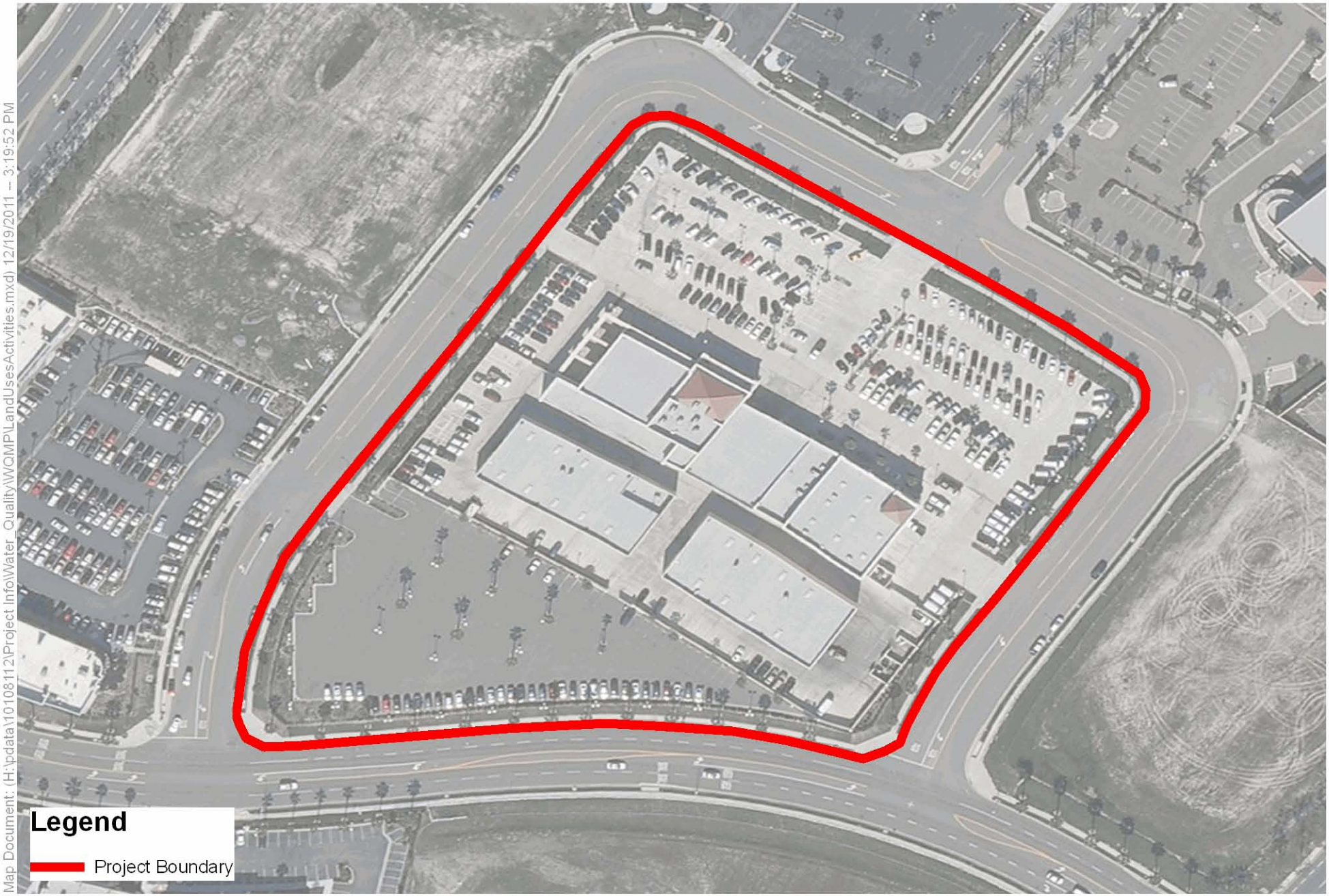
| Description of Proposed Project | | |
|---|---|---|
| Development Category (Verbatim from WQMP): | All significant redevelopment projects, where significant redevelopment is defined as the addition of 5,000 or more square feet of impervious surface on an already developed site, and the existing development or redevelopment project falls under another Priority Project Category. | |
| Project Area (ft²): 305,507 | Number of Dwelling Units: 75 | SIC Code: N/A |
| Narrative Project Description: | Residential Development<br><br>The 75 homes proposed on the site consist of detached two-story single-family residences. Three floor plans are proposed, measuring 1,736 square feet (37 percent of units), 2,102 square feet (43 percent), and 2,240 square feet (20 percent). Each home would have two attached garage spaces, which would be accessed from drives behind the homes. Each home would front on a common walkway and landscaped area, or onto Auto Center Drive. No homes will front onto Towne Centre Drive.<br><br>Each residence will have a private, outdoor yard area. These yards will be secured by 5-foot-tall masonry walls with stucco coating. Along Towne Centre Drive, a heavily landscaped slope will lead up to a decorative masonry and stucco wall to provide privacy and sound protection to the community. Decorative garden walls (up to 3 feet in height) and landscaping will enhance the front yards of homes fronting Auto Center Drive by providing a sense of ownership and security while maintaining a feeling of community and interaction between these homes and the surrounding land uses and sidewalks.<br><br>Entries, Driveways, and Parking<br><br>The project will include two gated entries, both off of Auto Center Drive. The primary entry, located along the northeastern side of the site facing Portola Parkway, will include two lanes that serve residents and guests (with a call box for guests to contact residents). The secondary entry, located along the northwestern side of the site, will serve residents and emergency vehicles only. Once within the community, 24-foot-wide drive aisles will provide access to onsite parking, garages, and recreational facilities. Onsite drive aisles will incorporate rolled curbs. | |

| | | | | |
|---|---|---|---|---|
| | The project will include a total of 220 onsite parking spaces, consisting of 150 garage spaces, 68 uncovered spaces, and 2 driveway spaces. The resulting parking ratio is 2.93 spaces per unit (including 2.00 garage spaces per unit, 0.91 uncovered spaces per unit, and the remainder driveway spaces). Additionally, 58 offsite spaces (along Auto Center Drive) could serve the community without affecting the surrounding uses due to the opposing peak use times of the parking spaces—daytime peak usage by the surrounding businesses and nighttime peak usage for the residences. If these offsite spaces are included in the total parking count, there are a total of 278 parking spaces, or 3.71 spaces per unit.<br><br>Pedestrian Facilities<br><br>The community is planned to be walkable, allowing for easy connections to the nearby mixed-use developments. A network of pedestrian paseos will allow for convenient connections between the front doors of each unit, onsite recreational facilities, and sidewalks along Towne Centre Drive and Auto Center Drive. Multiple connections will be provided from the onsite walkways to offsite sidewalks to reduce the need for lengthy detours by pedestrians.<br><br>Open Space, Recreation, and Water Quality Enhancement Features<br><br>At the center of the development is an open space area and recreation facility. This facility will include an outdoor seating area, community congregation space, pool, spa, barbeque, fire pit and bathrooms. A second open space area located to the southwest of this facility will include an outdoor lounge and gathering area.<br><br>To enhance water quality on the site, vegetated swales or similar devices will be placed in pedestrian paseo landscaped areas to capture runoff from rooftops and paved areas. Filterra water quality devices or similar devices will be placed at the end of drive aisles, also to capture runoff. Throughout the project, drought-tolerant landscaping is proposed which will limit irrigation runoff during the dry season. | | | |
| Project Area | Pervious | | Impervious | |
| | Area (acres or sq ft) | Percentage | Area (acres or sq ft) | Percentage |

| | | | | |
|---|---|---|---|---|
| Pre-Project Conditions | 0.7 | 10% | 6.3 | 90% |
| Post-Project Conditions | 2.0 | 29% | 5.0 | 71% |
| Drainage Patterns/Connections | The site generally flows from north to south and the surface water is directed down each of the alleys way to Filterra or similar proprietary biotreatment system. The homes frontage and open space shall be directed through vegetated swales or similar devices. Once into the storm drain system the site flows to two existing storm drains within Towne Centre Dr. | | | |




VICINITY MAP
N.T.S.




Map Document: (H:\pdata\10108112\Project Info\Water_Quality\WQMP\LandUsesActivities.mxd) 12/19/2011 -- 3:19:52 PM

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0 1 2 4 Miles

Source: Virtual Aerial

# The Village: Project Site Plan Land Uses/Activities

Existing Commercial, Auto Dealership

## II.2 Potential Stormwater Pollutants

| Pollutants of Concern | | | |
|---|---|---|---|
| Pollutant | Circle One: E=Expected to be of concern N=Not Expected to be of concern | | Additional Information and Comments |
| Suspended-Solid/ Sediment | E | N | |
| Nutrients | E | N | |
| Heavy Metals | E | N | |
| Pathogens (Bacteria/Virus) | E | N | |
| Pesticides | E | N | |
| Oil and Grease | E | N | |
| Toxic Organic Compounds | E | N | |
| Trash and Debris | E | N | |

## II.3 Hydrologic Conditions of Concern

Determine if streams located downstream from the project area are determined to be potentially susceptible to hydromodification impacts. *Refer to Section 2.2.3.1 in the TGD for* NOC.

☐ No – Show map

☒ Yes – Describe applicable hydrologic conditions of concern below. *Refer to Section 2.2.3 in the TGD.*

This project is located within an area determined to be potentially susceptible to hydromodification impacts according to the TGD. However, this project does not have hydrologic conditions of concern because the difference between the two-year frequency storm event's time of concentration and volume in existing condition and proposed condition does not exceed 5%. The project's existing and proposed condition storm water runoff volume and time of concentration are shown below:

| | EXISTING | PROPOSED | DIFFERENCE |
|---|---|---|---|
| | 2-year | 2-year | 2-year |
| Line A - Total V (ac-ft) | 0.46 | 0.41 | -10.9% |
| Line N - Total V (ac-ft) | 0.76 | 0.68 | -10.5% |
| Line A - Total Tc (min) | 8.15 | 8.28 | 1.6% |
| Line N - Total Tc (min) | 9.71 | 9.3 | -4.2% |

Volume and time of concentration calculations are located in Attachment F.

## II.4 Post Development Drainage Characteristics

The site generally flows from north to south where the surface water is directed either to a vegetated swale or similar device or down each of the alleys way to a Filterra or similar proprietary biotreatment system prior to leaving the site. The proposed project drainage system ties into the North Orange County MS4 at two locations along Town Centre Drive. The MS4 then outlets from a box culvert and concrete energy dissipater to Serrano Creek. From there, the runoff travels downstream and confluences with San Diego Creek Reach 2. Downstream of San Diego Creek is Newport Bay, which ultimately outlets to the Pacific Ocean.

## II.5 Property Ownership/Management

The existing onsite storm drains tie into the back of the catch basins in Auto Center Drive (Area N Storm Drain) and in Towne Center Dr. (Area A). In the proposed conditions, the existing pipe into the back of the catch basins will be removed and a new lateral storm drain will be connected to each of the storm drains. The Storm Drain N lateral will connect to the main line approximately 30' downstream of the existing CB and there will be approximately 36' of new SD in the Street ROW. The storm drain lateral A will connect to the main line approximately 65' downstream of the existing CB and there will be approximately 40' of new SD in Towne Centre ROW. The new storm drain connections to the project's boundary will be maintained by the city. A homeowner owner association will be formed that will be responsible for the long term maintenance of the on-site stormwater facilities.

# Section III Site Description

## III.1 Physical Setting

| | |
|---|---|
| Planning Area/ Community Name | Foothill Ranch Planning Community |
| Location/Address | 70 Auto Center Drive<br>Lake Forest, CA 92610 |
| Land Use | Existing: Commercial<br>Proposed: Residential |
| Zoning | Existing: Commercial PC-8<br>Proposed: Residential PC-8 |
| Acreage | 7.0 |
| Predominant Soil Type | *The underlying soil onsite is predominantly Soil Group C, with sections of Soil Group D per the Natural Resource Conservation Service.* |

## III.2 Site Characteristics

| | |
|---|---|
| *Precipitation Zone* | *Rainfall Zone Attachment XVI-1: Design Capture Storm Depth 0.95"* |
| *Topography* | *The existing project site consists of a 7.0 acre vacant Chevrolet car dealership in Lake Forest, with an auto repair shop currently operating on a portion of the lot. The local existing conditions hydrology analysis of the site shows that there are two main watersheds onsite, with a high point roughly dividing the northern portion of the property in half. The proposed site topography ranges from relatively flat (12 Horizontal: 1 Vertical) to moderately steep (2 Horizontal: 1 Vertical) between interior rows of homes and around the perimeter. The site is bounded on the north east and west by Auto Center Drive and the south by Towne Centre Drive, respectively. The existing site is predominately impervious surface with landscaping along the perimeter. Stormwater infiltration is more effective on level or gently sloping sites, but because the soil type predominantly Soil Group C/D, infiltration will have its challenges. The site elevation is approximately 840 feet above sea level. See attachment B for existing and proposed drainage patterns.* |

| | |
|---|---|
| *Drainage Patterns/Connections* | *Exiting site conditions include approximately 90% imperviousness with 2:1 landscaped slopes along the perimeter. The local proposed conditions hydrology analysis of the site shows that there are two main drainage management areas onsite. The proposed development generally flows from north to south, beginning at the northeast entrance on Auto Center Drive and continuing toward Towne Centre Drive. Similar to the existing condition, a high point extends over most of the site, generally dividing the east and west sides and directing flows to the southwest and southeast. Front portions of the houses will drain toward the common walkways where flows will be directed into swales. The remaining portions of the houses will typically drain to the attached outdoor yard areas where flows will be directed to the drives behind the homes. Flows in the drives will be intercepted by Filterra water quality devices or similar devices located at the end of drive aisles. Stormwater from the swales and water quality devices will then continue in proposed storm drain pipes within the development that will ultimately join existing Lines A and N in Towne Center Drive. The project is surrounded by local roads that convey street flows around the project into curb inlets and does not have adjacent parcels creating potential run-on conditions. See attachment B for existing and proposed drainage patterns.* |
| *Soil Type, Geology, and Infiltration Properties* | *The underlying soil onsite is predominantly Soil Group C, with sections of Soil Group D per the Natural Resource Conservation Service. Considering the Soil Groups are C and D with engineered fill, the site is not expected to be feasible for infiltration.* |

| ***Site Characteristics (continued)*** | |
|---|---|
| *Hydrogeologic (Groundwater) Conditions* | *NOC Mapped Depth to First Groundwater:* The site location is not within the OCWD Groundwater Basin Protection Boundary. According to GeoTek, Inc., Project No. 0750-CR3, "*Preliminary Geotechnical Evaluation for Proposed Residential Development Tract no. 17439, Paseos Project*" no natural groundwater condition is known to be present which would impact site improvements. Ground water was not reported to have been encountered at the site in the referenced reports by PSE. Groundwater or localized seepage can occur due to variations in rainfall, irrigation practices, and other factors not evident at the time of this investigation. |
| *Geotechnical Conditions (relevant to infiltration)* | *No geotechnical information available at this time.* |

| | |
|---|---|
| *Off-Site Drainage* | *The Project is bordered by existing streets where flow is directed around the Project and into the City's MS4. No offsite run-on is expected to be encountered.* |
| *Utility and Infrastructure Information* | *Existing subsurface utilities will limit the possible locations of certain BMPs and may constrain site design. Any infiltration BMPs being considered, will be evaluated to establish necessary setbacks from these utilities or if the utilities need to be relocated.* |

## III.3 Watershed Description

| | |
|---|---|
| Receiving Waters | The Project generally drains from north to south where it enters the North Orange County MS4 on Town Centre Drive. The North Orange County MS4 outlets from a box culvert with a concrete dissipater into Serrano Creek and downstream confluences with San Diego Creek Reach 2. Downstream of San Diego Creek is Newport Bay which ultimately outlets to the Pacific Ocean. |
| 303(d) Listed Impairments | Serrano Creek - Ammonia, PH, Indicator Bacteria<br>San Diego Creek Reach 2 – Indicator Bacteria |
| Applicable TMDLs | San Diego Creek Reach 2 TMDLs – Metals, Nutrients, Turbidity/Siltation<br>Newport Bay – Fecal Coliform, Pesticides |
| Pollutants of Concern for the Project | Metals, Suspended Solid/Sediments, Nutrients, Pathogens (Bacteria/Virus), Pesticides, Oil & Grease, and Trash & Debris. |
| Environmentally Sensitive and Special Biological Significant Areas | The Project does not discharge directly or within 200 feet of an Environmentally Sensitive Area or Area of Special Biological Significance. |

Map Document: (H:\pdata\10108112\Project Info\Water_Quality\WQMP\WaterBody_Arial_Watershed.mxd) 12/15/2011 -- 3:46:37 PM

RBF CONSULTING

0 3 6 12 Miles

Source: Virtual Aerial, SWRCB, RWQCB

# The Village Receiving Water Bodies

Project Location Map

# Section IV Best Management Practices (BMPs)

## IV. 1 Project Performance Criteria

| | | |
|---|---|---|
| (NOC Permit Area only) Is there an approved WIHMP or equivalent for the project area that includes more stringent LID feasibility criteria or if there are opportunities identified for implementing LID on regional or sub-regional basis? | YES ☐ | NO ☒ |
| If yes, describe WIHMP feasibility criteria or regional/sub-regional LID opportunities. | | |

| Project Performance Criteria (continued) | |
|---|---|
| If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP) | HCOC does not exist for this project.<br><br>Post-development runoff volume for the two-year frequency storm does not exceed that of the predevelopment condition by more than five percent, and<br><br>Time of concentration of post-development runoff for the two-year storm event is not less than that for the predevelopment condition by more than five percent.<br><br>Increases in Tc are be acceptable and reduction in Tc of more than 5 percent would not be acceptable. Tc is not reduced by more than 5 percent.<br><br>Watersheds that do not have developed WIHMPs should use the HCOC criteria detailed in section 7.II-2.4.2.2 and in the TGD. The WIHMP is currently in development and will not apply to this project as it has not been adopted by the RWQCB. |
| List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP) | Priority Projects must infiltrate, harvest and use, evapotranspire, or biotreat/biofilter, the 85th percentile, 24-hour storm event (Design Capture Volume).<br><br>A properly designed biotreatment system may only be considered if infiltration, harvest and use, and evapotranspiration (ET) cannot be feasibly implemented for the full design capture volume. In this case, infiltration, harvest and use, and ET practices must be implemented to the greatest extent feasible and biotreatment may be provided for the remaining design capture volume.<br><br>Equivalent performance criteria have been synthesized from permit requirements with consideration of the MEP standard and analysis of local precipitation and ET patterns. The following performance criteria result in capture and retention and/or biotreatment of 80 percent of average annual stormwater runoff volume. The performance criteria for LID are stated as follows:<br><br>o LID BMPs must be designed to retain, on-site, (infiltrate, harvest and use, or evapotranspire) stormwater runoff up to 80 percent average annual capture efficiency<br>o LID BMPs must be designed to:<br>  o Retain, on-site, (infiltrate, harvest and use, or evapotranspire) stormwater runoff as feasible up to the Design Capture Volume, and<br>  o Recover (i.e., draw down) the storage volume as soon as possible after a storm event (see criteria for maximizing drawdown rate in the TGD Appendix XI), and, if necessary<br>  o Biotreat, on-site, additional runoff, as feasible, up to 80 percent average annual capture efficiency (cumulative, retention plus biotreatment), and, if necessary<br>  o NOC Permit Area only – retain or biotreat, in a regional facility, the remaining runoff up to 80 percent average annual capture efficiency (cumulative, retention plus biotreatment, on-site plus off-site), and, if |

| | |
|---|---|
| | necessary<br>o Fulfill alternative compliance obligations for runoff volume not retained or biotreated up to 80 percent average annual capture efficiency using treatment controls or other alternative approaches as described in Section 7.II-3.<br><br>For new development or redevelopment projects within the SOC Permit Area, interim hydromodification criteria apply until a Hydromodification Management Plan (HMP) is adopted. The WIHMP is currently in development and will not apply to this project as it has not been adopted by the RWQCB. |
| List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP) | If it is not feasible to meet LID performance criteria through retention and/or biotreatment provided on-site or at a sub-regional/regional scale, then treatment control BMPs shall be provided on-site or offsite prior to discharge to waters of the US. Sizing of treatment control BMP(s) shall be based on either the unmet volume after claiming applicable water quality credits, if appropriate (See Section 7.II-3.1 Water Quality Credits) and as calculated in TGD Appendix VI. If treatment control BMPs can treat all of the remaining unmet volume and have a medium to high effectiveness for reducing the primary POCs, the project is considered to be in compliance; a waiver application and participation in an alternative program is not required. |
| Calculate LID design storm capture volume for Project. | Per Figure 7.II-7: *Design the Site Incorporating LID BMPs – Without HCOCs,* when selecting on-site LID BMPs, Infiltration BMPs are ruled out due to poor soils and engineered slopes. Therefore, the remaining (100%) volume would be utilizing biotreatment. Per TGD III.3.3 *Capture Efficiency Method for Flow-based BMPs*, "Use this method to compute the design flowrate to achieve 80 percent capture when HSC or other BMPs have been provided upstream that already manage a portion of the DCV". The incorporated HSC (rooftop disconnections) with the proposed biotreatment BMPs are used to achieve 80 percent average annual capture efficiency meeting DCV requirements. The table below is a summary of Worksheet A and D in Appendix A |

| BMP ID | BMP Type | Approved Methods for Calculating the LID Design Capture Volume (TGD Section III.3, method III.3.3) | $Q_{design}$ (cfs) |
|---|---|---|---|
| BMP-1 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.005 |
| BMP-2 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.055 |
| BMP-3 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.006 |
| BMP-4 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.114 |
| BMP-5 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.005 |
| BMP-6 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.066 |
| BMP-7 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.101 |
| BMP-8 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.000 |
| BMP-9 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.106 |
| BMP-10 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.006 |
| BMP-11 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.123 |
| BMP-12 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.007 |
| BMP-13 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.005 |
| BMP-14 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.058 |
| BMP-15 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.006 |
| BMP-16 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.124 |
| BMP-17 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.006 |
| BMP-18 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.066 |
| BMP-19 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.005 |
| BMP-20 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.052 |

# IV.2. SITE DESIGN AND DRAINAGE PLAN

The site design and drainage plan takes advantage of water quality techniques in three phases planning, design and construction. Planning phase techniques include building vertically rather than horizontally to minimize the building footprint, clustering the development to minimize driveway lengths, while reducing requirements for roads and preserve green space. The drainage planning has minimized runoff impacts to avoid the requirements for hydrologic source control. Preserving the existing drainage patterns and time of concentration into the site plan helps maintain the site's predevelopment hydrologic function.

The design phase incorporates the use of roof top disconnections, bioretention planter boxes and vegetated swales. Disconnecting impervious areas from conventional stormwater conveyance systems allows runoff to be collected and managed at the source or redirected onto pervious surfaces such as vegetated areas. Vegetated swales provide pollutant removal through settling and filtration in the vegetation (usually grasses) lining the swale. Where slopes are shallow and soil conditions limit or prohibit infiltration, an underdrain system for dry weather flows may be required to minimize ponding and convey treated and/or dry weather flows to an acceptable discharge point. Bioretention planter boxes are incorporate plants, soil and microbes engineered to provide treatment for dense urban parking lots, street, and roadways.

The construction phase incorporates permanent stabilization BMPs on disturbed slopes as quickly as possible to avoid potential runoff conditions and to meet coverage requirements. Vegetate slopes with native or drought tolerant vegetation is recommended where feasible. Providing vegetation sooner in the construction project minimizes the construction footprint, stabilizes slopes and minimizes potential sediment discharges.

The conceptual drainage plan routes water to areas suitable for Filterra or similar proprietary biotreatment BMPs. Drainage management areas have been designated for the design capture volume (DCV) or equivalent design flow calculations to determine the feasibility of the propose BMPs. HSCs are being considered and rooftop disconnections has been selected. Infiltration, evapotranspiration and rainwater harvesting considerations are not feasible for this site due to the unit density and soil type C/D. It is expected that the site will fully treat the DCV, assuming that the design of the selected BMPs are feasible. (See WQMP Plot Plan for GIS coordinates)

| BMP ID | TYPE | IMP | Tc (min) | AREA (Ac) | LAT | LONG |
|---|---|---|---|---|---|---|
| BMP-1 | SWALE | 30% | 5 | 0.13 | 33.6760 | -117.6611 |
| BMP-2 | PD | 85% | 5 | 0.39 | 33.6759 | -117.6615 |
| BMP-3 | SWALE | 30% | 5 | 0.14 | 33.6756 | -117.6615 |
| BMP-4 | PD | 85% | 5 | 0.69 | 33.6756 | -117.6617 |
| BMP-5 | SWALE | 30% | 5 | 0.13 | 33.6753 | -117.6617 |
| BMP-6 | PD | 85% | 5 | 0.42 | 33.6752 | -117.6620 |
| BMP-7 | PD | 85% | 5 | 0.56 | 33.6748 | -117.6613 |
| BMP-8 | PD | 85% | 5 | 0.16 | 33.6750 | -117.6620 |
| BMP-9 | PD | 85% | 5 | 0.67 | 33.6744 | -117.6623 |
| BMP-10 | SWALE | 30% | 5 | 0.15 | 33.6745 | -117.6620 |
| BMP-11 | PD | 85% | 5 | 0.71 | 33.6744 | -117.6617 |
| BMP-12 | SWALE | 30% | 5 | 0.17 | 33.6746 | -117.6615 |
| BMP-13 | SWALE | 30% | 5 | 0.12 | 33.6754 | -117.6602 |
| BMP-14 | PD | 85% | 5 | 0.39 | 33.6752 | -117.6601 |
| BMP-15 | SWALE | 30% | 5 | 0.15 | 33.6751 | -117.6605 |
| BMP-16 | PD | 85% | 5 | 0.79 | 33.6748 | -117.6604 |
| BMP-17 | SWALE | 30% | 5 | 0.15 | 33.6747 | -117.6607 |
| BMP-18 | PD | 85% | 5 | 0.42 | 33.6745 | -117.6607 |
| BMP-19 | SWALE | 30% | 5 | 0.11 | 33.6745 | -117.6610 |
| BMP-20 | PD | 85% | 5 | 0.35 | 33.6744 | -117.6612 |

PD = PROPRIETARY DEVICE

IMP = IMPERVIOUS PERCENTAGE OF AREA TRIBUTARY TO BMP

100' 50' 0 100'

GRAPHIC SCALE


RBF
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# THE VILLAGE - TENTATIVE TRACT 14739
# WQMP PLOT PLAN

# IV.3 LID BMP SELECTION AND PROJECT CONFORMANCE ANALYSIS

## IV.3.1 Hydrologic Source Controls

| Name | Included? |
|---|---|
| Localized on-lot infiltration | ☐ |
| Impervious area dispersion (e.g. roof top disconnection) | ☒ |
| Street trees (canopy interception) | ☐ |
| Residential rain barrels (not actively managed) | ☐ |
| Green roofs/Brown roofs | ☐ |
| Blue roofs | ☐ |
| Impervious area reduction (e.g. permeable pavers, site design) | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |

HSC will be included by the use of roof top disconnections.

## IV.3.2 Infiltration BMPs

| Name | Included? |
|---|---|
| Bioretention without underdrains | ☐ |
| Rain gardens | ☐ |
| Porous landscaping | ☐ |
| Infiltration planters | ☐ |
| Retention swales | ☐ |
| Infiltration trenches | ☐ |
| Infiltration basins | ☐ |
| Drywells | ☐ |
| Subsurface infiltration galleries | ☐ |
| French drains | ☐ |
| Permeable asphalt | ☐ |
| Permeable concrete | ☐ |
| Permeable concrete pavers | ☐ |
| Other: | ☐ |
| Other: | ☐ |

Preliminary Geotechnical Evaluation For Proposed Residential Development Tract No. 17439, Paseos Project, City of Lake Forest, Orange County, California, Prepared By GeoTek, Inc. reports, "maximum depth of fill on the order of up to 20 feet." The Natural Resource Conservation Service indentifies the underlying soil onsite to consist of Soil Group C and Soil Group D. The TGD VII.3.1 Testing Criteria states, "Infiltration testing should not be conducted in engineered or undocumented fill" therefore, infiltration is not feasible (See Attachment G: Infiltration BMP Feasibility Worksheet).

## IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

| Name | Included? |
|---|---|
| All HSCs; *See Section IV.3.1* | ☐ |
| Surface-based infiltration BMPs | ☐ |
| Biotreatment BMPs | ☐ |
| Above-ground cisterns and basins | ☐ |
| Underground detention | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |

Modified EAWU = ($ETo_{wet}$ x $K_L$ x LA x 0.015) / IE

Table X.2: $ETo_{wet}$ = 3.0 in/mo
Table X.4: $K_L$ = 0.35
LA = 87,120 sqft
IE = 0.90
Modified EAWU = (3.0 x 0.35 x 87,120 x 0.015) / 0.90

Modified EAWU = 1,525

Figure XVI-1: $D_{design}$ = 0.95
Table X.6: Minimum Partial Capture = 770 GPD/acres x 5 acres
Minimum Partial Capture = 3,850

Modified EAWU = 1,525 < Minimum Partial Capture = 3,850

The modified Estimated Daily Average Water Usage does not meet the Minimum Partial Capture, Harvest and Use is not feasible.

## IV.3.4 Biotreatment BMPs

| Name | Included? |
|---|---|
| Bioretention with underdrains | ☐ |
| Stormwater planter boxes with underdrains | ☐ |
| Rain gardens with underdrains | ☐ |
| Constructed wetlands | ☐ |
| Vegetated swales | ☒ |
| Vegetated filter strips | ☐ |
| Proprietary vegetated biotreatment systems | ☒ |
| Wet extended detention basin | ☐ |
| Dry extended detention basins | ☐ |
| Other: | ☐ |
| Other: | ☐ |

To enhance water quality on the site, vegetated swales or similar devices will be placed in pedestrian paseo landscaped areas to capture runoff from rooftops and paved areas. Proprietary biotreatment planter boxes such as Katchall water quality BMPs (or similar devices) will be placed at the end of drive aisles to treat the LID design storm capture volume. (See calculations in Attachment A: Summary, Worksheet A and D)

## IV.3.5 Hydromodification Control BMPs

| Hydromodification Control BMPs | |
|---|---|
| **BMP Name** | **BMP Description** |
| N/A | N/A |
| | |
| | |

### IV.3.6 Regional/Sub-Regional LID BMPs

| Regional/Sub-Regional LID BMPs |
|---|
| The Regional/ Sub-Regional LID BMPs approach will not be considered at this time, as the requirement for a WIHMP is currently in development and not approved by the RWQCB. |

### IV.3.7 Treatment Control BMPs

| Treatment Control BMPs | |
|---|---|
| **BMP Name** | **BMP Description** |
| N/A | N/A |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

## IV.3.8 Non-structural Source Control BMPs

| Non-Structural Source Control BMPs | | | | |
|---|---|---|---|---|
| **Identifier** | **Name** | **Check One** | | **If not applicable, state brief reason** |
| | | **Included** | **Not Applicable** | |
| N1 | Education for Property Owners, Tenants and Occupants | ☒ | ☐ | |
| N2 | Activity Restrictions | ☒ | ☐ | |
| N3 | Common Area Landscape Management | ☒ | ☐ | |
| N4 | BMP Maintenance | ☒ | ☐ | |
| N5 | Title 22 CCR Compliance (How development will comply) | ☐ | ☒ | No hazardous materials are expected to be onsite. |
| N6 | Local Industrial Permit Compliance | ☐ | ☒ | No industrial activities onsite. |
| N7 | Spill Contingency Plan | ☐ | ☒ | No hazardous materials are expected to be onsite. |
| N8 | Underground Storage Tank Compliance | ☐ | ☒ | No storage tanks onsite. |
| N9 | Hazardous Materials Disclosure Compliance | ☐ | ☒ | No hazardous materials are expected to be onsite. |
| N10 | Uniform Fire Code Implementation | ☐ | ☒ | No hazardous materials are expected to be onsite. |
| N11 | Common Area Litter Control | ☒ | ☐ | |
| N12 | Employee Training | ☒ | ☐ | |
| N13 | Housekeeping of Loading Docks | ☐ | ☒ | No loading dock onsite. |
| N14 | Common Area Catch Basin Inspection | ☒ | ☐ | |
| N15 | Street Sweeping Private Streets and Parking Lots | ☒ | ☐ | |
| N16 | Retail Gasoline Outlets | ☐ | ☒ | No retail gasoline outlets onsite. |

## IV.3.9 Structural Source Control BMPs

| Structural Source Control BMPs | | | | |
|---|---|---|---|---|
| **Identifier** | **Name** | **Check One** | | **If not applicable, state brief reason** |
| | | **Included** | **Not Applicable** | |
| S1 | Provide storm drain system stenciling and signage | ☒ | ☐ | |
| S2 | Design and construct outdoor material storage areas to reduce pollution introduction | ☐ | ☒ | No hazardous materials are expected to be onsite. |
| S3 | Design and construct trash and waste storage areas to reduce pollution introduction | ☒ | ☐ | |
| S4 | Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control | ☒ | ☐ | |
| S5 | Protect slopes and channels and provide energy dissipation | ☒ | ☐ | |
| | Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit) | ☐ | ☒ | Santa Ana RWQCB 8 |
| S6 | Dock areas | ☐ | ☒ | No dock areas onsite. |
| S7 | Maintenance bays | ☐ | ☒ | No maintenance bays onsite. |
| S8 | Vehicle wash areas | ☐ | ☒ | No vehicle wash areas onsite. |
| S9 | Outdoor processing areas | ☐ | ☒ | No outdoor processing areas onsite. |
| S10 | Equipment wash areas | ☐ | ☒ | No equipment wash areas onsite. |
| S11 | Fueling areas | ☐ | ☒ | No fueling areas onsite. |
| S12 | Hillside landscaping | ☒ | ☐ | |
| S13 | Wash water control for food preparation areas | ☐ | ☒ | No food establishment onsite. |
| S14 | Community car wash racks | ☐ | ☒ | No community car wash racks onsite. |

# IV.4 ALTERNATIVE COMPLIANCE PLAN (IF APPLICABLE)

## IV.4.1 Water Quality Credits

| Description of Proposed Project | | | | |
|---|---|---|---|---|
| Project Types that Qualify for Water Quality Credits (Select all that apply): | | | | |
| ☒Redevelopment projects that reduce the overall impervious footprint of the project site. | ☐Brownfield redevelopment, meaning redevelopment, expansion, or reuse of real property which may be complicated by the presence or potential presence of hazardous substances, pollutants or contaminants, and which have the potential to contribute to adverse ground or surface WQ if not redeveloped. | | ☒ Higher density development projects which include two distinct categories (credits can only be taken for one category): those with more than seven units per acre of development (lower credit allowance); vertical density developments, for example, those with a Floor to Area Ratio (FAR) of 2 or those having more than 18 units per acre (greater credit allowance). | |
| ☐ Mixed use development, such as a combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that can demonstrate environmental benefits that would not be realized through single use projects (e.g. reduced vehicle trip traffic with the potential to reduce sources of water or air pollution). | | ☐ Transit-oriented developments, such as a mixed use residential or commercial area designed to maximize access to public transportation; similar to above criterion, but where the development center is within one half mile of a mass transit center (e.g. bus, rail, light rail or commuter train station). Such projects would not be able to take credit for both categories, but may have greater credit assigned | | ☐ Redevelopment projects in an established historic district, historic preservation area, or similar significant city area including core City Center areas (to be defined through mapping). |
| ☐Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses. | ☒ Developments in a city center area. | ☐ Developments in historic districts or historic preservation areas. | ☐ Live-work developments, a variety of developments designed to support residential and vocational needs together – similar to criteria to mixed use development; would not be able to take credit for both categories. | ☒In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas. |
| Calculation of Water Quality Credits (if applicable) | Water Quality Credits are available, but are not necessary because LID BMPs will treat all of the project's DCV or the equivalent design flow. | | | |

## IV.4.2 Alternative Compliance Plan Information

Using a combination of site design and on-site LID BMPs. The site is intending to either qualify for Water Quality Credits that can be applied to reduce or fully satisfy the remaining design capture volume that must be treated before evaluating alternative approaches.

# Section V Inspection/Maintenance Responsibility for BMPs

The Home Owner Association (HOA) will be ultimately maintaining the proposed BMPs once the project is completed. Prior to the HOA establishment and assuming responsibilities, Trumark Companies will maintain the BMPs in the interim.

Responsible Party Information: Trumark Companies
Address: 9911 Irvine Center Dr., Suite 150, Irvine, CA 92618
Phone Number: (949) 202-5782
Contact: James O'Malley

| BMP Inspection/Maintenance | | | |
|---|---|---|---|
| **BMP** | **Reponsible Party(s)** | **Inspection/ Maintenance Activities Required** | **Minimum Frequency of Activities** |
| Bioretention Planter Box | HOA | Inspection for dead/diseased vegetation; mulch replacement; inspect for standing water | Biannual health evaluation of trees/shrubs + additional inspection after heavy runoff |
| Vegetated Swale | HOA | Check for erosion or damage to vegetated swale. 70% or greater grass coverage is required for this BMP. Re-seed/replace grass at bald spots accordingly. | Biannual health evaluation + additional inspection after heavy runoff |
| N1 - Education for Property Owners | HOA | Storm water education | Tenants and occupants to be implemented at start of occupancy |
| N2 – Activity Restrictions | HOA | Outlined in CC&Rs | As governed by the CC&Rs |

| BMP Inspection/Maintenance | | | |
|---|---|---|---|
| **BMP** | **Reponsible Party(s)** | **Inspection/ Maintenance Activities Required** | **Minimum Frequency of Activities** |
| N3 – Common Area Landscaping Management | HOA | Usage consistent with Management Guidelines | To be implemented at start of construction phase |
| N4 – BMP Maintenance | HOA | Maintenance as described herein | Maintenance as described herein |
| N11 - Common Area Litter Control | HOA | Usage consistent with Management Guidelines | To be implemented as needed to prevent pollution |
| N12 - Employee Training | HOA | Usage consistent with Management Guidelines | To be implemented monthly or as needed |
| N14 - Common Area Catch Basin Inspection | HOA | Usage consistent with Management Guidelines | To be implemented as needed to prevent pollution |
| N15 - Street Sweeping Private Streets and Parking Lots | HOA | Usage consistent with Management Guidelines | To be implemented weekly or per the City's maintenance schedule |

# Section VI Site Plan and Drainage Plan

## VI.1 SITE PLAN AND DRAINAGE PLAN

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location – The Village Receiving Water Bodies (page 13)
- Site boundary– Project Site Plan Land Uses/Activities (page 6)
- Land uses and land covers, as applicable – Project Site Plan Land Uses/Activities (page 6)
- Suitability/feasibility constraints – Attachment C
- Structural BMP locations – WQMP Plot Plan (page 18)
- Drainage delineations and flow information – Attachment B
- Drainage connections – Attachment B
- BMP details – Attachment E

## VI.2 ELECTRONIC DATA SUBMITTAL

The minimum requirement is to provide submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open.

If the local jurisdiction requires specialized electronic document formats (CAD, GIS) to be submitted, this section will be used to describe the contents (e.g., layering, nomenclature, georeferencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

# Section VII Educational Materials

| Education Materials | | | |
|---|---|---|---|
| **Residential Material (http://www.ocwatersheds.com)** | **Check If Applicable** | **Business Material (http://www.ocwatersheds.com)** | **Check If Applicable** |
| The Ocean Begins at Your Front Door | ☐ | Tips for the Automotive Industry | ☐ |
| Tips for Car Wash Fund-raisers | ☐ | Tips for Using Concrete and Mortar | ☐ |
| Tips for the Home Mechanic | ☒ | Tips for the Food Service Industry | ☐ |
| Homeowners Guide for Sustainable Water Use | ☒ | Proper Maintenance Practices for Your Business | ☐ |
| Household Tips | ☒ | **Other Material** | **Check If Attached** |
| Proper Disposal of Household Hazardous Waste | ☒ | | |
| Recycle at Your Local Used Oil Collection Center (North County) | ☒ | Paint Projects | ☒ |
| Recycle at Your Local Used Oil Collection Center (Central County) | ☐ | Watershed Brochure | ☒ |
| Recycle at Your Local Used Oil Collection Center (South County) | ☐ | Children's Brochure | ☒ |
| Tips for Maintaining a Septic Tank System | ☐ | Pool Draining | ☒ |
| Responsible Pest Control | ☒ | | ☐ |
| Sewer Spill | ☐ | | ☐ |
| Tips for the Home Improvement Projects | ☒ | | ☐ |
| Tips for Horse Care | ☐ | | ☐ |
| Tips for Landscaping and Gardening | ☒ | | ☐ |
| Tips for Pet Care | ☒ | | ☐ |
| Tips for Pool Maintenance | ☒ | | ☐ |
| Tips for Residential Pool, Landscape and Hardscape Drains | ☐ | | ☐ |
| Tips for Projects Using Paint | ☐ | | ☐ |

# Attachment A

# Summary Table and Sample Worksheets A and D

| BMP ID | BMP Type | Approved Methods for Calculating the LID Design Capture Volume (TGD Section III.3, method III.3.3) | $Q_{design}$ (cfs) |
|---|---|---|---|
| BMP-1 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.005 |
| BMP-2 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.055 |
| BMP-3 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.006 |
| BMP-4 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.114 |
| BMP-5 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.005 |
| BMP-6 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.066 |
| BMP-7 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.101 |
| BMP-8 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.000 |
| BMP-9 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.106 |
| BMP-10 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.006 |
| BMP-11 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.123 |
| BMP-12 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.007 |
| BMP-13 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.005 |
| BMP-14 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.058 |
| BMP-15 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.006 |
| BMP-16 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.124 |
| BMP-17 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.006 |
| BMP-18 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.066 |
| BMP-19 | Vegitated Swale | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.005 |
| BMP-20 | Proprietary Device (Katchall) | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | 0.052 |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-1 | |
| Total drainage area | 0.13 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.04 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-1 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.039 | 0.020 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.020 |
| | Box 2: | | $IA_{total}$ = | 0.039 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.500 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 64.0% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.500 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 64.0% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.15 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.11 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.13 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.30 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.375 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.0054 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-2 | |
| Total drainage area | 0.39 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.33 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-2 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.179 | 0.090 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.090 |
| | Box 2: | | $IA_{total}$ = | 0.332 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.270 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 44.7% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.270 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 44.7% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.08 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.18 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.39 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.85 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.788 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.0553 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-3 | |
| Total drainage area | 0.14 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.04 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-3 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.042 | 0.021 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.021 |
| | Box 2: | | $IA_{total}$ = | 0.042 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.500 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 64.0% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.500 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 64.0% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.15 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.11 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.14 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.30 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.375 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.0058 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-4 | |
| Total drainage area | 0.69 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.59 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-4 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.179 | 0.090 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.090 |
| | Box 2: | | $IA_{total}$ = | 0.587 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.153 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 29.0% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.153 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 29.0% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.05 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.21 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.69 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.85 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.788 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.1141 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-5 | |
| Total drainage area | 0.13 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.04 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-5 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.039 | 0.020 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di × $IA_i$ = | 0.020 |
| | Box 2: | | $IA_{total}$ = | 0.039 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.500 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 64.0% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.500 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 64.0% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.15 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.11 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.13 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.30 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.375 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.0054 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-6 | |
| Total drainage area | 0.42 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.36 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-6 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.145 | 0.073 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di × $IA_i$ = | 0.073 |
| | Box 2: | | $IA_{total}$ = | 0.357 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.204 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 37.4% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.204 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 37.4% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.06 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.2 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.42 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.85 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.788 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.0662 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-7 | |
| Total drainage area | 0.56 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.48 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-7 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.090 | 0.045 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.045 |
| | Box 2: | | $IA_{total}$ = | 0.476 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.094 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 18.6% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.094 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 18.6% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.03 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.23 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.56 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.85 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.788 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.1014 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-8 | |
| Total drainage area | 0.16 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.14 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-8 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.000 | 0.000 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.000 |
| | Box 2: | | $IA_{total}$ = | 0.136 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.000 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 0.0% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.000 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 0.0% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.26 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.16 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.85 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.788 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.0000 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-9 | |
| Total drainage area | 0.67 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.57 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-9 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.224 | 0.112 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.112 |
| | Box 2: | | $IA_{total}$ = | 0.570 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.196 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 36.3% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.196 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 36.3% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.06 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.2 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.67 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.85 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.788 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.1055 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-10 | |
| Total drainage area | 0.15 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.05 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-10 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.045 | 0.023 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.023 |
| | Box 2: | | $IA_{total}$ = | 0.045 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.500 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 64.0% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.500 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 64.0% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.15 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.11 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.15 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.30 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.375 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.0062 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-11 | |
| Total drainage area | 0.71 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.60 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-11 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.157 | 0.078 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.078 |
| | Box 2: | | $IA_{total}$ = | 0.604 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.130 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 25.1% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.130 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 25.1% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.04 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.22 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.71 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.85 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.788 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.1230 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-12 | |
| Total drainage area | 0.17 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.05 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-12 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.051 | 0.026 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.026 |
| | Box 2: | | $IA_{total}$ = | 0.051 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.500 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 64.0% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.500 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 64.0% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.15 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.11 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.17 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.30 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.375 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.0070 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-13 | |
| Total drainage area | 0.12 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.04 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-13 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.036 | 0.018 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.018 |
| | Box 2: | | $IA_{total}$ = | 0.036 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.500 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 64.0% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.500 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 64.0% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.15 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.11 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.12 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.30 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.375 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.0050 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-14 | |
| Total drainage area | 0.39 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.33 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-14 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.179 | 0.090 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.090 |
| | Box 2: | | $IA_{total}$ = | 0.332 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.270 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 44.7% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.270 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 44.7% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.07 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.19 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.39 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.85 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.788 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.0584 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-15 | |
| Total drainage area | 0.15 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.05 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-15 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.045 | 0.023 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.023 |
| | Box 2: | | $IA_{total}$ = | 0.045 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.500 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 64.0% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.500 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 64.0% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.15 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.11 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.15 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.30 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.375 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.0062 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-16 | |
| Total drainage area | 0.79 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.67 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-16 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.235 | 0.117 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.117 |
| | Box 2: | | $IA_{total}$ = | 0.672 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.175 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 32.8% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.175 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 32.8% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.06 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.2 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.79 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.85 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.788 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.1244 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-17 | |
| Total drainage area | 0.15 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.05 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-17 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.045 | 0.023 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.023 |
| | Box 2: | | $IA_{total}$ = | 0.045 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.500 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 64.0% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.500 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 64.0% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.15 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.11 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.15 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.30 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.375 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.0062 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-18 | |
| Total drainage area | 0.42 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.36 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-18 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.134 | 0.067 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.067 |
| | Box 2: | | $IA_{total}$ = | 0.357 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.188 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 35.0% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.188 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 35.0% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.06 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.2 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.42 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.85 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.788 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.0662 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-19 | |
| Total drainage area | 0.11 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.03 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-19 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.033 | 0.017 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di $\times IA_i$ = | 0.017 |
| | Box 2: | | $IA_{total}$ = | 0.033 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.500 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 64.0% |

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.500 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 64.0% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.15 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.11 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.11 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.30 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.375 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.0045 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

## Worksheet A: Hydrologic Source Control Calculation Form

| | | |
|---|---|---|
| Drainage area ID | BMP-20 | |
| Total drainage area | 0.35 | acres |
| Total drainage area Impervious Area ($IA_{total}$) | 0.30 | acres |

| HSC ID | HSC Type/ Description/Reference BMP Fact Sheet | Effect of individual HSCi per criteria in **BMP Fact Sheets** (XIV.1) ($d_{HSCi}$)[1] in inches | Impervious Area Tributary to HSCi ($IA_i$) in acres | $d_i \times IA_i$ |
|---|---|---|---|---|
| BMP-20 | Downspout Dispersion, 1:1 ratio of rooftop to pervious area. | 0.5 | 0.134 | 0.067 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | Box 1: | | $\Sigma$ di × $IA_i$ = | 0.067 |
| | Box 2: | | $IA_{total}$ = | 0.298 |
| | [Box 1]/[Box 2]: | | $d_{HSC\ total}$ = | 0.226 |
| | | Percent Capture Provided by HSCs (Table III.1) | | 39.9% |

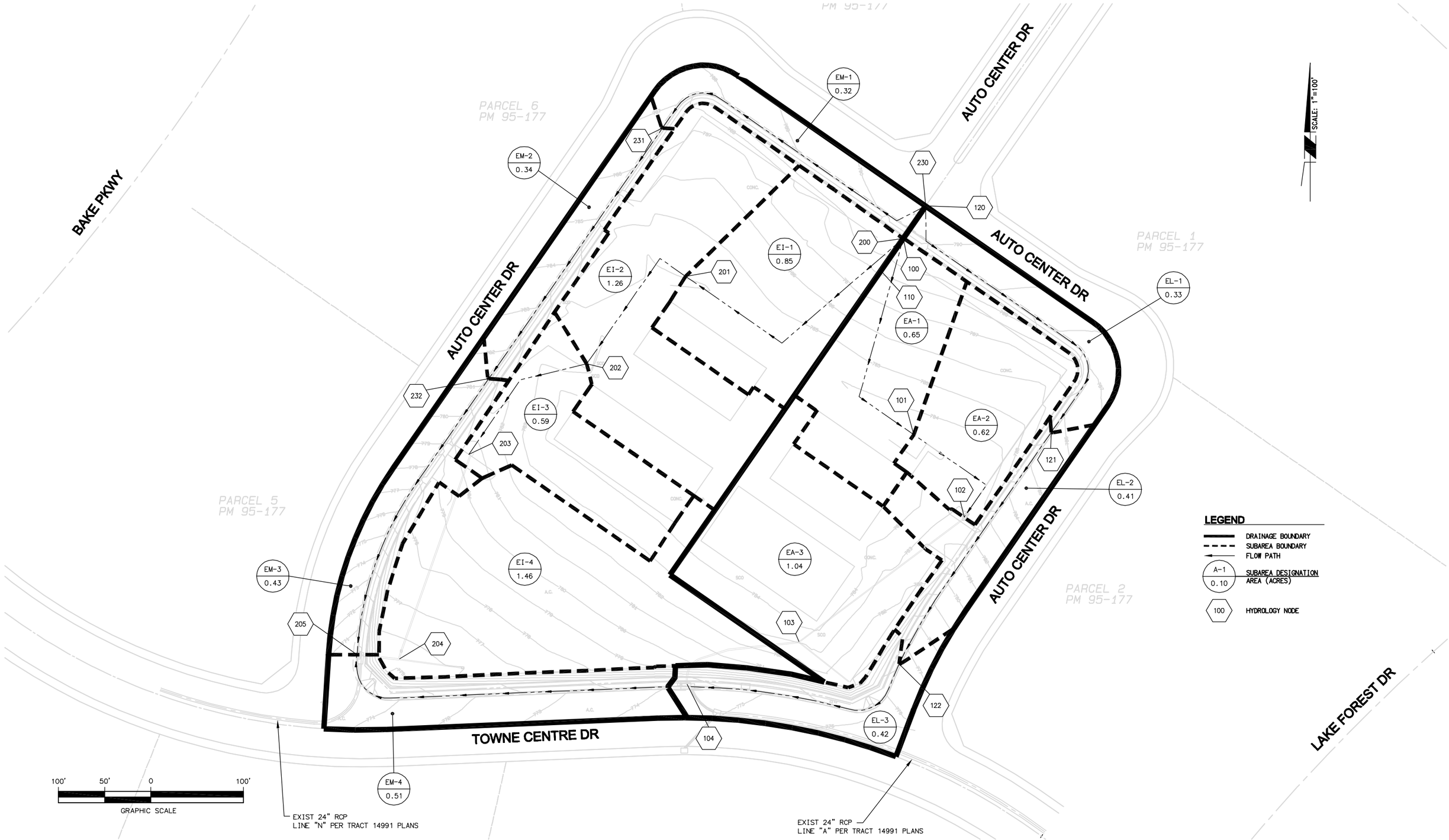
1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

## Worksheet D: Capture Efficiency Method for Flow-Based BMPs

| | | | | |
|---|---|---|---|---|
| **Step 1: Determine the design capture storm depth used for calculating volume** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See Appendix IV.2) | $T_c$= | 5 | |
| 2 | Using Figure III.4, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.26 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0.226 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (Worksheet A) | $Y_{2=}$ | 39.9% | % |
| 5 | Using Figure III.4, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0.07 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}$= $I_1$-$I_2$ | $I_{design}$= | 0.19 | |
| **Step 2: Calculate the design flowrate** | | | | |
| 1 | Enter Project area tributary to BMP (s), A (acres) | A= | 0.35 | acres |
| 2 | Enter Project Imperviousness, imp (unitless) | imp= | 0.85 | |
| 3 | Calculate runoff coefficient, C= (0.75 x imp) + 0.15 | C= | 0.788 | |
| 4 | Calculate design flowrate, $Q_{design}$= (C x $i_{design}$ x A) | $Q_{design}$= | 0.0524 | cfs |
| **Supporting Calculations** | | | | |
| Describe system: Alley way draining to bioretention planter box. | | | | |
| Provide time of concentration assumptions: Tc of 5 minutes. | | | | |

# Attachment B

# Drainage Maps

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# THE VILLAGE - TENTATIVE TRACT 14739
# EXISTING CONDITION HYDROLOGY MAP

H:\PDATA\10108112\PROJECT INFO\WATER_QUALITY\WQMP\ARCHIVE\8112-HY-EXST-001.DWG KEVARTS 5/21/12 8:15 am

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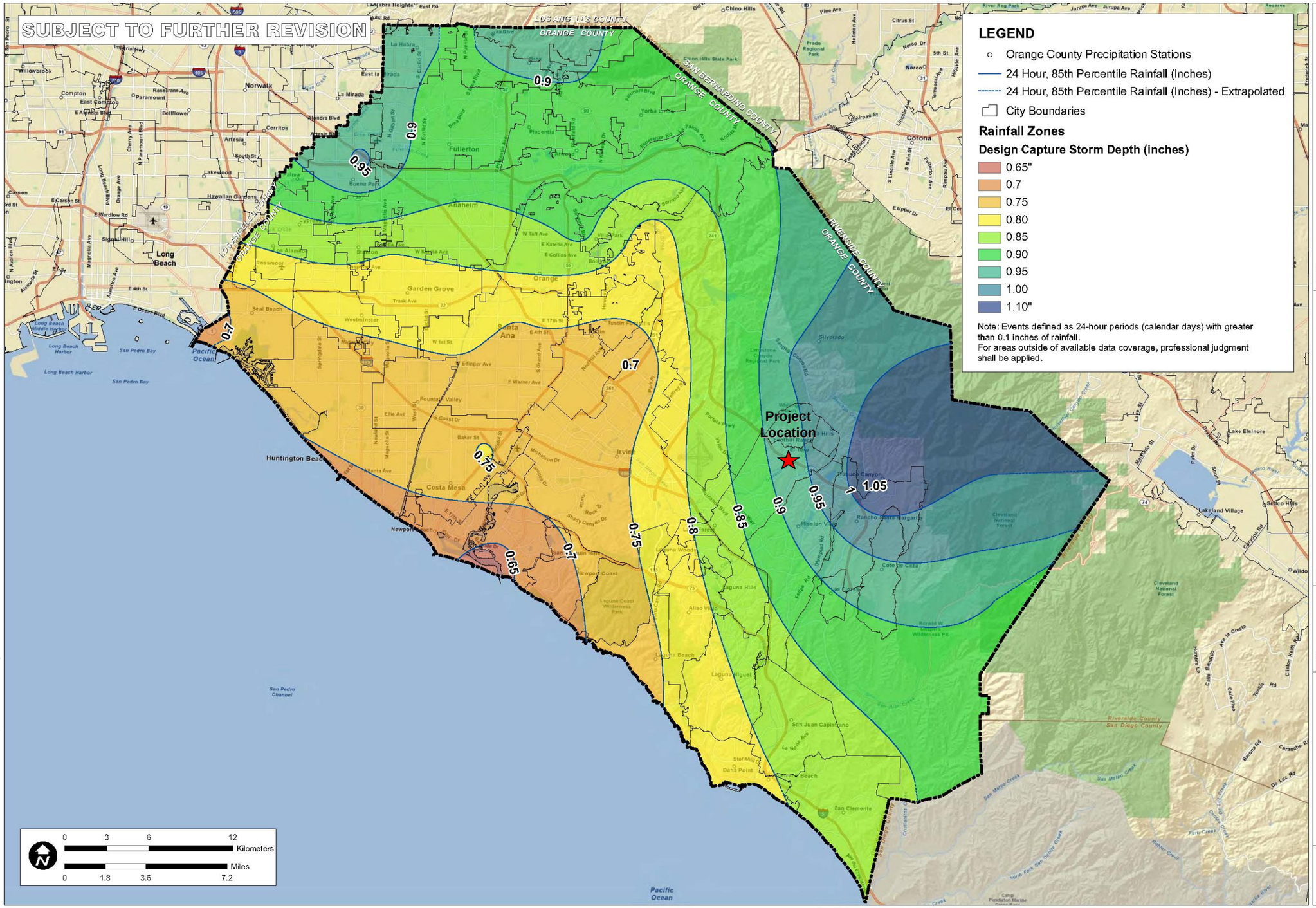
# THE VILLAGE - TENTATIVE TRACT 14739
# PROPOSED CONDITION HYDROLOGY MAP

# Attachment C

# TGD Reference Maps




TITLE
RAINFALL ZONES

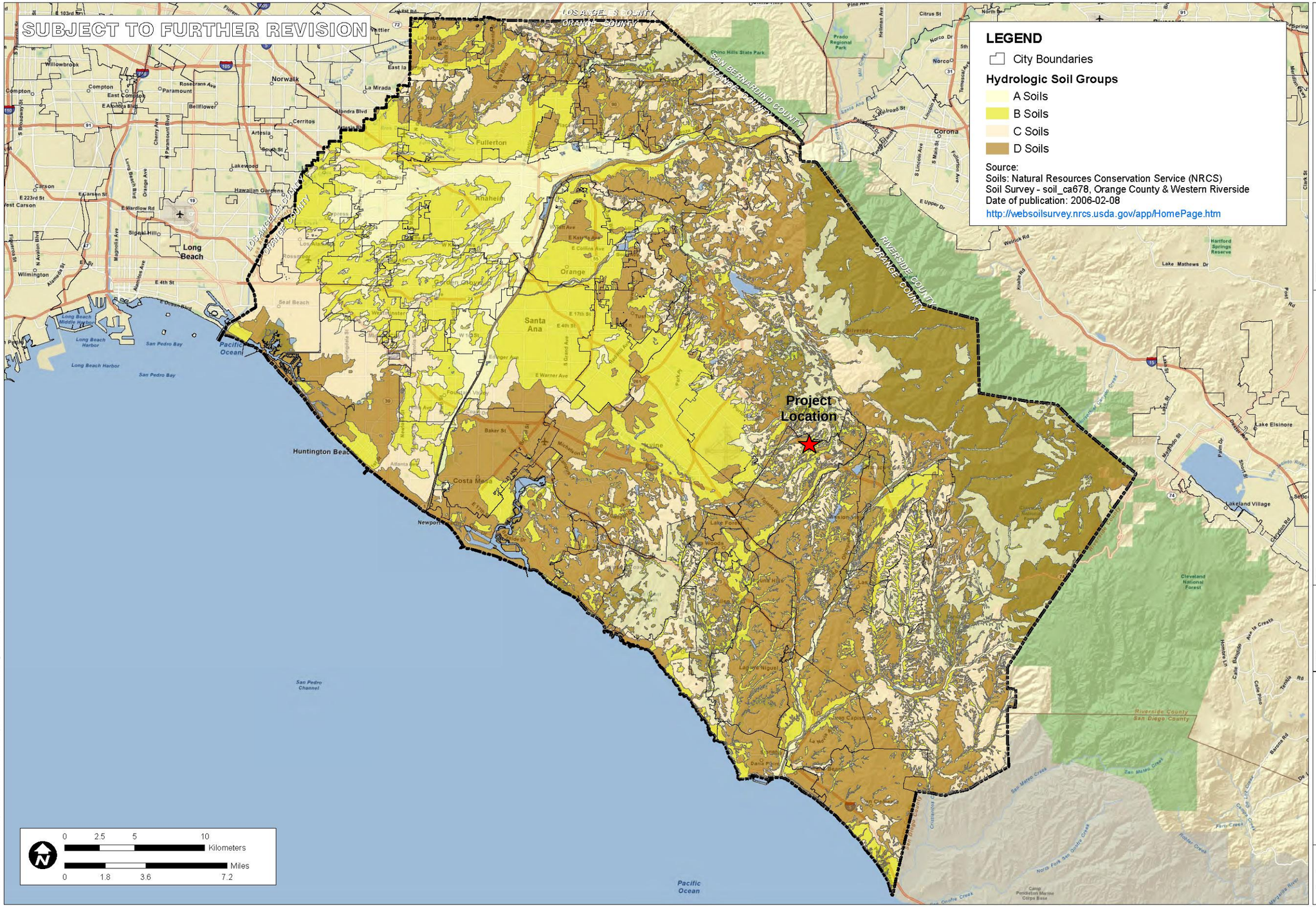
JOB
ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT
ORANGE CO. CA

| | |
|---|---|
| SCALE | 1" = 1.8 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 04/22/10 |
| JOB NO. | 9526-E |

PACE Advanced Water Engineering

FIGURE
XVI-1

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasibility_20110215\9526E_FigureXVI-1_RainfallZones_20110215.mxd




P:\9526E\6-GIS\Mxd\Reports\InfiltrationFeasibility_20110215\9526E_FigureXVI-2a_HydroSoils_20110215.mxd

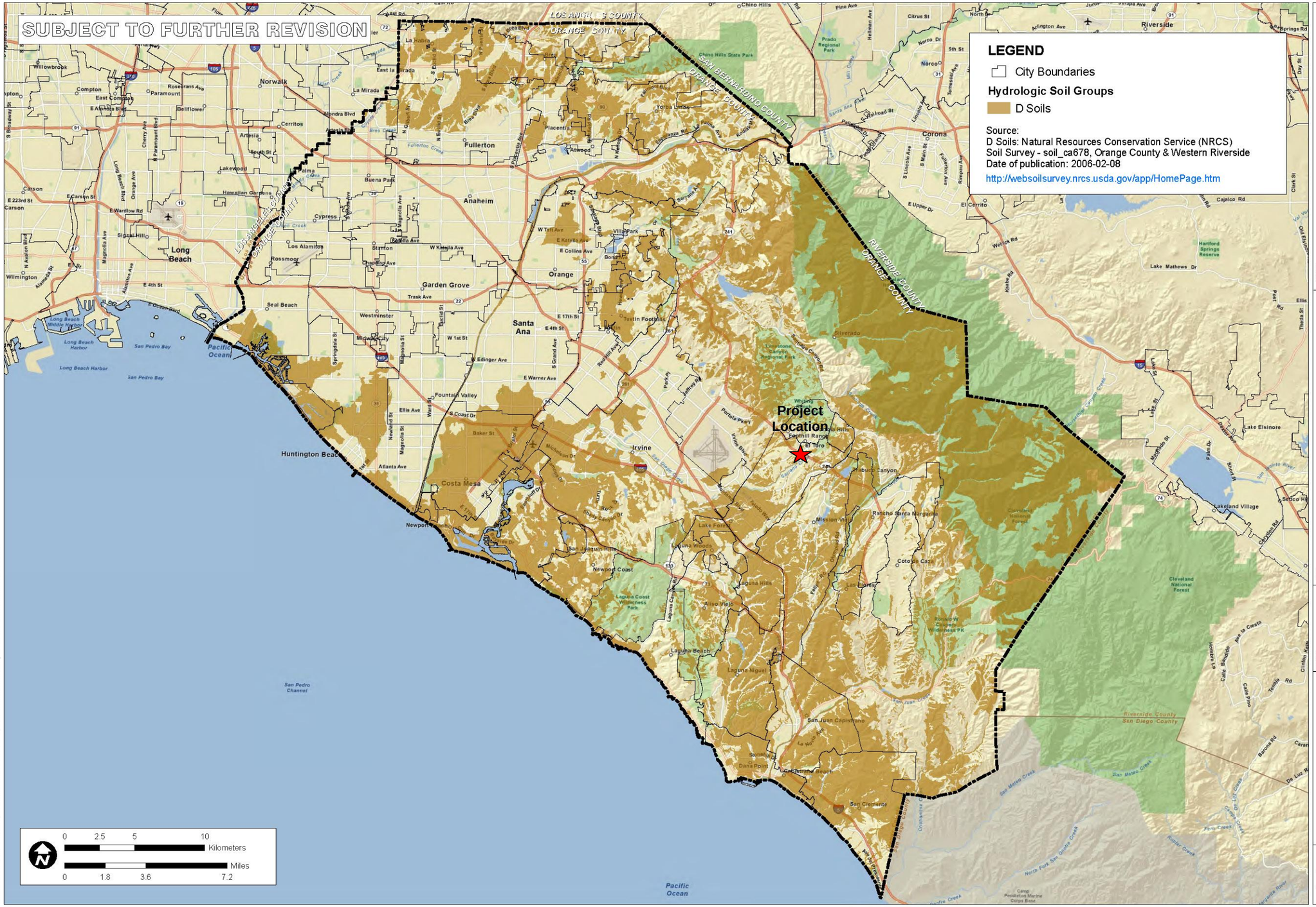
TITLE
NRCS HYDROLOGIC SOILS GROUPS

JOB
ORANGE COUNTY INFILTRATION STUDY
ORANGE CO. CA

| | |
|---|---|
| SCALE | 1" = 1.8 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 02/09/11 |
| JOB NO. | 9526-E |

PACE Advanced Water Engineering

FIGURE
XVI-2a

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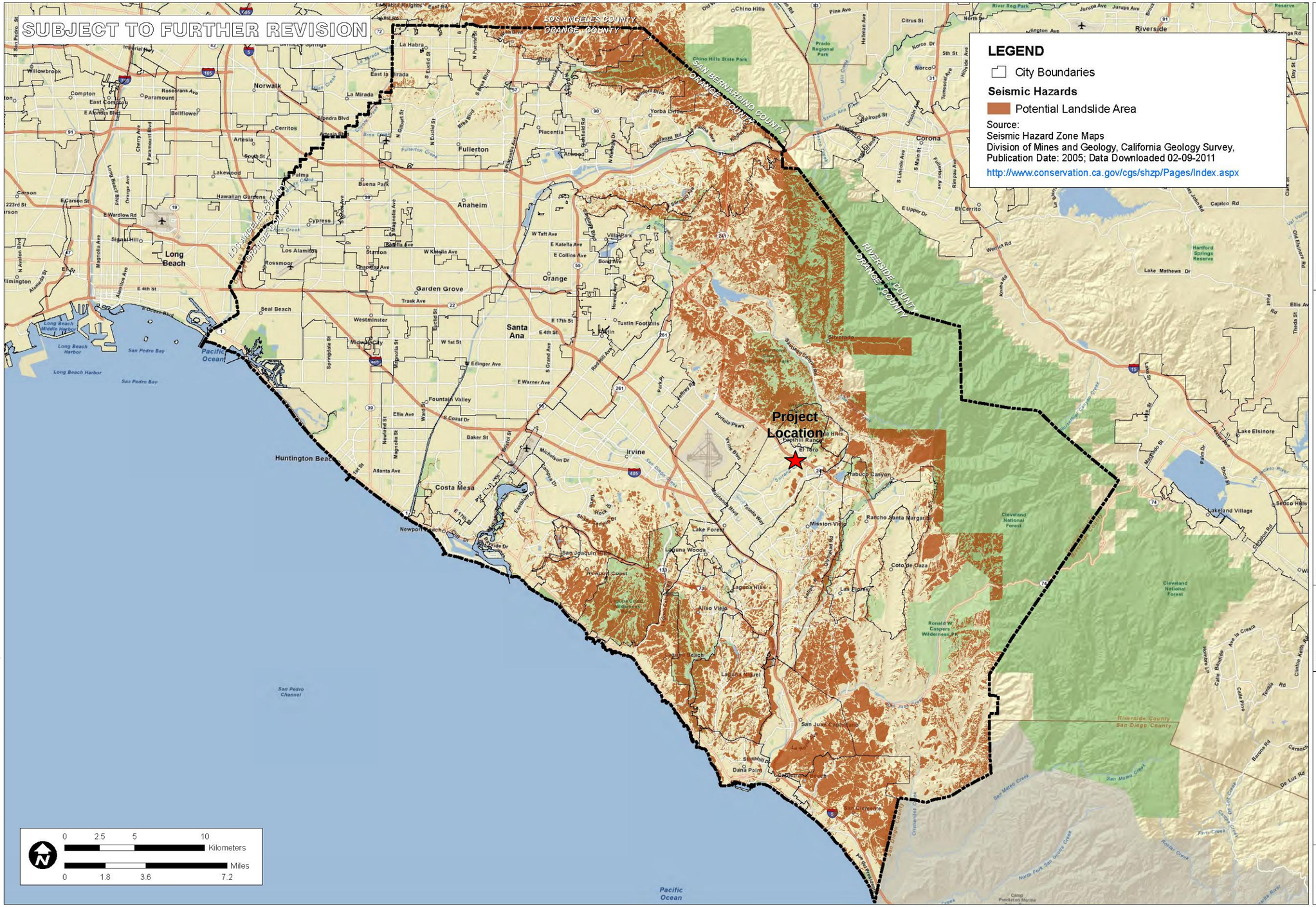
TITLE
HYDROLOGIC SOIL GROUP
TYPE D NRCS SOIL SURVEY

JOB
ORANGE COUNTY
INFILTRATION STUDY
ORANGE CO. CA

| | |
|---|---|
| SCALE | 1" = 1.8 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 02/09/11 |
| JOB NO. | 9526-E |

PACE
Advanced Water Engineering

FIGURE
XVI-2b

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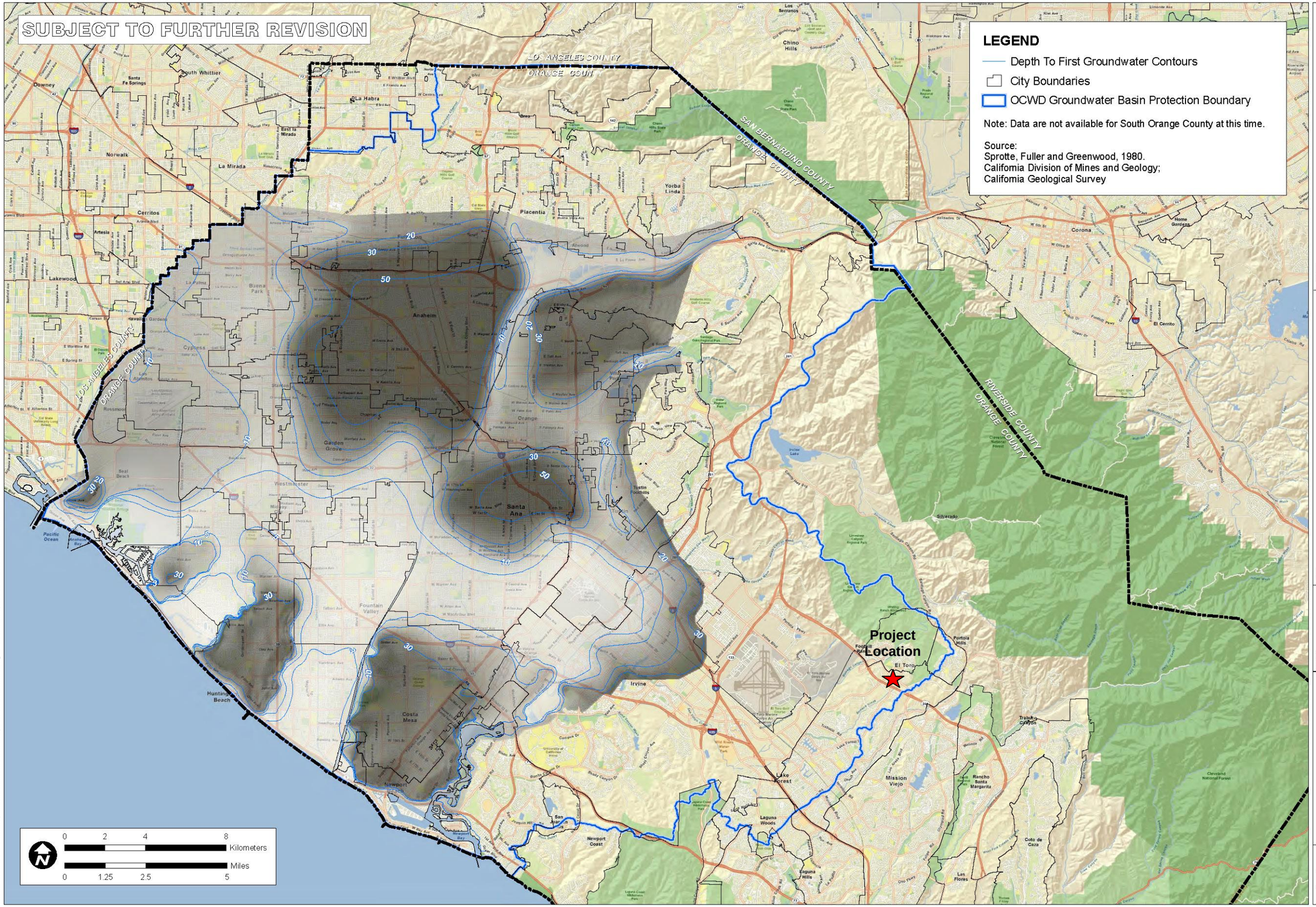
TITLE
HYDROLOGIC SOIL GROUP
TYPE D NRCS SOIL SURVEY

JOB
ORANGE COUNTY
INFILTRATION STUDY
ORANGE CO. CA

| | |
|---|---|
| SCALE | 1" = 1.25 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 02/09/11 |
| JOB NO. | 9526-E |

PACE
Advanced Water Engineering

FIGURE
XVI-2c




TITLE
NORTH ORANGE COUNTY
MAPPED DEPTH TO FIRST
GROUNDWATER

JOB
ORANGE COUNTY
INFILTRATION STUDY
ORANGE CO. CA

| | |
|---|---|
| SCALE | 1" = 1.25 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 02/09/11 |
| JOB NO. | 9526-E |

PACE
Advanced Water Engineering

FIGURE
XVI-2d

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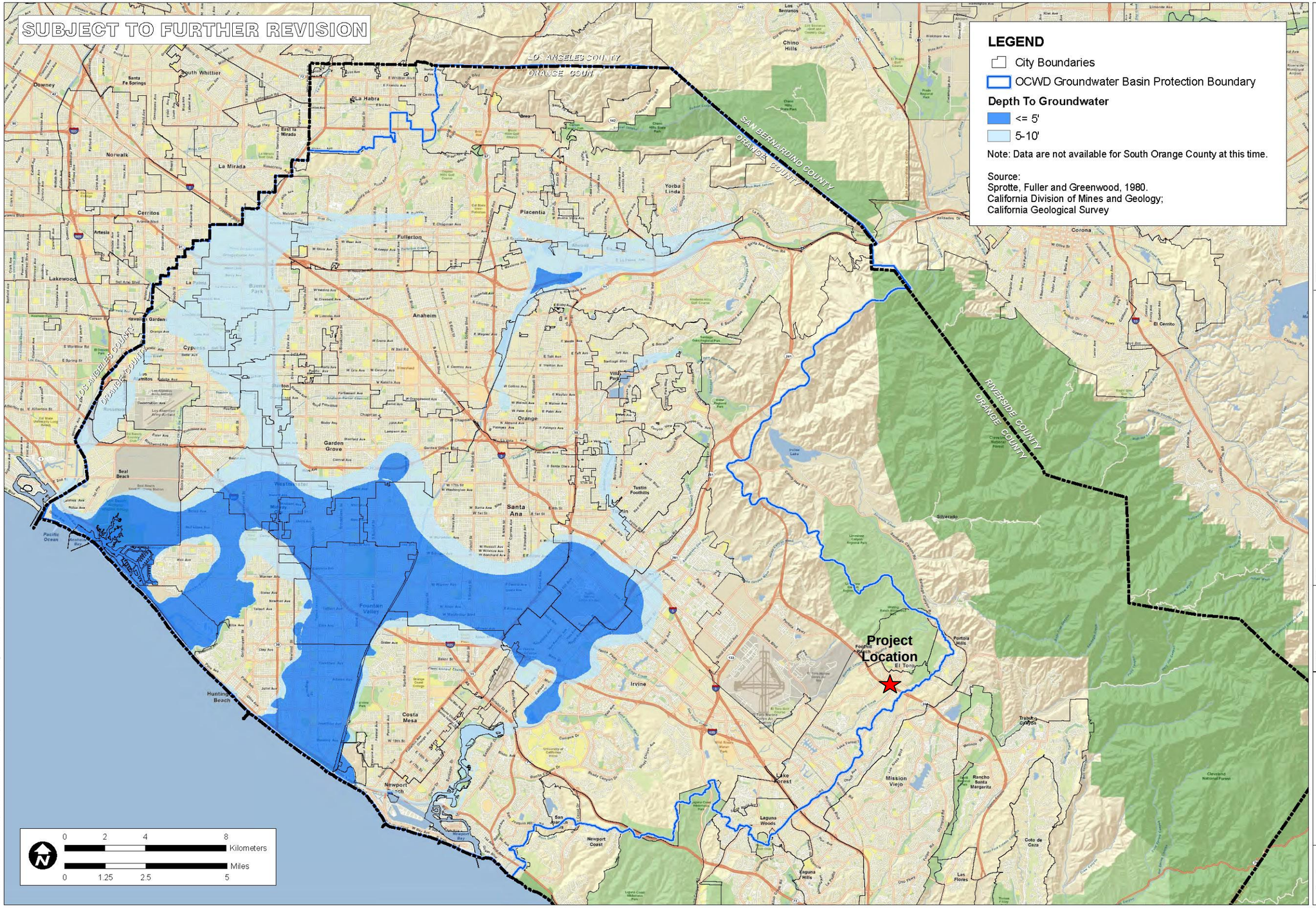


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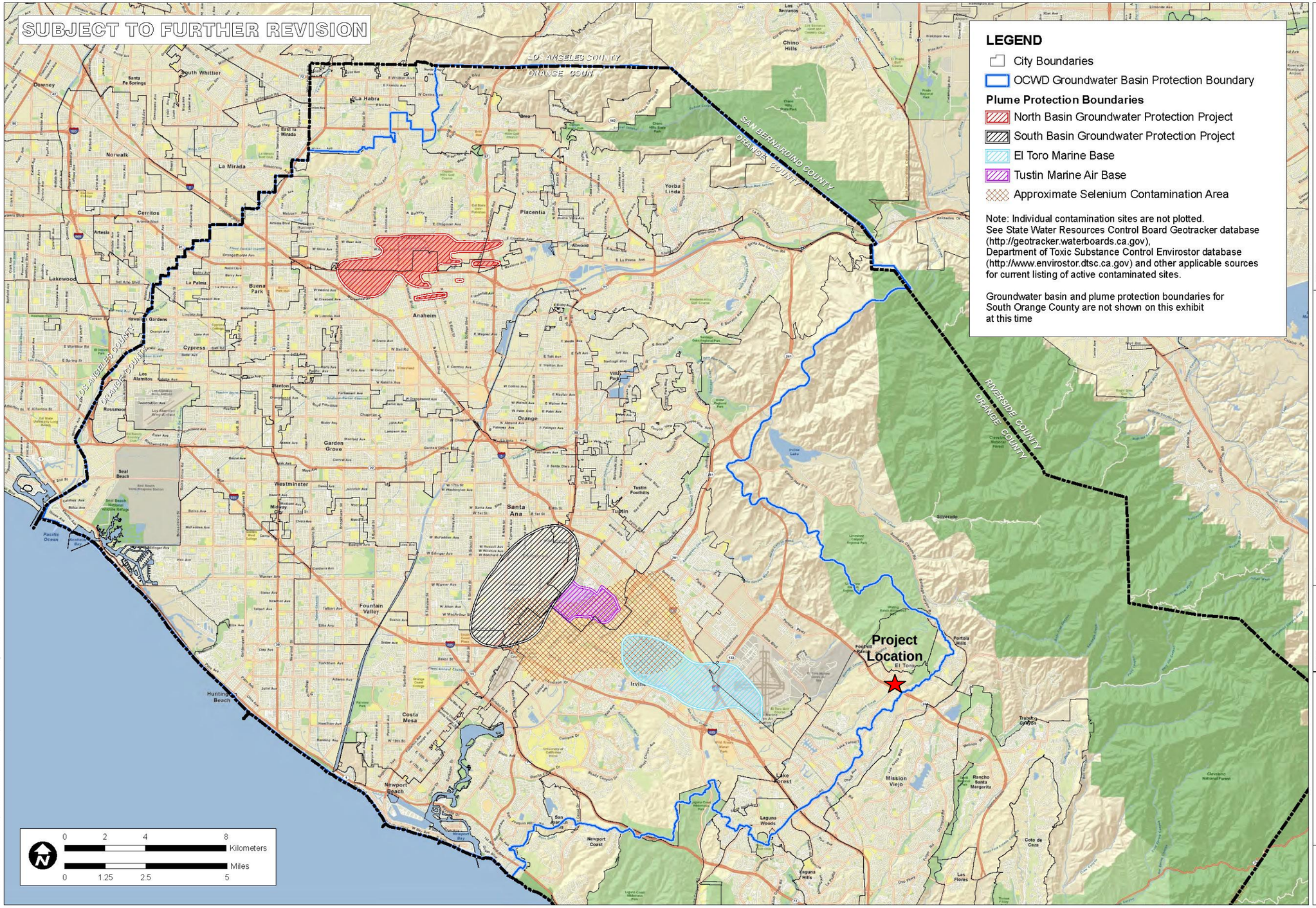
TITLE
NORTH ORANGE COUNTY
MAPPED SHALLOW GROUNDWATER

JOB
ORANGE COUNTY
INFILTRATION STUDY
ORANGE CO. CA

| | |
|---|---|
| SCALE | 1" = 1.25 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 02/09/11 |
| JOB NO. | 9526-E |

PACE Advanced Water Engineering

FIGURE
XVI-2e




P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasibility_20110215\9526E_FigureXVI-2f_NorthOCGroundwaterProtectionAreasStreetMap_20110215.mxd

TITLE

NORTH ORANGE COUNTY GROUNDWATER PROTECTION AREAS

JOB

ORANGE COUNTY INFILTRATION STUDY

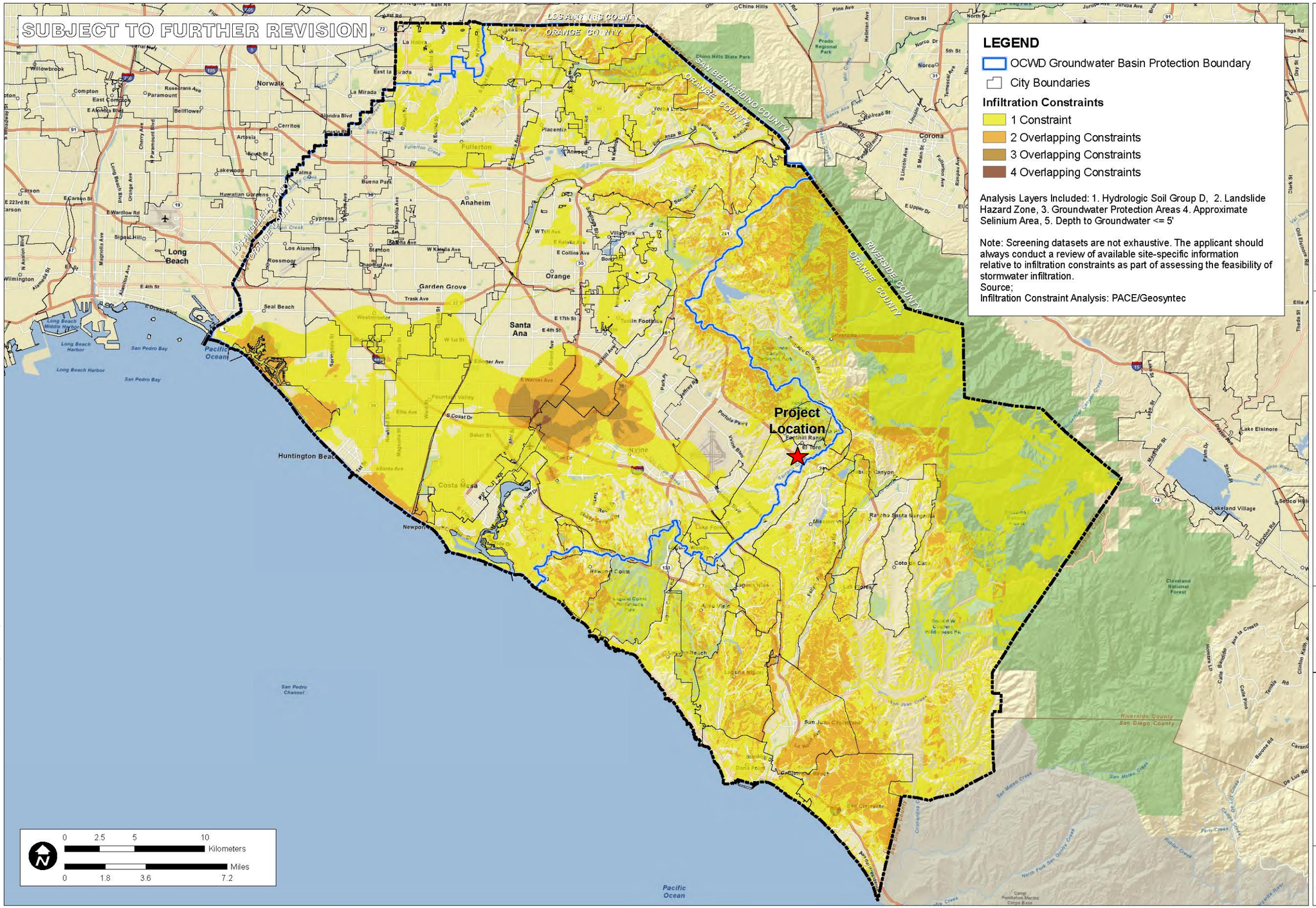
ORANGE CO. CA

| | |
|---|---|
| SCALE | 1" = 1.25 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 04/22/10 |
| JOB NO. | 9526-E |

PACE Advanced Water Engineering

FIGURE

XVI-2f




TITLE

INFILTRATION ANALYSIS
OVERLAPPING CONSTRAINT
LOCATIONS

JOB

ORANGE COUNTY
INFILTRATION STUDY

ORANGE CO. CA

| | |
|---|---|
| SCALE | 1" = 1.8 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 04/22/10 |
| JOB NO. | 9526-E |

PACE
Advanced Water Engineering

FIGURE

XVI-2g

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# Attachment D

# Educational Material

# The Pollution Solution

Several residential activities can result in water pollution. Among these activities are car washing and hosing off driveways and sidewalks. Both activities can waste water and result in excess runoff. Water conservation methods described in this pamphlet can prevent considerable amounts of runoff and conserve water. By taking your car to a commercial car wash and by sweeping driveways and sidewalks, you can further prevent the transport of pollutants to Orange County waterways. Here are some of the common pollutants for which you can be part of the solution:

## 1 Pesticides and Fertilizer

- **Pollution:** The same pesticides that are designed to be toxic to pests can have an equally lethal impact on our marine life. The same fertilizer that promotes plant growth in lawns and gardens can also create nuisance algae blooms, which remove oxygen from the water and clog waterways when it decomposes.
- **Solution:** Never use pesticides or fertilizer within 48 hours of an anticipated rainstorm. Use only as much as is directed on the label and keep it off driveways and sidewalks.

## 2 Dirt and Sediment

- **Pollution:** Dirt or sediment can impede the flow of the stormwater and negatively impact stream habitat as it travels through waterways and deposits downstream. Pollutants can attach to sediment, which can then be transported through our waterways.
- **Solution:** Protect dirt stockpiles by covering them with tarps or secure plastic sheets to prevent wind or rain from allowing dirt or sediment to enter the storm drain system.

## 3 Metals

- **Pollution:** Metals and other toxins present in car wash water can harm important plankton, which forms the base of the aquatic food chain.
- **Solution:** Take your car to a commercial car wash where the wash water is captured and treated at a local wastewater treatment plant.

***DID YOU KNOW?***

*Did you know that most of the pollution found in our waterways is not from a single source, but from a "non-point" source meaning the accumulation of pollution from residents and businesses throughout the community*

## 4 Pet Waste

- **Pollution:** Pet waste carries bacteria through our watersheds and eventually will be washed out to the ocean. This can pose a health risk to swimmers and surfers.
- **Solution:** Pick up after your pets!

## 5 Trash and Debris

- **Pollution:** Trash and debris can enter waterways by wind, littering and careless maintenance of trash receptacles. Street sweeping collects some of this trash; however, much of what isn't captured ends up in our storm drain system where it flows untreated out to the ocean.
- **Solution:** Don't litter and make sure trash containers are properly covered. It is far more expensive to clean up the litter and trash that ends up in our waterways than it is to prevent it in the first place. Come out to one of Orange County's many locations for Coastal and Inner-Coastal Cleanup Day, which is held in September.

## 6 Motor Oil / Vehicle Fluids

- **Pollution:** Oil and petroleum products from our vehicles are toxic to people, wildlife and plants.
- **Solution:** Fix any leaks from your vehicle and keep the maintenance up on your car. Use absorbent material such as cat litter on oil spills, then sweep it up and dispose of it in the trash. Recycle used motor oil at a local Household Hazardous Waste Collection Center.

## A TEAM EFFORT

The Orange County Stormwater Program has teamed with the Municipal Water District of Orange County (MWDOC) and the University of California Cooperative Extension Program (UCCE) to develop this pamphlet.

Low Impact Development (LID) and sustainable water use prevents water pollution and conserves water for drinking and reuse. Reducing your water use and the amount of water flowing from your home protects the environment and saves you money.

## Thank you for making water protection a priority!

For more information, please visit
www.ocwatersheds.com/publiced/

www.mwdoc.com

www.uccemg.com

To report a spill, call the Orange County 24-Hour Water Pollution Prevention Reporting Hotline at 1-877-89-SPILL \ (1-877-897-7455)

**Special Thanks to**
The City of Los Angeles Stormwater Program for the use of its artwork

The Metropolitan Water District of Southern California for the use of the California-Friendly Plant and Native Habitat photos

# Homeowners Guide for Sustainable Water Use

**Low Impact Development, Water Conservation & Pollution Prevention**

The Ocean Begins at Your Front Door

# RUNOFF, RAINWATER AND REUSE

### Where Does Water Runoff Go?

Stormwater, or water from rainfall events, and runoff from outdoor water use such as sprinklers and hoses flows from homes directly into catch basins and the storm drain system. After entering the storm drain, the water flows untreated into streams, rivers, bays and ultimately the Pacific Ocean. Runoff can come from lawns, gardens, driveways, sidewalks and roofs. As it flows over hard, impervious surfaces, it picks up pollutants. Some pollutants carried by the water runoff include trash, pet waste, pesticides, fertilizer, motor oil and more.

### Water Conservation

Pollution not only impairs the water quality for habitat and recreation, it can also reduce the water available for reuse. Runoff allowed to soak into the ground is cleaned as it percolates through the soil, replenishing depleted groundwater supplies. Groundwater provides at least 50% of the total water for drinking and other indoor household activities in north and central Orange County. When land is covered with roads, parking lots, homes, etc., there is less land to take in the water and more hard surfaces over which the water can flow.

In Orange County, 60-70% of water used by residents and businesses goes to irrigation and other outdoor uses. Reusing rainwater to irrigate our lawn not only reduces the impact of water pollution from runoff, but it also is a great way to conserve our precious water resources and replenish our groundwater basin.

### What is Low Impact Development (LID)?

Low Impact Development (LID) is a method of development that seeks to maintain the natural hydrologic character of an area. LID provides a more sustainable and pollution-preventative approach to water management.

New water quality regulations require implementation of LID in larger new developments and encourage implementation of LID and other sustainable practices in existing residential areas. Implementing modifications to your lawn or garden can reduce pollution in our environment, conserve water and reduce your water bill.

Permeable pavement allows water runoff to infiltrate through the soil and prevents most pollutants from reaching the storm drain system.

## OPTIONS FOR RAINWATER HARVESTING AND REUSE

Rainwater harvesting is a great way to save money, prevent pollution and reduce potable water use. To harvest your rainwater, simply redirect the runoff from roofs and downspouts to rain barrels. Rain gardens are another option; these reduce runoff as well as encourage infiltration.

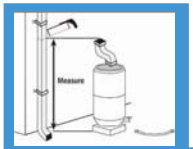
### Downspout Disconnection/Redirection

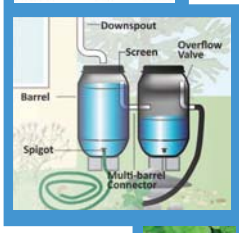
Disconnecting downspouts from pipes running to the gutter prevents runoff from transporting pollutants to the storm drain. Once disconnected, downspouts can be redirected to rain gardens or other vegetated areas, or be connected to a rain barrel.

### Rain Barrels

Rain barrels capture rainwater flow from roofs for reuse in landscape irrigation. Capacity of rain barrels needed for your home will depend on the amount of roof area and rainfall received. When purchasing your rain barrel, make sure it includes a screen, a spigot to siphon water for use, an overflow tube to allow for excess water to run out and a connector if you wish to connect multiple barrels to add capacity of water storage.

Mosquito growth prevention is very important when installing a rain barrel. The best way to prevent mosquito breeding is to eliminate entry points by ensuring all openings are sealed tightly. If these methods are unsuccessful, products are available to kill mosquito larvae, but that are harmless to animals and humans. Regular application of these products is essential. Please visit the Orange County Vector Control website for more information at www.ocvcd.org/mosquitoes3.php.




### Rain Gardens

Rain gardens allow runoff to be directed from your roof downspout into a landscaped area. Vegetation and rocks in the garden will slow the flow of water to allow for infiltration into the soil. Plants and soil particles will absorb pollutants from the roof runoff. By utilizing a native plant palate, rain gardens can be maintained all year with minimal additional irrigation. These plants are adapted to the semi-arid climate of Southern California, require less water and can reduce your water bill.

Before modifying your yard to install a rain garden, please consult your local building and/or planning departments to ensure your garden plan follows pertinent building codes and ordinances. Besides codes and ordinances, some home owner associations also have guidelines for yard modifications. If your property is in hill areas or includes engineered slopes, please seek professional advice before proceeding with changes.

For information on how to disconnect a downspout or to install and maintain a rain barrel or rain garden at your home, please see the Los Angeles Rainwater Harvesting Program, A Homeowner's "How-To" Guide, November 2009 at www.larainwaterharvesting.org/

## OTHER WATER CONSERVATION AND POLLUTION PREVENTION TECHNIQUES

### Native Vegetation and Maintenance

"California Friendly" plants or native vegetation can significantly reduce water use. These plants often require far less fertilizers and pesticides, which are two significant pollutants found in Orange County waterways. Replacing water "thirsty" plants and grass types with water efficient natives is a great way to save water and reduce the need for potentially harmful pesticides and fertilizer.

Please see the California Friendly Garden Guide produced by the Metropolitan Water District of Southern California and associated Southern California Water Agencies for a catalog of California friendly plants and other garden resources at www.bewaterwise.com/Gardensoft.

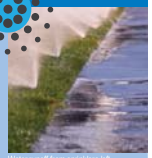
### Weed Free Yards

Weeds are water thieves. They often reproduce quickly and rob your yard of both water and nutrients. Weed your yard by hand if possible. If you use herbicides to control the weeds, use only the amount recommended on the label and never use it if rain is forecast within the next 48 hours.

### Soil Amendments

Soil amendments such as green waste (e.g. grass clippings, compost, etc.) can be a significant source of nutrients and can help keep the soil near the roots of plants moist. However, they can cause algal booms if they get into our waterways, which reduces the amount of oxygen in the water and impacts most aquatic organisms. It is important to apply soil amendments more than 48 hours prior to predicted rainfall.

## IRRIGATE EFFICIENTLY



Water runoff from sprinklers left on too long will carry pollutants into our waterways.

### Smart Irrigation Controllers

Smart Irrigation Controllers have internal clocks as well as sensors that will turn off the sprinklers in response to environmental changes. If it is raining, too windy or too cold, the smart irrigation control sprinklers will automatically shut off.

Check with your local water agency for available rebates on irrigation controllers and smart timers.

- Aim your sprinklers at your lawn, not the sidewalk – By simply adjusting the direction of your sprinklers you can save water, prevent water pollution from runoff, keep your lawn healthy and save money.
- **Set a timer for your sprinklers** – lawns absorb the water they need to stay healthy within a few minutes of turning on the sprinklers. Time your sprinklers; when water begins running off your lawn, you can turn them off. Your timer can be set to water your lawn for this duration every time.
- **Water at Sunrise** – Watering early in the morning will reduce water loss due to evaporation. Additionally, winds tend to die down in the early morning so the water will get to the lawn as intended.
- **Water by hand** – Instead of using sprinklers, consider watering your yard by hand. Hand-watering ensures that all plants get the proper amount of water and you will prevent any water runoff, which wastes water and carries pollutants into our waterways.
- **Fix leaks** - Nationwide, households waste one trillion gallons of water a year to leaks – that is enough water to serve the entire state of Texas for a year. If your garden hose is leaking, replace the nylon or rubber hose washer and ensure a tight connection. Fix broken sprinklers immediately.

ENVIRONMENTAL
# CHALLENGE

## YOUR SCORE

**0 POINTS:**
**SPOTLESS**
*Congratulations, your family, friends and neighbors are doing a great job keeping your environment pollutant-free.*

**5-50 POINTS:**
**SPRINKLING OF POLLUTANTS**
*Your neighbors/schoolmates are working hard to keep your environment pollutant-free. Keep up the good work.*

**55-100 POINTS:**
**SEVERAL POLLUTANTS**
*Your environment has too many pollutants. Help keep your environment pollutant free by doing your part.*

**105-150 POINTS:**
**SCORES OF POLLUTANTS**
*With so many pollutants in your environment, consider teaming up with a friend or family member to educate your community about the simple ways they can keep your environment pollutant free.*

**155+ POINTS:**
**SUBMERGED IN POLLUTANTS**
*Your environment has a significant amount of pollutants that may enter the storm drain and flow directly to the ocean. Consider working with adults in your area to organize a school/ neighborhood clean-up event.*

ENVIRONMENTAL
## CHALLENGE

Are you able to spot real pollutants? Search your yard, neighborhood or schoolyard for the following pollutants. Each item has a point value. Once your search is completed, add up your points and find out how polluted your environment is.

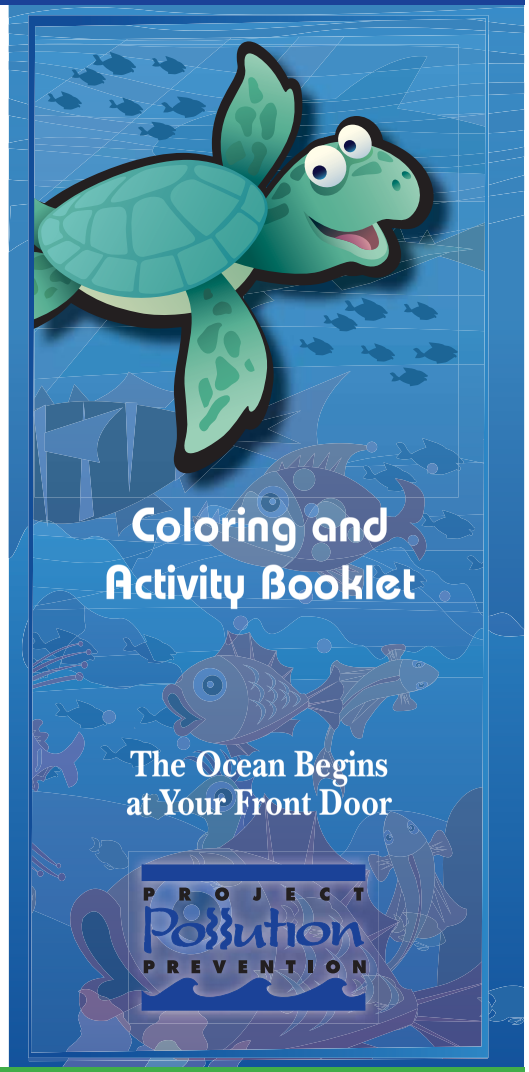
| | |
|---|---|
| Animal waste | 10 points |
| Bag | 10 points |
| Candy wrapper | 10 points |
| Cardboard | 15 points |
| Cigarette | 5 points |
| Cut grass | 10 points |
| Dirt on the street | 15 points |
| Fallen leaves | 5 points |
| Fast food wrapper | 10 points |
| Glass | 20 points |
| Metal | 15 points |
| Newspaper | 10 points |
| Oil | 15 points |
| Paper | 5 points |
| Plastic bottle | 10 points |
| Soapsuds | 20 points |
| Soda can | 5 points |
| Water in the gutter | 10 points |

## YOU CAN HELP KEEP YOUR ENVIRONMENT POLLUTANT FREE BY:

- Not Littering
- Participate in a clean-up event.
- Recycling
- Picking up after your pet
- Do not overwater your lawn.
- Sweeping up trash, leaves and cut grass from your driveway, sidewalk or patio and putting it in the trash.
- Soaking up outdoor spills with towels or cat litter rather than rinsing them with water.
- Reminding your parents to check their cars for leaks.
- Never putting anything into the storm drain. Storm drains are only for rainwater.
- Teaching others how to protect the environment.

**To learn more about protecting your environment from pollution visit www.ocwatersheds.com.**
**Pollution Prevention Hotline**
**1-877-89-SPILL / 1-877-897-7455**

Help Prevent Ocean Pollution



# Environmental Encyclopedia

**STORMWATER:**
Water from nature such as rain or snow melt.

**URBAN RUN-OFF:**
Water from a hose or sprinkler that flows into the street.

**POLLUTANT:**
Materials such as litter, pet waste, motor oil and yard clippings that harm the environment.

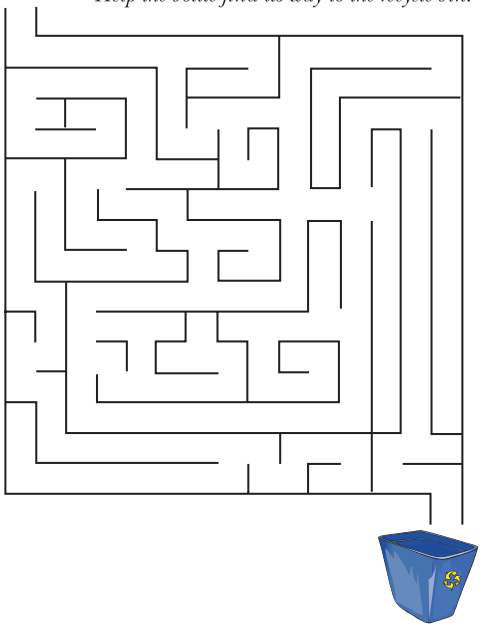
**STORM DRAIN:**
An opening in the street where water from rain or urban run-off flows. This water picks up pollutants on the way to the storm drain. Once in the storm drain, the water and pollutants flow untreated to the ocean.

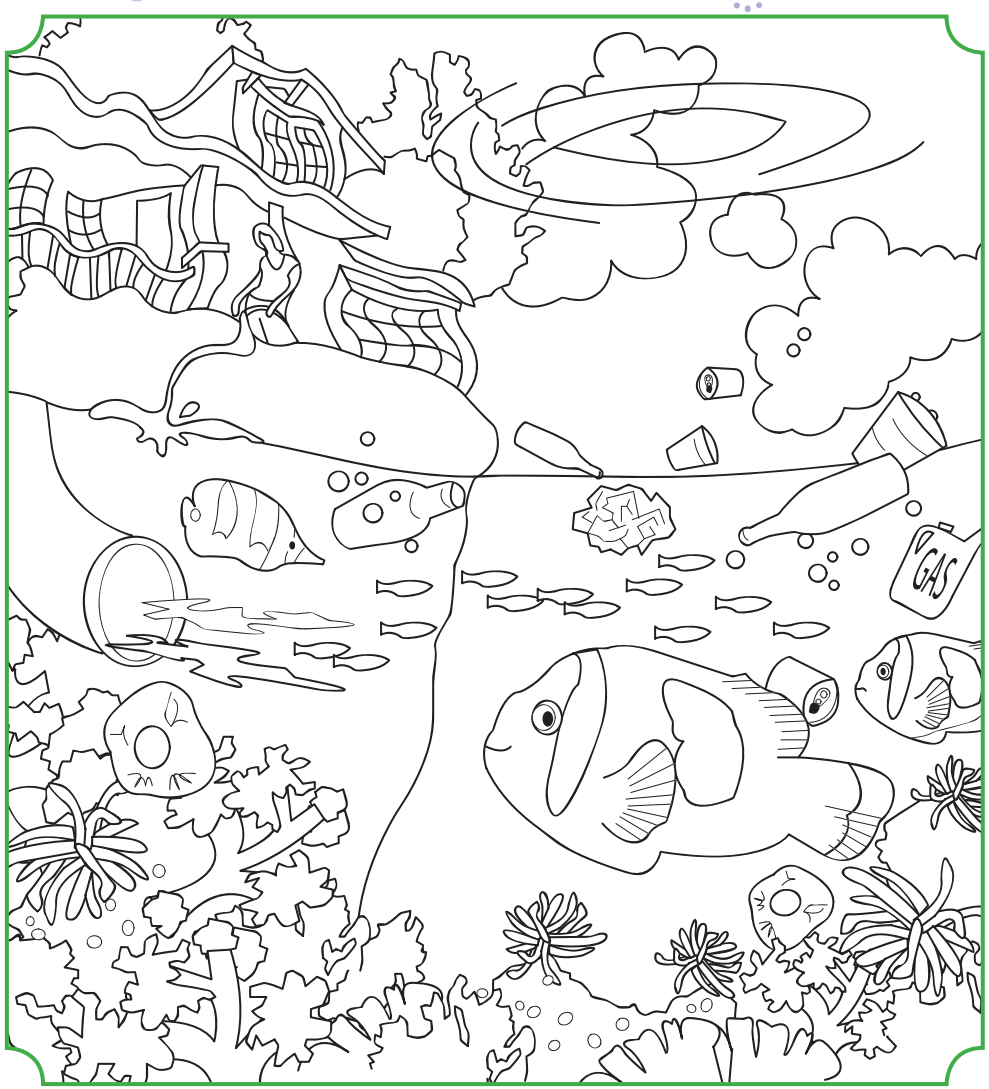
## WHAT DOES NOT BELONG IN THE OCEAN?

*When we throw trash on the ground, it can end up in the ocean. Put an 'X' on the things that DO NOT belong in the ocean and color the things that DO belong in the ocean.*

## MAZE:

*Help the bottle find its way to the recycle bin!*






*A Fish EyeView of Pollution.*

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as painting can lead to water pollution if you're not careful. Paint must be used, stored and disposed of properly to ensure that it does not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump paint into the ocean, so don't let it enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL** (1-877-897-7455)
or visit
**www.ocwatersheds.com**

To report a spill,
call the
**Orange County 24-Hour Water Pollution Problem Reporting Hotline**
at **1-877-89-SPILL** (1-877-897-7455).

**For emergencies, dial 911.**

The tips contained in this brochure provide useful information to help prevent water pollution while using, storing and disposing of paint. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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Help Prevent Ocean Pollution:

# Tips for Projects Using Paint

# Tips for Projects Using Paint

Paint can cause significant damage to our environment. Whether you hire a contractor or do it yourself, it is important to follow these simple tips when purchasing, using, cleaning, storing and disposing of paint.

## *Purchasing Paint*

- Measure the room or object to be painted, then buy only the amount needed.
- Whenever possible, use water-based paint since it usually does not require hazardous solvents such as paint thinner for cleanup.

## *Painting*

- Use only one brush or roller per color of paint to reduce the amount of water needed for cleaning.
- Place open paint containers or trays on a stable surface and in a position that is unlikely to spill.
- Always use a tarp under the area or object being painted to collect paint drips and contain spills.

## *Cleaning*

- Never clean brushes or rinse paint containers in the street, gutter or storm drain.
- For oil-based products, use as much of the paint on the brushes as possible. Clean brushes with thinner. To reuse thinner, pour it through a fine filter (e.g. nylon, metal gauze or filter paper) to remove solids such as leftover traces of paint.
- For water-based products, use as much of the paint on the brushes as possible, then rinse in the sink.
- Collect all paint chips and dust. Chips and dust from marine paints or paints containing lead, mercury or tributyl tin are hazardous waste. Sweep up and dispose of at a Household Hazardous Waste Collection Center (HHWCC).

## *Storing Paint*

- Store paint in a dry location away from the elements.
- Store leftover water-based paint, oil-based paint and solvents separately in original or clearly marked containers.
- Avoid storing paint cans directly on cement floors. The bottom of the can will rust much faster on cement.
- Place the lid on firmly and store the paint can upside-down to prevent air from entering. This will keep the paint usable longer. Oil-based paint is usable for up to 15 years. Water-based paint remains usable for up to 10 years.

## *Alternatives to Disposal*

- Use excess paint to apply another coat, for touch-ups, or to paint a closet, garage, basement or attic.
- Give extra paint to friends or family. Extra paint can also be donated to a local theatre group, low-income housing program or school.
- Take extra paint to an exchange program such as the **"Stop & Swap"** that allows you to drop off or pick up partially used home care products free of charge. **"Stop & Swap"** programs are available at most HHWCCs.
- For HHWCC locations and hours, call **(714) 834-6752** or visit **www.oclandfills.com**.

## *Disposing of Paint*

- Never put wet paint in the trash.

### *For water-based paint:*

- If possible, brush the leftover paint on cardboard or newspaper. Otherwise, allow the paint to dry in the can with the lid off in a well-ventilated area protected from the elements, children and pets. Stirring the paint every few days will speed up the drying.
- Large quantities of extra paint should be taken to a HHWCC.
- Once dried, paint and painted surfaces may be disposed of in the trash. When setting a dried paint can out for trash collection, leave the lid off so the collector will see that the paint has dried.

### *For oil-based paint:*

- Oil-based paint is a household hazardous waste. All leftover paint should be taken to a HHWCC.

### *Aerosol paint:*

- Dispose of aerosol paint cans at a HHWCC.

## *Spills*

- Never hose down pavement or other impermeable surfaces where paint has spilled.
- Clean up spills immediately by using an absorbent material such as cat litter. Cat litter used to clean water-based paint spills can be disposed of in the trash. When cleaning oil-based paint spills with cat litter, it must be taken to a HHWCC.
- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at **(714) 567-6363** or visit **www.ocwatersheds.com** to fill out an incident reporting form.

PROJECT Pollution PREVENTION

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL** (1-877-897-7455)
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To report a spill,
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**For emergencies, dial 911.**

The tips contained in this brochure provide useful information to help prevent water pollution. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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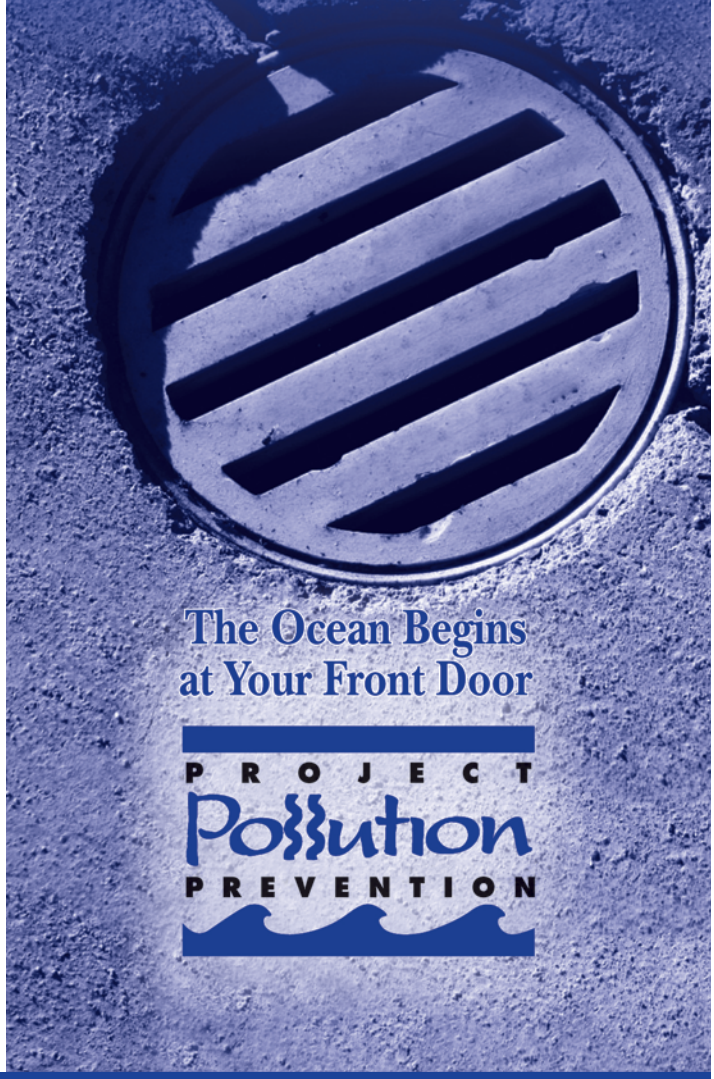
Help Prevent Ocean Pollution:

# Tips for Residential Pool, Landscape and Hardscape Drains



The Ocean Begins at Your Front Door

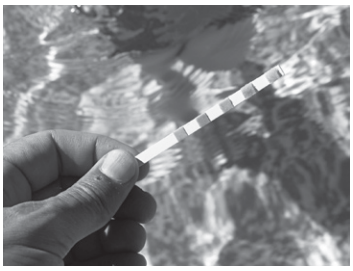
PROJECT Pollution PREVENTION

# Tips for Residential Pool, Landscape and Hardscape Drains

## *Pool Maintenance*

All pool water discharged to the curb, gutter or permitted pool drain from your property must meet the following water quality criteria:

- The residual chlorine does not exceed 0.1 mg/L (parts per million).
- The pH is between 6.5 and 8.5.
- The water is free of any unusual coloration.
- There is no discharge of filter media or acid cleaning wastes.



Some cities have ordinances that do not allow pool water to be discharged to the storm drain. Check with your city.

## *Landscape and Hardscape Drains*

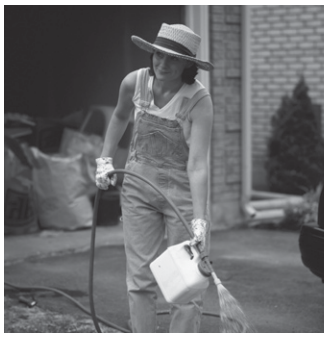
The following recommendations will help reduce or prevent pollutants from your landscape and hardscape drains from entering the street, gutter or storm drain. Unlike water that enters the sewer (from sinks and toilets), water that enters a landscape or hardscape drain is not treated before entering our creeks, rivers, bays and ocean.

### *Household Activities*

- Do not rinse spills of materials or chemicals to any drain.
- Use dry cleanup methods such as applying cat litter or another absorbent material, then sweep it up and dispose of it in the trash. If the material is hazardous, dispose of it at a Household Hazardous Waste Collection Center (HHWCC). For locations, call **(714) 834-6752** or visit **www.oclandfills.com**.
- Do not hose down your driveways, sidewalks or patios to your landscape or hardscape drain. Sweep up debris and dispose of it in the trash.
- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash.
- Do not store items such as cleaners, batteries, automotive fluids, paint products, TVs, or computer monitors uncovered outdoors. Take them to a HHWCC for disposal.

### *Yard Maintenance*

- Do not overwater. Water by hand or set automated irrigation systems to reflect seasonal water needs.
- Follow directions on pesticides and fertilizers (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Cultivate your garden often to control weeds and reduce the need to use chemicals.



### *Vehicle Maintenance*

- Never pour oil or antifreeze down your landscape or hardscape drain. Recycle these substances at a service station, a waste collection center or used oil recycling center. For locations, contact the Used Oil Program at **1-800-CLEANUP** or visit **www.CLEANUP.org**.
- Whenever possible, take your vehicle to a commercial car wash.
- If you do wash your vehicle at home, do not allow the washwater to go down your landscape or hardscape drain. Instead, dispose of it in the sanitary sewer (a sink or toilet) or onto an absorbent surface such as your lawn.
- Use a spray nozzle that will shut off the water when not in use.

Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Swimming pools and spas are common in Orange County, but they must be maintained properly to guarantee that chemicals aren't allowed to enter the street, where they can flow into the storm drains and then into the waterways. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump pool chemicals into the ocean, so don't let it enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL** (1-877-897-7455)
or visit
**www.ocwatersheds.com**

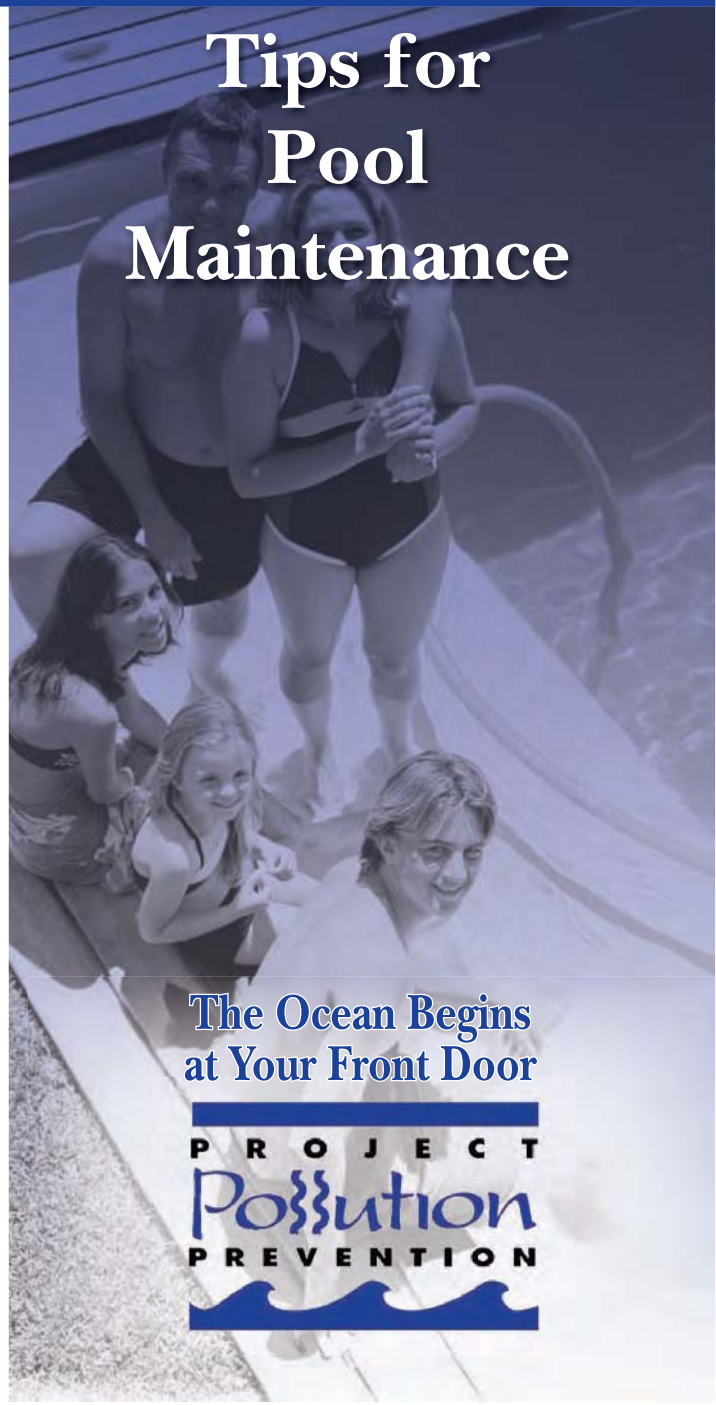
To report a spill,
call the
**Orange County 24-Hour**
**Water Pollution Reporting Hotline**
**1-877-89-SPILL** (1-877-897-7455).

**For emergencies, dial 911.**

The tips contained in this brochure provide useful information to help prevent water pollution while maintaining your pool. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

Help Prevent Ocean Pollution:

# Tips for Pool Maintenance



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

# Tips for Pool Maintenance

Many pools are plumbed to allow the pool to drain directly to the sanitary sewer. If yours is not, follow these instructions for disposing of pool and spa water.

## *Acceptable and Preferred Method of Disposal*

When you cannot dispose of pool water in the sanitary sewer, the release of dechlorinated swimming pool water is allowed if all of these tips are followed:

- The residual chlorine does not exceed 0.1 mg/l (parts per million).
- The pH is between 6.5 and 8.5.
- The water is free of any unusual coloration, dirt or algae.
- There is no discharge of filter media.
- There is no discharge of acid cleaning wastes.
- Some cities may have ordinances that do not allow pool water to be disposed into a storm drain. Check with your city.

## *How to Know if You're Following the Standards*

You can find out how much chlorine is in your water by using a pool testing kit. Excess chlorine can be removed by discontinuing the use of chlorine for a few days prior to discharge or by purchasing dechlorinating chemicals from a local pool supply company. Always make sure to follow the instructions that come with any products you use.

## *Doing Your Part*

By complying with these guidelines, you will make a significant contribution toward keeping pollutants out of Orange County's creeks, streams, rivers, bays and the ocean. This helps to protect organisms that are sensitive to pool chemicals, and helps to maintain the health of our environment.

PROJECT Pollution PREVENTION

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Pet waste and pet care products can be washed into the storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never put pet waste or pet care products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL** (1-877-897-7455)
or visit
**www.ocwatersheds.com**

To report a spill,
call the
**Orange County 24-Hour Water Pollution Problem Reporting Hotline**
**1-877-89-SPILL** (1-877-897-7455).

**For emergencies, dial 911.**

The tips contained in this brochure provide useful information to help prevent water pollution while caring for your pet. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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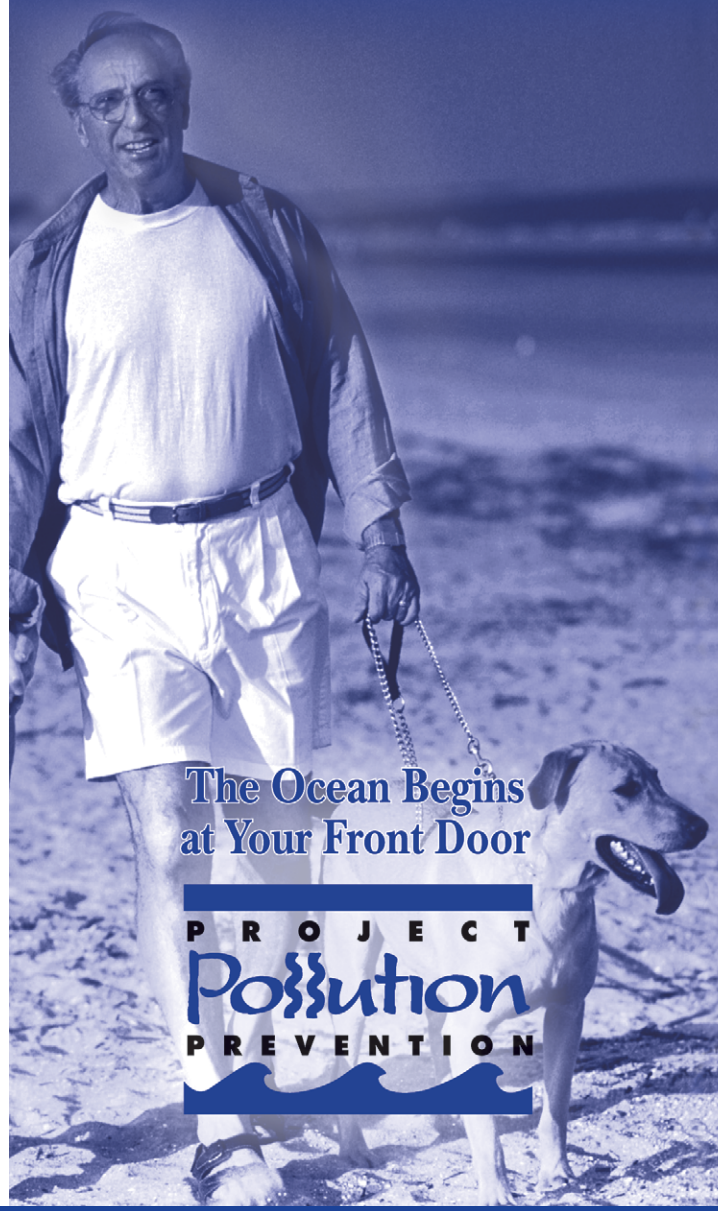
Help Prevent Ocean Pollution:

# Tips for Pet Care



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

# Tips for Pet Care

Never let any pet care products or washwater run off your yard and into the street, gutter or storm drain.

## *Washing Your Pets*

Even biodegradable soaps and shampoos can be harmful to marine life and the environment.

- If possible, bathe your pets indoors using less-toxic shampoos or have your pet professionally groomed. Follow instructions on the products and clean up spills.

- If you bathe your pet outside, wash it on your lawn or another absorbent/ permeable surface to keep the washwater from running into the street, gutter or storm drain.

## *Flea Control*

- Consider using oral or topical flea control products.

- If you use flea control products such as shampoos, sprays or collars, make sure to dispose of any unused products at a Household Hazardous Waste Collection Center. For location information, call **(714) 834-6752**.

## *Why You Should Pick Up After Your Pet*

It's the law! Every city has an ordinance requiring you to pick up after your pet. Besides being a nuisance, pet waste can lead to water pollution, even if you live inland. During rainfall, pet waste left outdoors can wash into storm drains. This waste flows directly into our waterways and the ocean where it can harm human health, marine life and the environment.

As it decomposes, pet waste demands a high level of oxygen from water. This decomposition can contribute to killing marine life by reducing the amount of dissolved oxygen available to them.

Have fun with your pets, but please be a responsible pet owner by taking care of them and the environment.

- Take a bag with you on walks to pick up after your pet.

- Dispose of the waste in the trash or in a toilet.

PROJECT Pollution PREVENTION

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Fertilizers, pesticides and other chemicals that are left on yards or driveways can be blown or washed into storm drains that flow to the ocean. Overwatering lawns can also send materials into storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never pour gardening products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL** (1-877-897-7455)
or visit
**www.ocwatersheds.com**

**UCCE Master Gardener Hotline:**
**(714) 708-1646**

To report a spill,
call the
**Orange County 24-Hour**
**Water Pollution Problem**
**Reporting Hotline**
**1-877-89-SPILL** (1-877-897-7455).

**For emergencies, dial 911.**

The tips contained in this brochure provide useful information to help prevent water pollution while landscaping or gardening. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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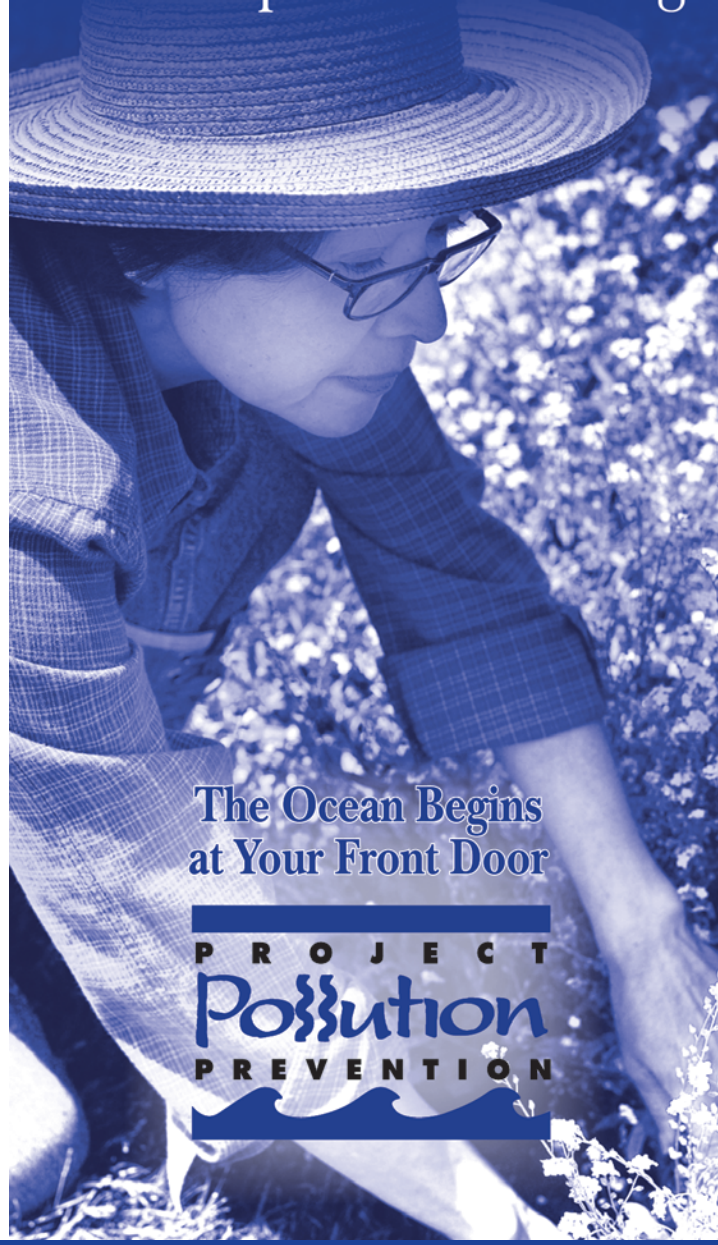
Help Prevent Ocean Pollution:

# Tips for Landscape & Gardening



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

# Tips for Landscape & Gardening

Never allow gardening products or polluted water to enter the street, gutter or storm drain.

## *General Landscaping Tips*

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.

- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.

- Plant native vegetation to reduce the amount of water, fertilizers, and pesticide applied to the landscape.

- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

## *Garden & Lawn Maintenance*

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro spray systems. Periodically inspect and fix leaks and misdirected sprinklers.

- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.

- Use slow-release fertilizers to minimize leaching, and use organic fertilizers.

- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.

- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.

- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.

- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting. For more information, visit **www.ipm.ucdavis.edu**.

- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.

- Take unwanted pesticides to a Household Hazardous Waste Collection Center to be recycled. Locations are provided below.

**Household Hazardous Waste Collection Centers**

| | |
|---|---|
| **Anaheim:** | 1071 N. Blue Gum St. |
| **Huntington Beach:** | 17121 Nichols St. |
| **Irvine:** | 6411 Oak Canyon |
| **San Juan Capistrano:** | 32250 La Pata Ave. |

**For more information, call (714) 834-6752 or visit www.oclandfills.com**

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Home improvement projects and work sites must be maintained to ensure that building materials do not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump building materials into the ocean, so don't let them enter the storm drains. Follow these tips to help prevent water pollution.

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL** (1-877-897-7455)
or visit
**www.ocwatersheds.com**

To report a spill,
call the
**Orange County 24-Hour Water Pollution Problem Reporting Hotline**
at **1-877-89-SPILL** (1-877-897-7455).

**For emergencies, dial 911.**

The tips contained in this brochure provide useful information to help prevent water pollution while performing home improvement projects. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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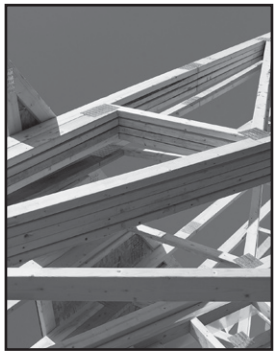
Help Prevent Ocean Pollution:

# Tips for Home Improvement Projects

# Tips for Home Improvement Projects

Home improvement projects can cause significant damage to the environment. Whether you hire a contractor or work on the house yourself, it is important to follow these simple tips while renovating, remodeling or improving your home:

## General Construction



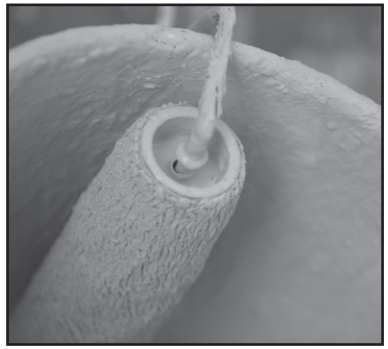
- Schedule projects for dry weather.
- Keep all construction debris away from the street, gutter and storm drain.
- Store materials under cover with temporary roofs or plastic sheets to eliminate or reduce the possibility that rainfall, runoff or wind will carry materials from the project site to the street, storm drain or adjacent properties.

## Building Materials

- Never hose materials into a street, gutter or storm drain.
- Exposed piles of construction material should not be stored on the street or sidewalk.
- Minimize waste by ordering only the amount of materials needed to complete the job.
- Do not mix more fresh concrete than is needed for each project.
- Wash concrete mixers and equipment in a designated washout area where the water can flow into a containment area or onto dirt.
- Dispose of small amounts of dry excess materials in the trash. Powdery waste, such as dry concrete, must be properly contained within a box or bag prior to disposal. Call your local trash hauler for weight and size limits.

## Paint

- Measure the room or object to be painted, then buy only the amount needed.
- Place the lid on firmly and store the paint can upside-down in a dry location away from the elements.
- Tools such as brushes, buckets and rags should never be washed where excess water can drain into the street, gutter or storm drain. All tools should be rinsed in a sink connected to the sanitary sewer.
- When disposing of paint, never put wet paint in the trash.
- Dispose of water-based paint by removing the lid and letting it dry in the can. Large amounts must be taken to a Household Hazardous Waste Collection Center (HHWCC).



- Oil-based paint is a household hazardous waste. All leftover paint should be taken to a HHWCC.
- For HHWCC locations and hours, call **(714) 834-6752** or visit **www.oclandfills.com**.

## Erosion Control

- Schedule grading and excavation projects for dry weather.
- When temporarily removing soil, pile it in a contained, covered area where it cannot spill into the street, or obtain the required temporary encroachment or street closure permit and follow the conditions instructed by the permit.
- When permanently removing large quantities of soil, a disposal location must be found prior to excavation. Numerous businesses are available to handle disposal needs. For disposal options, visit **www.ciwmb.ca.gov/SWIS**.
- Prevent erosion by planting fast-growing annual and perennial grasses. They will shield and bind the soil.

## Recycle

- Use a construction and demolition recycling company to recycle lumber, paper, cardboard, metals, masonry (bricks, concrete, etc.), carpet, plastic, pipes (plastic, metal and clay), drywall, rocks, dirt and green waste.
- For a listing of construction and demolition recycling locations in your area, visit **www.ciwmb.ca.gov/recycle.**

## Spills

- Clean up spills immediately by using an absorbent material such as cat litter, then sweep it up and dispose of it in the trash.
- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at **(714) 567-6363** or visit **www.ocwatersheds.com** to fill out an incident reporting form.

PROJECT Pollution PREVENTION

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as pest control can lead to water pollution if you're not careful. Pesticide treatments must be planned and applied properly to ensure that pesticides do not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump pesticides into the ocean, so don't let it enter the storm drains. Pesticides can cause significant damage to our environment if used improperly. If you are thinking of using a pesticide to control a pest, there are some important things to consider.

For more information,
please call
University of California Cooperative
Extension Master Gardeners at
(714) 708-1646
or visit these Web sites:
www.uccemg.org
www.ipm.ucdavis.edu

For instructions on collecting a specimen sample visit the Orange County Agriculture Commissioner's website at:
http://www.ocagcomm.com/ser_lab.asp

To report a spill, call the
**Orange County 24-Hour Water Pollution Problem Reporting Hotline at 1-877-89-SPILL (1-877-897-7455).**

**For emergencies, dial 911.**

Information From:
Cheryl Wilen, Area IPM Advisor; Darren Haver, Watershed Management Advisor; Mary Louise Flint, IPM Education and Publication Director; Pamela M. Geisel, Environmental Horticulture Advisor; Carolyn L. Unruh, University of California Cooperative Extension staff writer. Photos courtesy of the UC Statewide IPM Program and Darren Haver.

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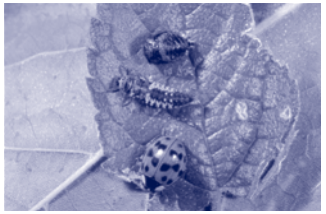
Help Prevent Ocean Pollution:

# Responsible Pest Control

# Tips for Pest Control

## *Key Steps to Follow:*

***Step 1:*** **Correctly identify the pest (insect, weed, rodent, or disease) and verify that it is actually causing the problem.**



Three life stages of the common lady beetle, a beneficial insect.

This is important because beneficial insects are often mistaken for pests and sprayed with pesticides needlessly.

Consult with a Certified Nursery Professional at a local nursery or garden center or send a sample of the pest to the Orange County Agricultural Commissioner's Office.

Determine if the pest is still present – even though you see damage, the pest may have left.

***Step 2:*** **Determine how many pests are present and causing damage.**

Small pest populations may be controlled more safely using non-pesticide techniques. These include removing food sources, washing off leaves with a strong stream of water, blocking entry into the home using caulking and replacing problem plants with ones less susceptible to pests.

Integrated Pest Management (IPM) usually combines several least toxic pest control methods for long-term prevention and management of pest problems without harming you, your family, or the environment.

UC CE University of California Cooperative Extension

***Step 3:*** **If a pesticide must be used, choose the least toxic chemical.**

Obtain information on the least toxic pesticides that are effective at controlling the target pest from the UC Statewide Integrated Pest Management (IPM) Program's Web site at www.ipm.ucdavis.edu.

Seek out the assistance of a Certified Nursery Professional at a local nursery or garden center when selecting a pesticide. Purchase the smallest amount of pesticide available.

Apply the pesticide to the pest during its most vulnerable life stage. This information can be found on the pesticide label.

***Step 4:*** **Wear appropriate protective clothing.**

Follow pesticide labels regarding specific types of protective equipment you should wear. Protective clothing should always be washed separately from other clothing.

***Step 5:*** **Continuously monitor external conditions when applying pesticides such as weather, irrigation, and the presence of children and animals.**

Never apply pesticides when rain is predicted within the next 48 hours. Also, do not water after applying pesticides unless the directions say it is necessary.

Apply pesticides when the air is still; breezy conditions may cause the spray or dust to drift away from your targeted area.

In case of an emergency call 911 and/or the regional poison control number at (714) 634-5988 or (800) 544-4404 (CA only).

For general questions you may also visit www.calpoison.org.

***Step 6:*** **In the event of accidental spills, sweep up or use an absorbent agent to remove any excess pesticides. Avoid the use of water.**

Be prepared. Have a broom, dust pan, or dry absorbent material, such as cat litter, newspapers or paper towels, ready to assist in cleaning up spills.

Contain and clean up the spill right away. Place contaminated materials in a doubled plastic bag. All materials used to clean up the spill should be properly disposed of according to your local Household Hazardous Waste Disposal site.

***Step 7:*** **Properly store and dispose of unused pesticides.**

Purchase Ready-To-Use (RTU) products to avoid storing large concentrated quantities of pesticides.

Store unused chemicals in a locked cabinet.

Unused pesticide chemicals may be disposed of at a Household Hazardous Waste Collection Center.

Empty pesticide containers should be triple rinsed prior to disposing of them in the trash.

**Household Hazardous Waste Collection Center**
**(714) 834-6752**
**www.oclandfills.com**

PROJECT Pollution PREVENTION

***Did you know that just one quart of oil can pollute 250,000 gallons of water?***

A clean ocean and healthy creeks, rivers, bays and beaches are important to Orange County. However, not properly disposing of used oil can lead to water pollution. If you pour or drain oil onto driveways, sidewalks or streets, it can be washed into the storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering the ocean. Help prevent water pollution by taking your used oil to a used oil collection center.

Included in this brochure is a list of locations that will accept up to five gallons of used motor oil at no cost. Many also accept used oil filters. Please contact the facility before delivering your used oil. This listing of companies is for your reference and does not constitute a recommendation or endorsement of the company.

Please note that used oil filters may not be disposed of with regular household trash. They must be taken to a household hazardous waste collection or recycling center in Anaheim, Huntington Beach, Irvine or San Juan Capistrano. For information about these centers, visit www.oclandfills.com.

Please do not mix your oil with other substances!

For more information, please call the Orange County Stormwater Program at 1-877-89-SPILL (1-877-897-7455) or visit www.watersheds.com.

For information about the proper disposal of household hazardous waste, call the Household Waste Hotline at (714) 834-6752 or visit www.oclandfills.com.

RECYCLE USED OIL

For additional information about the nearest oil recycling center, call the Used Oil Program at 1-800-CLEANUP or visit www.cleanup.org.

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Help Prevent Ocean Pollution:

# Recycle at Your Local Used Oil Collection Center

**The Ocean Begins at Your Front Door**

PROJECT Pollution PREVENTION

NORTH COUNTY

# Used Oil Collection Centers

## Anaheim

**All Seasons Tire and Auto Center, Inc.**
817 S Brookhurst St., Anaheim, CA 92804
(714)772-6090( )
CIWMB#: 30-C-03177

**AutoZone #3317**
423 N Anaheim Blvd., Anaheim, CA 92805
(714)776-0787( )
CIWMB#: 30-C-05263

**AutoZone #5226**
2145 W Lincoln Ave., Anaheim, CA 92801
(714)533-6599( )
CIWMB#: 30-C-04604

**Bedard Automotive**
3601 E Miraloma Ave., Anaheim, CA 92806
(714)528-1380( )
CIWMB#: 30-C-02205

**Classic Chevrolet**
1001 Weir Canyon Rd., Anaheim, CA 92807
(714)283-5400( )
CIWMB#: 30-C-05223

**Econo Lube N' Tune #4**
3201 W Lincoln Ave., Anaheim, CA 92801
(714)821-0128( )
CIWMB#: 30-C-01485

**EZ Lube Inc - Savi Ranch #43**
985 N Weir Canyon Rd., Anaheim, CA 92807
(714)556-1312( )
CIWMB#: 30-C-06011

**Firestone Store #71C7**
1200 S Magnolia Ave., Anaheim, CA 92804
(949)598-5520( )
CIWMB#: 30-C-05743

**Great Western Lube Express**
125 N Brookhurst St., Anaheim, CA 92801
(714)254-1300( )
CIWMB#: 30-C-05542

**HR Pro Auto Service Center**
3180 W Lincoln Ave., Anaheim, CA 92801
(714)761-4343( )
CIWMB#: 30-C-05927

**Ira Newman Automotive Services**
1507 N State College Blvd., Anaheim, CA 92806
(714)635-2392( )
CIWMB#: 30-C-01482

**Jiffy Lube #1028**
2400 W Ball Rd., Anaheim, CA 92804
(714)761-5211( )
CIWMB#: 30-C-00870

**Jiffy Lube #1903**
2505 E Lincoln Ave., Anaheim, CA 92806
(714)772-4000( )
CIWMB#: 30-C-05511

**Jiffy Lube #2340**
2181 W Lincoln Ave., Anaheim, CA 92801
(714)533-1000( )
CIWMB#: 30-C-04647

**Kragen Auto Parts #1303**
1088 N State College Blvd., Anaheim, CA 92806
(714)956-7351( )
CIWMB#: 30-C-03438

**Kragen Auto Parts #1399**
2245 W Ball Rd., Anaheim, CA 92804
(714)490-1274( )
CIWMB#: 30-C-04094

**Kragen Auto Parts #1565**
2072 Lincoln Ave., Anaheim, CA 92806
(714)502-6992( )
CIWMB#: 30-C-04078

**Kragen Auto Parts #1582**
3420 W Lincoln Ave., Anaheim, CA 92801
(714)828-7977( )
CIWMB#: 30-C-04103

**Pep Boys #613**
10912 Katella Ave., Anaheim, CA 92804
(714)638-0863( )
CIWMB#: 30-C-01756

**Pep Boys #663**
3030 W Lincoln Anaheim, CA 92801
(714)826-4810( )
CIWMB#: 30-C-03417

**Pep Boys #809**
8205 E Santa Ana Cyn Rd., Anaheim, CA 92808
(714)974-0105( )
CIWMB#: 30-C-03443

**Pick Your Part**
1235 S Beach Blvd., Anaheim, CA 92804
(714)527-1645( )
CIWMB#: 30-C-03744

**PK Auto Performance**
3106 W. Lincoln Ave., Anaheim, CA 92801
(714)826-2141( )
CIWMB#: 30-C-05628

**Quick Change Lube and Oil**
2731 W Lincoln Ave., Anaheim, CA 92801
(714)821-4464( )
CIWMB#: 30-C-04363

**Saturn of Anaheim**
1380 S Auto Center Dr., Anaheim, CA 92806
(714)648-2444( )
CIWMB#: 30-C-06332

**Sun Tech Auto Service**
105 S State College Blvd., Anaheim, CA 92806
(714)956-1389( )
CIWMB#: 30-C-06455

**Vonic Truck Services**
515 S Rose St., Anaheim, CA 92805
(714)533-3333( )
CIWMB#: 30-C-01142

## Anaheim Hills

**Anaheim Hills Car Wash & Lube**
5810 E La Palma Ave., Anaheim Hills, CA 92807
(714)777-6605( )
CIWMB#: 30-C-01387

## Brea

**Firestone Store #27A9**
891 E Imperial Hwy., Brea, CA 92821
(714)529-8404( )
CIWMB#: 30-C-01221

**Oil Can Henry's**
230 N Brea Blvd., Brea, CA 92821
(714)990-1900( )
CIWMB#: 30-C-04273

## Buena Park

**Firestone Store #71F7**
6011 Orangethorpe Buena Park, CA 90620
(714)670-7912( )
CIWMB#: 30-C-01218

**Firestone Store #71T8**
8600 Beach Blvd., Buena Park, CA 90620
(714)827-5300( )
CIWMB#: 30-C-02121

**Kragen Auto Parts #1204**
5303 Beach Blvd., Buena Park, CA 90621
(714)994-1320( )
CIWMB#: 30-C-02623

## Cypress

**AutoZone #5521**
5471 Lincoln Ave., Cypress, CA 90630
(714)995-4644( )
CIWMB#: 30-C-00836

**Big O Tires**
6052 Cerritos Ave., Cypress, CA 90630
(714)826-6334( )
CIWMB#: 30-C-04245

**Econo Lube N' Tune #213**
5497 Cerritos Ave., Cypress, CA 90630
(714)761-0456( )
CIWMB#: 30-C-06240

**Jiffy Lube #851**
4942 Lincoln Ave., Cypress, CA 90630
(626)965-9689( )
CIWMB#: 30-C-06182

**M & N Coastline Auto & Tire Service**
4005 Ball Rd., Cypress, CA 90630
(714)826-1001( )
CIWMB#: 30-C-04387

**Masterlube #103**
5904 Lincoln Cypress, CA 90630
(714)826-2323( )
CIWMB#: 30-C-01071

**Masterlube #104**
5971 Ball Rd., Cypress, CA 90630
(714)220-1555( )
CIWMB#: 30-C-04682

**Metric Motors of Cypress**
6042 Cerritos Ave., Cypress, CA 90630
(714)821-4702( )
CIWMB#: 30-C-05157

## Fullerton

**AutoZone #2898**
146 N. Raymond Ave., Fullerton, CA 92831
(714)870-9772( )
CIWMB#: 30-C-04488

**AutoZone #5522**
1801 Orangethorpe W. Fullerton, CA 92833
(714)870-8286( )
CIWMB#: 30-C-06062

**AutoZone #5523**
102 N Euclid Fullerton, CA 92832
(714)870-8286( )
CIWMB#: 30-C-04755

**EZ Lube #17**
4002 N Harbor Blvd., Fullerton, CA 92835
(714)871-9980( )
CIWMB#: 30-C-03741

**Firestone Store #27EH**
1933 N Placentia Ave., Fullerton, CA 92831
(714)993-7100( )
CIWMB#: 30-C-02122

**Fox Service Center**
1018 W Orangethorpe Fullerton, CA 92833
(714)879-1430( )
CIWMB#: 30-C-02318

**Fullerton College Automotive Technology**
321 E Chapman Ave., Fullerton, CA 92832
(714)992-7275( )
CIWMB#: 30-C-03165

**Kragen Auto Parts #0731**
2978 Yorba Linda Fullerton, CA 92831
(714)996-4780( )
CIWMB#: 30-C-02628

**Kragen Auto Parts #4133**
904 W Orangethorpe Ave., Fullerton, CA 92832
(714)526-3570( )
CIWMB#: 30-C-06256

**Pep Boys #642**
1530 S Harbor Blvd., Fullerton, CA 92832
(714)870-0700( )
CIWMB#: 30-C-01755

**Sunnyside 76 Car Care Center**
2701 N Brea Blvd., Fullerton, CA 92835
(714)256-0773( )
CIWMB#: 30-C-01381

## Garden Grove

**76 Pro Lube Plus**
9001 Trask Ave., Garden Grove, CA 92844
(714)393-0590( )
CIWMB#: 30-C-05276

**AutoZone #5527**
13190 Harbor Blvd., Garden Grove, CA 92843
(714)636-5665( )
CIWMB#: 30-C-04760

**David Murray Shell**
12571 Vly View St., Garden Grove, CA 92845
(714)898-0170( )
CIWMB#: 30-C-00547

**Express Lube & Wash**
8100 Lampson Ave., Garden Grove, CA 92841
(909)316-8261( )
CIWMB#: 30-C-06544

**Firestone Store #7180**
10081 Chapman Ave., Garden Grove, CA 92840
(714)530-4630( )
CIWMB#: 30-C-01224

**Firestone Store #71W3**
13961 Brookhurst St., Garden Grove, CA 92843
(714)590-2741( )
CIWMB#: 30-C-03690

**Jiffy Lube #1991**
13970 Harbor Blvd., Garden Grove, CA 92843
(714)554-0610( )
CIWMB#: 30-C-05400

**Kragen Auto Parts #1251**
13933 N Harbor Blvd., Garden Grove, CA 92843
(714)554-3780( )
CIWMB#: 30-C-02663

**Kragen Auto Parts #1555**
9851 Chapman Ave., Garden Grove, CA 92841
(714)741-8030( )
CIWMB#: 30-C-04079

**Nissan of Grarden Grove**
9670 Trask Ave., Garden Grove, CA 92884
(714)537-0900( )
CIWMB#: 30-C-06553

**Toyota of Garden Grove**
9444 Trask Ave., Garden Grove, CA 92844
(714)895-5595( )
CIWMB#: 30-C-06555

## La Habra

**AutoZone #5532**
1200 W Imperial Hwy., La Habra, CA 90631
(562)694-5337( )
CIWMB#: 30-C-04784

**Burch Ford**
201 N Harbor Blvd., La Habra, CA 90631
(562)691-3225( )
CIWMB#: 30-C-05179

**Firestone Store #2736**
1071 S Beach Blvd., La Habra, CA 90631
(562)691-1731( )
CIWMB#: 30-C-01169

**Kragen Auto Parts #1569**
1621 W Whittier Blvd., La Habra, CA 90631
(562)905-2538( )
CIWMB#: 30-C-04076

**Pep Boys #997**
125 W Imperial Hwy., La Habra, CA 90631
(714)447-0601( )
CIWMB#: 30-C-04026

**SpeeDee Oil Change & Tune-Up**
1580 W Imperial Hwy., La Habra, CA 90631
(562)697-3513( )

## Los Alamitos

**Jiffy Lube #1740**
3311 Katella Ave., Los Alamitos, CA 90720
(562)596-1827( )
CIWMB#: 30-C-03529

## Midway City

**Bolsa Transmission**
8331 Bolsa Ave., Midway City, CA 92655
(714)799-6158( )
CIWMB#: 30-C-05768

## Placentia

**Advanced Auto & Diesel**
144 S Bradford Placentia, CA 92870
(714)996-8222( )
CIWMB#: 30-C-06242

**Castner's Auto Service**
214 S. Bradford Ave., Placentia, CA 92870
(714)528-1311( )
CIWMB#: 30-C-06452

**Econo Lube N' Tune**
100 W Chapman Ave., Placentia, CA 92870
(714)524-0424( )
CIWMB#: 30-C-06454

**Fairway Ford**
1350 E Yorba Linda Blvd., Placentia, CA 92870
(714)524-1200( )
CIWMB#: 30-C-01863

## Seal Beach

**M & N Coastline Auto & Tire Service**
12239 Seal Beach Blvd., Seal Beach, CA 90740
(714)826-1001( )
CIWMB#: 30-C-04433

**Seal Beach Chevron**
12541 Seal Beach Blvd., Seal Beach, CA 90740
(949)495-0774(14 )
CIWMB#: 30-C-06425

## Stanton

**AutoZone #2806**
11320 Beach Blvd., Stanton, CA 90680
(714)895-7665( )
CIWMB#: 30-C-04563

**Joe's Auto Clinic**
11763 Beach Blvd., Stanton, CA 90680
(714)891-7715( )
CIWMB#: 30-C-03253

**Kragen Auto Parts #1742**
11951 Beach Blvd., Stanton, CA 90680
(714)799-7574( )
CIWMB#: 30-C-05231

**Scher Tire #20**
7000 Katella Ave., Stanton, CA 90680
(714)892-9924( )
CIWMB#: 30-C-05907

**USA 10 Minute Oil Change**
8100 Lampson Ave., Stanton, CA 92841
(714)373-4432( )
CIWMB#: 30-C-05909

## Westminster

**AutoZone #5543**
6611 Westminster Blvd., Westminster, CA 92683
(714)898-2898( )
CIWMB#: 30-C-04964

**AutoZone #5544**
8481 Westminster Blvd., Westminster, CA 92683
(714)891-3511( )
CIWMB#: 30-C-04966

**City of Westminster Corporate Yard**
14381 Olive St., Westminster, CA 92683
(714)895-2876(292 )
CIWMB#: 30-C-02008

**Honda World**
13600 Beach Blvd., Westminster, CA 92683
(714)890-8900( )
CIWMB#: 30-C-03639

**Jiffy Lube #1579**
6011 Westminster Blvd., Westminster, CA 92683
(714)899-2727( )
CIWMB#: 30-C-02745

**John's Brake & Auto Repair**
13050 Hoover St., Westminster, CA 92683
(714)379-2088( )
CIWMB#: 30-C-05617

**Kragen Auto Parts #0762**
6562 Westminster Blvd., Westminster, CA 92683
(714)898-0810( )
CIWMB#: 30-C-02590

**Midway City Sanitary District**
14451 Cedarwood St., Westminster, CA 92683
(714)893-3553( )
CIWMB#: 30-C-01626

**Pep Boys #653**
15221 Beach Blvd., Westminster, CA 92683
(714)893-8544( )
CIWMB#: 30-C-03415

## Yorba Linda

**AutoZone #5545**
18528 Yorba Linda Blvd., Yorba Linda, CA 92886
(714)970-8933( )
CIWMB#: 30-C-04971

**Econo Lube N' Tune**
22270 La Palma Ave., Yorba Linda, CA 92887
(714)692-8394( )
CIWMB#: 30-C-06513

**EZ Lube Inc. #41**
17511 Yorba Linda Blvd., Yorba Linda, CA 92886
(714)556-1312( )
CIWMB#: 30-C-05739

**Firestone Store #27T3**
18500 Yorba Linda Blvd., Yorba Linda, CA 92886
(714)779-1966( )
CIWMB#: 30-C-01222

**Jiffy Lube #1532**
16751 Yorba Linda Blvd., Yorba Linda, CA 92886
(714)528-2800( )
CIWMB#: 30-C-03777

**Mike Schultz Import Service**
4832 Eureka Ave., Yorba Linda, CA 92886
(714)528-4411( )
CIWMB#: 30-C-04313

*This information was provided by the County of Orange Integrated Waste Management Department and the California Integrated Waste Management Board (CIWMB).*

***Do your part to prevent water pollution in our creeks, rivers, bays and ocean.***

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, not properly disposing of household hazardous waste can lead to water pollution. Batteries, electronics, paint, oil, gardening chemicals, cleaners and other hazardous materials cannot be thrown in the trash. They also must never be poured or thrown into yards, sidewalks, driveways, gutters or streets. Rain or other water could wash the materials into the storm drain and eventually into our waterways and the ocean. In addition, hazardous waste must not be poured in the sanitary sewers (sinks and toilets).

***NEVER DISPOSE OF HOUSEHOLD HAZARDOUS WASTE IN THE TRASH, STREET, GUTTER, STORM DRAIN OR SEWER.***

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL** (1-877-897-7455)
or visit
**www.ocwatersheds.com**

**To Report Illegal Dumping of Household Hazardous Waste call 1-800-69-TOXIC**

To report a spill,
call the
**Orange County 24-Hour Water Pollution Problem Reporting Hotline**
**1-877-89-SPILL** (1-877-897-7455).

**For emergencies, dial 911.**

RECYCLE USED OIL

Printed on Recycled Paper

Help Prevent Ocean Pollution:

# Proper Disposal of Household Hazardous Waste

**The Ocean Begins at Your Front Door**

PROJECT Pollution PREVENTION

**ORANGE COUNTY**

# Pollution Prevention

Leftover household products that contain corrosive, toxic, ignitable, or reactive ingredients are considered to be "household hazardous waste" or "HHW." HHW can be found throughout your home, including the bathroom, kitchen, laundry room and garage.

*WHEN POSSIBLE, USE NON-HAZARDOUS OR LESS-HAZARDOUS PRODUCTS.*

Disposal of HHW down the drain, on the ground, into storm drains, or in the trash is illegal and unsafe.

Proper disposal of HHW is actually easy. Simply drop them off at a Household Hazardous Waste Collection Center (HHWCC) for free disposal and recycling. Many materials including anti-freeze, latex-based paint, motor oil and batteries can be recycled. Some centers have a "Stop & Swap" program that lets you take partially used home, garden, and automobile products free of charge. There are four HHWCCs in Orange County:

**Anaheim**:.....1071 N. Blue Gum St
**Huntington Beach**:.....17121 Nichols St
**Irvine**:..... 6411 Oak Canyon
**San Juan Capistrano**:... 32250 La Pata Ave

Centers are open Tuesday-Saturday, 9 a.m.-3 p.m. Centers are closed on rainy days and major holidays. For more information, call **(714) 834-6752** or visit **www.oclandfills.com.**

## *Common household hazardous wastes*

- Batteries
- Paint and paint products
- Adhesives
- Drain openers
- Household cleaning products
- Wood and metal cleaners and polishes
- Pesticides
- Fungicides/wood preservatives
- Automotive products (antifreeze, motor oil, fluids)
- Grease and rust solvents
- Fluorescent lamps
- Mercury (thermometers & thermostats)
- All forms of electronic waste including computers and microwaves
- Pool & spa chemicals
- Cleaners
- Medications
- Propane (camping & BBQ)
- Mercury-containing lamps
- Television & monitors (CRTs, flatscreens)

## *Tips for household hazardous waste*

- Never dispose of HHW in the trash, street, gutter, storm drain or sewer.
- Keep these materials in closed, labeled containers and store materials indoors or under a cover.
- When possible, use non-hazardous products.
- Reuse products whenever possible or share with family and friends.
- Purchase only as much of a product as you'll need. Empty containers may be disposed of in the trash.
- HHW can be harmful to humans, pets and the environment. Report emergencies to 911.

*Do your part to prevent water pollution in our creeks, rivers, bays and ocean.*

Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common household activities can lead to water pollution if you're not careful.

**REMEMBER THE WATER IN YOUR STORM DRAIN IS NOT TREATED BEFORE IT ENTERS OUR WATERWAYS**

Litter, oil, chemicals and other substances that are left on your yard or driveway can be blown or washed into storm drains that flow to the ocean. Over-watering your lawn and washing your car can also flush materials into the storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated.

You would never pour soap, fertilizers or oil into the ocean, so don't let them enter streets, gutters or storm drains. Follow the easy tips in this brochure to help prevent water pollution.

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL** (1-877-897-7455)
or visit
**www.ocwatersheds.com**

To report a spill,
call the
**Orange County 24-Hour Water Pollution Problem Reporting Hotline**
**1-877-89-SPILL** (1-877-897-7455).

**For emergencies, dial 911.**

The tips contained in this brochure provide useful information to help prevent water pollution while performing everyday household activities. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

GENUINE RECYCLED PAPER
50% PRE-CONSUMER AND 15% POST-CONSUMER

RECYCLE USED OIL

Help Prevent Ocean Pollution:

# Household Tips

**The Ocean Begins at Your Front Door**

PROJECT Pollution PREVENTION

# Pollution Prevention

## *Household Activities*

- **Do not rinse spills with water!** Sweep outdoor spills and dispose of in the trash. For wet spills like oil, apply cat litter or another absorbent material, then sweep and bring to a household hazardous waste collection center (HHWCC).
- Securely cover trash cans.
- Take household hazardous waste to a household hazardous waste collection center.
- Store household hazardous waste in closed, labeled containers inside or under a cover.
- Do not hose down your driveway, sidewalk or patio. Sweep up debris and dispose of in trash.
- Always pick up after your pet. Flush waste down the toilet or dispose of in the trash.
- Bathe pets indoors or have them professionally groomed.

### *Household Hazardous Wastes include:*

- ▲ **Batteries**
- ▲ **Paint thinners, paint strippers and removers**
- ▲ **Adhesives**
- ▲ **Drain openers**
- ▲ **Oven cleaners**
- ▲ **Wood and metal cleaners and polishes**
- ▲ **Herbicides and pesticides**
- ▲ **Fungicides/wood preservatives**
- ▲ **Automotive fluids and products**
- ▲ **Grease and rust solvents**
- ▲ **Thermometers and other products containing mercury**
- ▲ **Fluorescent lamps**
- ▲ **Cathode ray tubes, e.g. TVs, computer monitors**
- ▲ **Pool and spa chemicals**

## *Gardening Activities*

- Follow directions on pesticides and fertilizers, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Water your lawn and garden by hand to control the amount of water you use. Set irrigation systems to reflect seasonal water needs. If water flows off your yard and onto your driveway or sidewalk, your system is over-watering.
- Mulch clippings or leave them on the lawn. If necessary, dispose in a green waste container.
- Cultivate your garden often to control weeds.

## *Washing and Maintaining Your Car*

- Take your car to a commercial car wash whenever possible.
- Choose soaps, cleaners, or detergents labeled "non-toxic," "phosphate free" or "biodegradable." Vegetable and citrus-based products are typically safest for the environment, **but even these should not be allowed into the storm drain.**
- Shake floor mats into a trash can or vacuum to clean.
- Do not use acid-based wheel cleaners and "hose off" engine degreasers at home. They can be used at a commercial facility, which can properly process the washwater.
- **Do not dump washwater onto your driveway, sidewalk, street, gutter or storm drain.** Excess washwater should be disposed of in the sanitary sewers (through a sink, or toilet) or onto an absorbent surface like your lawn.
- Use a nozzle to turn off water when not actively washing down automobile.
- Monitor vehicles for leaks and place pans under leaks. Keep your car well maintained to stop and prevent leaks.
- Use cat litter or other absorbents and sweep to remove any materials deposited by vehicles. Contain sweepings and dispose of at a HHWCC.
- Perform automobile repair and maintenance under a covered area and use drip pans or plastic sheeting to keep spills and waste material from reaching storm drains.
- **Never pour oil or antifreeze in the street, gutter or storm drains.** Recycle these substances at a service station, HHWCC, or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.ciwmb.ca.gov/UsedOil.

*For locations and hours of Household Hazardous Waste Collection Centers in Anaheim, Huntington Beach, Irvine and San Juan Capistrano, call (714)834-6752 or visit www.oclandfills.com.*

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, not properly disposing of used oil is illegal and can lead to fines. If you pour or drain oil onto driveways, sidewalks or streets, it can be washed into the storm drain.

Help prevent water pollution by taking your used oil and oil filters to a used oil collection center. Most major automotive maintenance centers will accept up to five gallons of used motor oil at no cost. For a list of locations, please visit www.cleanup.org.

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL (1-877-897-7455)** or visit **www.ocwatersheds.com.**

For information about the proper disposal of household hazardous waste, call the **Household Waste Hotline** at **1-877-89-SPILL (1-877-897-7455)** or visit **www.oclandfills.com.**

For additional information about the nearest oil recycling center, call the **Used Oil Program** at **1-800-CLEANUP** or visit **www.cleanup.org.**

RECYCLE USED OIL

emc/rev9/08

Help Prevent Ocean Pollution:

# Tips for the Home Mechanic

PROJECT Pollution PREVENTION

**The Ocean Begins at Your Front Door**

# Tips for the Home Mechanic

WORK SITE

- Locate the storm drains on or near your property. Do not allow used oil or any materials to flow into these drains.
- Examine your home for sources of pollution.
- Perform automotive projects under cover and in a controlled area to prevent stormwater runoff.
- Sweep or vacuum your automotive workspace regularly
- Use a damp mop to clean work areas. Never hose down surfaces into the street, gutter or storm drain.

- Pour mop water into a sink or toilet. Never dispose of water in a parking lot, street, gutter or storm drain.

PREVENT LEAKS AND SPILLS

- Keep absorbent materials such as rags and/or cat litter in the work area
- Empty drip pans into a labeled, seal container before they are full
- Wipe up any spills or repair leaks as they happen. Don't let them sit.
- Place large pans under any wrecked cars until all fluids are drained.
- Promptly dispose of collected fluids into a hazardous waste drum or deliver them to an oil recycling center. Used oil recycling locations can be found at http://www.ochealthinfo.com/regulatory/usedoil.htm

CLEANING SPILLS

- Clean up spills immediately by using absorbent material such as rags, cat litter or sand. If the material spilled is hazardous, dispose of the rag, litter or sand in the same manner as hazardous waste. If the material spill is non-hazardous, dispose of it in the trash.

- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at 1-877-89-SPILL (1-877-897-7455) or visit www.ocwatersheds.com to fill out an incident report.
- Report emergencies to 911.

VEHICLE FLUID MANAGEMENT

- Vehicle fluids are hazardous waste and must be stored and disposed of in accordance with all local, state and federal laws.
- Designate an area to drain vehicle fluids away from storm drains and sanitary drains.
- When possible, drain vehicle fluids indoors or within covered areas, and only over floors that are constructed of a non-porous material such as concrete. Asphalt and dirt floors absorb spilled or leaked fluids, making the cleanup extremely difficult.

PROJECT Pollution PREVENTION

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, if we are not careful, our daily activities can lead directly to water pollution problems. Water that drains through your watershed can pick up pollutants which are then transported to our waterways and beautiful ocean.

You can prevent water pollution by taking personal action and by working with members of your watershed community to prevent urban runoff from entering your waterway.

For more information,
please call the
**Orange County Stormwater Program**
at **1.877.89.SPILL**
or visit
**www.ocwatersheds.com**

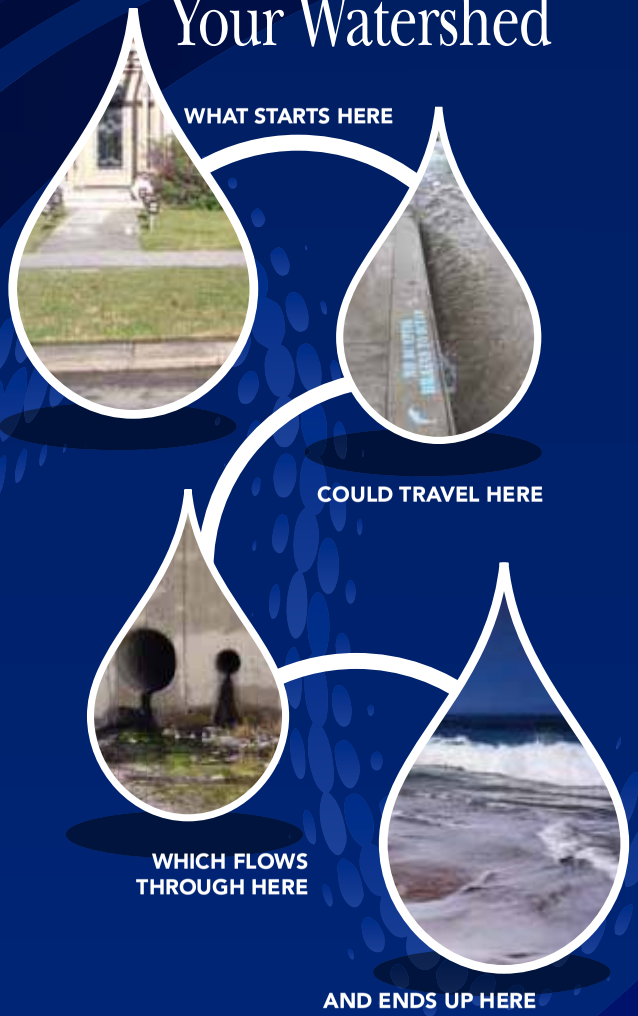
To report a spill,
call the
**Orange County 24-Hour Water Pollution Problem Reporting Hotline**
at **1.877.89.SPILL**.

**For emergencies, dial 911.**

The tips contained in this brochure provide useful information to help protect your watershed. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

Printed on Recycled Paper

# Help Prevent Ocean Pollution:
# Tips For Protecting Your Watershed




The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

# Tips for Protecting Your Watershed

## *My Watershed. Our Ocean.*

**Water + shed,** *noun: A region of land within which water flows down into a specified water body, such as a river, lake, sea, or ocean; a drainage basin or catchment basin.*

Orange County is comprised of 11 major watersheds into which most of our water flows, connecting all of Orange County to the Pacific Ocean.

As water from rain (stormwater) or sprinklers and hoses (urban runoff) runs down your driveway and into your neighborhood streets, sidewalks and gutters, it flows into storm drains that lead to waterways within your watershed. The waterways from other cities merge as they make their way through our watersheds until all the runoff water in Orange County meets at the Pacific Ocean. The water that reaches our ocean is not pure. As it flows through the watershed, it picks up pollutants such as litter, cigarette butts, fertilizer, pesticides, pet waste, motor oil and lawn clippings. Unlike water that enters the sewer (from sinks and toilets), water that enters the storm drain is not treated before it flows, ultimately, to the ocean.

Water quality can be improved by "Adopting Your Watershed." Through this effort, we are challenging citizens and organizations to join the Orange County Stormwater Program and others who are working to protect and restore our creeks, rivers, bays and ocean.

**There are many opportunities to get involved:**

- Appreciate your watershed - explore the creeks, trails and ocean and make observations about its conditions. If you see anything abnormal (such as dead fish, oil spills, leaking barrels, and other pollution) contact the Orange County 24-hour water pollution problem reporting hotline at 1.877.89.SPILL to report the problem.
- Research your watershed. Learn about what watershed you live in by visiting www.ocwatersheds.com.
- Find a watershed organization in your community and volunteer to help. If there are no active groups, consider starting your own.
- Visit EPA's Adopt Your Watershed's Catalog of Watershed Groups at www.epa.gov/adopt to locate groups in your community.
- Organize or join in a creek, river, bay or ocean cleanup event such as Coastal & Inner Coastal Cleanup Day that takes place the 3rd Saturday of every September. For more information visit www.coast4u.org.

### Follow these simple tips to protect the water quality of your watershed:

- **Sweep up debris and dispose of it in the trash. Do not hose down driveways or sidewalks into the street or gutter.**
- **Use dry cleanup methods such as cat litter to absorb spills and sweep up residue.**
- **Set your irrigation systems to reflect seasonal water needs or use weather-based controllers. Inspect for runoff regularly.**
- **Cover trashcans securely.**
- **Take hazardous waste to a household hazardous waste collection center. (For example, paint, batteries and petroleum products)**
- **Pick up after your pet.**
- **Follow application and disposal directions for pesticides and fertilizers.**
- **If you wash your car at home, wash it on your lawn or divert the runoff onto a landscaped area. Consider taking your car to a commercial car wash, where the water is reclaimed or recycled.**
  - **Keep your car well maintained.**
    - **Never pour oil or antifreeze in the street, gutter or storm drain.**

# Attachment E

# BMP Details

## HSC-2: Impervious Area Dispersion

Impervious area dispersion refers to the practice of routing runoff from impervious areas, such as rooftops, walkways, and patios onto the surface of adjacent pervious areas. Runoff is dispersed uniformly via splash block or dispersion trench and soaks into the ground as it move slowly across the surface of pervious areas. Minor ponding may occur, but it is not the intent of this practice to actively promote localized on-lot storage (See HSC-1: Localized On-Lot Infiltration).

*Also known as:*

- *Downspout disconnection*
- *Impervious area disconnection*
- *Sheet flow dispersion*

Simple Downspout Dispersion
*Source: toronto.ca/environment/water.htm*

### *Feasibility Screening Considerations*

- Impervious area dispersion can be used where infiltration would otherwise be infeasible, however dispersion depth over landscaped areas should be limited by site-specific conditions to prevent standing water or geotechnical issues.

### *Opportunity Criteria*

- Rooftops and other low traffic impervious surface present in drainage area.
- Soils are adequate for infiltration. If not, soils can be amended to improve capacity to absorb dispersed water (see MISC-2: Amended Soils).
- Significant pervious area present in drainage area with shallow slope
- Overflow from pervious area can be safely managed.

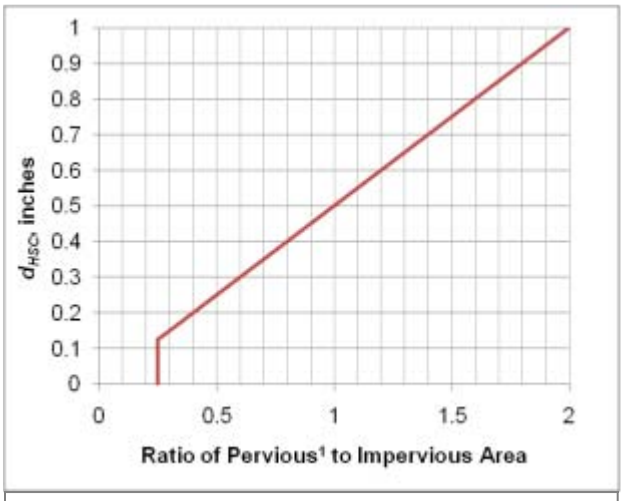
### *OC-Specific Design Criteria and Considerations*

- ☐ Soils should be preserved from their natural condition or restored via soil amendments to meet minimum criteria described in Section .
- ☐ A minimum of 1 part pervious area capable of receiving flow should be provided for every 2 parts of impervious area disconnected.
- ☐ The pervious area receiving flow should have a slope ≤ 2 percent and path lengths of ≥ 20 feet per 1000 sf of impervious area.
- ☐ Dispersion areas should be maintained to remove trash and debris, loose vegetation, and protect any areas of bare soil from erosion.
- ☐ Velocity of dispersed flow should not be greater than 0.5 ft per second to avoid scour.

### *Calculating HSC Retention Volume*

- The retention volume provided by downspout dispersion is a function of the ratio of impervious to pervious area and the condition of soils in the pervious area.
- Determine flow patterns in pervious area and estimate footprint of pervious area receiving dispersed flow. Calculate the ratio of pervious to impervious area.
- Check soil conditions using the soil condition design criteria below; amend if necessary.
- Look up the storm retention depth, $d_{HSC}$ from the chart below.

- The max $d_{HSC}$ is equal to the design storm depth for the project site.




[1] Pervious area used in calculation should only include the pervious area receiving flow, not pervious area receiving only direct rainfall or upslope pervious drainage.

### *Soil Condition Design Criteria*

- ☐ Maximum slope of 2 percent
- ☐ Well-established lawn or landscaping
- ☐ Minimum soil amendments per criteria in MISC-2: Amended Soils.

### *Configuration for Use in a Treatment Train*

- Impervious area disconnection is an HSC that may be used as the first element in any treatment train
- The use of impervious area disconnection reduces the sizing requirement for downstream LID and/or treatment control BMPs

### *Additional References for Design Guidance*

- SMC LID Manual (pp 131) http://www.lowimpactdevelopment.org/guest75/pub/All_Projects/SoCal_LID_Manual/SoCalLID_Manual_FINAL_040910.pdf
- City of Portland Bureau of Environmental Services. 2010. How to manage stormwater – Disconnect Downspouts. http://www.portlandonline.com/bes/index.cfm?c=43081&a=177702
- Seattle Public Utility: http://www.cityofseattle.org/util/stellent/groups/public/@spu/@usm/documents/webcontent/spu01_006395.pdf
- Thurston County, Washington State (pp 10): http://www.co.thurston.wa.us/stormwater/manual/docs-faqs/DG-5-Roof-Runoff-Control_Rev11Jan24.pdf

BIO-2: Vegetated Swale

*Also known as:*

- *Bioswale*
- *Biofiltration swale*
- *Grass swale*

Vegetated Swale
*Source: Geosyntec Consultants*

Vegetated swale filters (vegetated swales) are open, shallow channels with low-lying vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. Vegetated swales provide pollutant removal through settling and filtration in the vegetation (usually grasses) lining the channels. In addition, they provide the opportunity for volume reduction through infiltration and ET, and reduce the flow velocity in addition to conveying storm water runoff. Where soil conditions allow, volume reduction in vegetated swales can be enhanced by adding a gravel drainage layer underneath the swale allowing additional flows to be retained and infiltrated. Where slopes are shallow and soil conditions limit or prohibit infiltration, an underdrain system or low flow channel for dry weather flows may be required to minimize ponding and convey treated and/or dry weather flows to an acceptable discharge point. An effective vegetated swale achieves uniform sheet flow through a densely vegetated area for a period of several minutes. The vegetation in the swale can vary depending on its location within the project area and is generally the choice of the designer, subject to the design criteria outlined in this section.

### *Feasibility Screening Considerations*

- Swales may cause incidental infiltration; however, infiltration is not a mandatory mechanism for pollutant removal for swales and it may create hazards in some circumstances. Therefore, conditions should be evaluated to determine whether circumstances require an impermeable liner to avoid infiltration into the subsurface.

### *Opportunity Criteria*

- Open areas are needed for vegetated swales, including, but not limited to, road shoulders, road medians, parks and athletic fields and can be constructed in residential or commercial areas.
- Site slope is less than 10 percent.
- Drainage area is ≤ 5 acres.
- Vegetated swales must not interfere with flood control functions of existing conveyance and detention structures.

### *OC-Specific Design Criteria and Considerations*

☐ Swales should have a minimum bottom width of 2 feet and a maximum bottom width of 10 feet. Swale dividers should be used if the bottom width must exceed 10 feet to promote even distribution of flow across the swale. Local juridictions may require larger minimum widths based on maintenance requirements.

☐ The channel side slope should not exceed 2:1 (H:V) for a total swale depth of 1 foot or less. For deeper swales or mowed grass swales, the maximum channel side slope should be 3:1. Where space is constrained, swales may have vertical concrete or block walls provided that slope

stability, maintenance access and public safety considerations are met.

- ☐ The minimum swale length for biotreatment applications is 100 feet. The minimum residence time for flows in the swale is 10 minutes.
- ☐ If slope is less than 1.5%, underdrains should be provided for the length of the swale
- ☐ A gravel blanket or bedding is required around the underdrain pipe(s). At least 0.5 feet of washed aggregate must be placed below, to the top, and to the sides of the underdrain pipe(s).
- ☐ If an underdrain is included, an amended soil layer of 1 foot minimum thickness must be provided above the underdrain meeting the specifications of MISC-1: Planting/Storage Media.
- ☐ The maximum bed slope in flow direction should not exceed 6% (unles check dams are provided).
- ☐ The maximum flow velocity should not exceed 1.0 ft/sec for water quality treatment swales.
- ☐ For infrequently mowed swales, a maximum flow depth of 4 inches should be implemented. For frequently mowed turf swales, the maximum flow depth is 2 inches.
- ☐ The vegetation height should be maintained between 4 to 6 inches.
- ☐ Gradual meandering bends in the swale are desirable for aesthetic purposes and to promote slower flow and particulate settling.
- ☐ Blockages in the swale that result in uneven flow distribution and points of concentrated flow should be avoided. Blockages that should be avoided include trees, bushes, light pole piers, and utility vaults or pads.

### *Sizing Method for Vegetated Swales*

The Design Capture Method for Flow-based BMPs should be used to determine the design flowrate for a vegetated swale. The user then selects the design flow depth and longitudinal slope and uses the sizing steps below to determine the length and width of the swale. The sizing steps are as follows:

**Step 1: Determine Design Flowrate (Q)**

Calculate the Design Flowrate (Q) using the Capture Efficiency Method for Flow-based BMPs (See **Appendix III.3.3**). Inputs include the time of concentration of the catchment ($T_c$) and the capture efficiency achieved upstream by HSCs or other BMPs.

**Step 2: Estimate the Swale Bottom Width**

For shallow flow depths, channel side slopes can be ignored and the bottom width can be calculated using a simplified form of Manning's formula:

$$b = (Q \times n_{WQ}) / (1.49 \times y^{1.67} \times s^{0.5})$$

Where:

b = estimated swale bottom width, ft

Q = design flowrate, cfs

$n_{WQ}$ = Manning's roughness coefficient for shallow flow conditions, use 0.2 unless other information is available

y = design flow depth, ft (not to exceed 4 inches or 0.33 ft)

s = longitudinal slope in flow direction, ft/ft (not to exceed 0.06)

If b is between 2 and 10 feet, proceed to step 3.

If b is less than 2 feet, increase b to 2 feet and recalculate design flow depth using the following:

$y = ((Q \times n_{WQ}) / (1.49 \times b \times s^{0.5}))^{0.6}$

If b is greater than 10 feet, one of the following steps is necessary:

- Increase longitudinal slope to a maximum of 6% or 0.06, and recalculate b
- Increase design flow depth to a maximum of 4 inches or 0.33 ft, and recalculate b
- Install a divider lengthwise along swale bottom at least three-quarters of the swale length, beginning at the inlet. The swale width can be increased to 16 feet if a divider is provided.

**Step 3: Determine Design Flow Velocity**

Calculate the design flow velocity using the following equation:

$V_{WQ} = Q / A_{WQ}$

Where:

$V_{WQ}$ = design flow velocity, fps

Q = design flowrate, cfs

$A_{WQ} = by + Zy^2$, cross sectional area of flow at design depth

Z = side slope length per unit height

If the design flow velocity exceeds 1 foot per second, design parameters in Step 2 should be adjusted (slope, bottom width, or design flow depth) until $V_{WQ}$ is equal or less than 1 fps.

**Step 4: Calculate Swale Length**

Calculate the swale length needed to achieve a minimum hydraulic residence time of 10 minutes using the following equation:

$L = 60 \times t_{HR} \times V_{WQ}$

Where:

L = swale length, ft

$t_{HR}$ = hydraulic residence time, min (minimum 10 minutes)

$V_{WQ}$ = design flow velocity, fps

**Step 5: If Needed, Adjust Swale Length to Site Constraints**

Note that oftentimes swale length can be accomodated by providing a meandering swale. However, if swale length is too large for the site, the length can be adjusted as follows:

- Calculate the swale treatment top area ($A_{top}$), based on the swale length calculated in Step 4:

$A_{TOP} = (b_i + b_{SLOPE}) \times L_i$

Where:

$A_{TOP}$ = top area ($ft^2$) at the design treatment depth

$b_i$ = bottom width (ft), calculated in Step 2

$b_{SLOPE}$ = the additional top width (ft) above the side slope for the design water depth (for 3:1 side slopes and a 4-inch water depth, $b_{slope}$ = 2 feet)

$L_i$ = initial length (ft) calculated in Step 4

- Use the swale top area and a reduced swale length ($L_f$) to increase the bottom width, using the following equation:

$L_F = A_{TOP} / (b_F + b_{SLOPE})$

Where:

$L_F$ = reduced swale length (ft)

$b_F$ = increased bottom width (ft)

- Recalculate $V_{WQ}$ according to Step 3 using the revised cross-sectional area $A_{WQ}$ based on the increased bottom width ($b_F$). Revise the design as necessary if the design flow velocity exceeds 1 foot per second.
- Recalculate to ensure that the 10 minute retention time is retained.

### *Configuration for Use in a Treatment Train*

- Vegetated swales can be incorporated in a treatment train to provide enhanced water quality treatment and reductions in runoff volume and rate. For example, if a vegetated swale is placed upgradient of a dry extended detention (ED) basin, the rate and volume of water flowing to the dry ED basin can be reduced and the water quality enhanced. As another example, dry ED basins may be placed upstream a vegetated swale to reduce the size of the vegetated swale.
- Vegetated swales can be used as pretreatment for infiltration BMPs.
- If designed with an infiltration sump, vegetated "bioinfiltration" swales can provide retention and biotreatment capacity.

### *Additional References for Design Guidance*

Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4: **http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850**

Santa Barbara BMP Guidance Manual, Chapter 6: **http://www.santabarbaraca.gov/NR/rdonlyres/91D1FA75-C185-491E-A882-49EE17789DF8/0/Manual_071008_Final.pdf**

- County of San Diego Drainage Design Manual for design criteria, Section 5.5: **http://www.co.san-diego.ca.us/dpw/floodcontrol/floodcontrolpdf/drainage-designmanual05.pdf**

  County of Los Angeles Low Impact Development Standards Manual, Chapter 5: **http://dpw.lacounty.gov/wmd/LA_County_LID_Manual.pdf**

- Los Angeles County Stormwater BMP Design and Maintenance Manual: **http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf**

## BIO-7: Proprietary Biotreatment

Proprietary biotreatment devices are devices that are manufactured to mimic natural systems such as bioretention areas by incorporating plants, soil, and microbes engineered to provide treatment at higher flow rates or volumes and with smaller footprints than their natural counterparts. Incoming flows are typically filtered through a planting media (mulch, compost, soil, plants, microbes, etc.) and either infiltrated or collected by an underdrain and delivered to the storm water conveyance system. Tree box filters are an increasingly common type of proprietary biotreatment device that are installed at curb level and filled with a bioretention type soil. For low to moderate flows they operate similarly to bioretention systems and are bypassed during high flows. Tree box filters are highly adaptable solutions that can be used in all types of development and in all types of soils but are especially applicable to dense urban parking lots, street, and roadways.

*Also known as:*

- *Catch basin planter box*
- *Bioretention vault*
- *Tree box filter*

Proprietary biotreatment
*Source: http://www.americastusa.com /index.php/filterra/*

### *Feasibility Screening Considerations*

- Proprietary biotreatment devices that are unlined may cause incidental infiltration. Therefore, an evaluation of site conditions should be conducted to evaluate whether the BMP should include an impermeable liner to avoid infiltration into the subsurface.

### *Opportunity Criteria*

- Drainage areas of 0.25 to 1.0 acres.
- Land use may include commercial, residential, mixed use, institutional, and subdivisions. Proprietary biotreatment facilities may also be applied in parking lot islands, traffic circles, road shoulders, and road medians.
- Must not adversely affect the level of flood protection provided by the drainage system.

### *OC-Specific Design Criteria and Considerations*

- ☐ Frequent maintenance and the use of screens and grates to keep trash out may decrease the likelihood of clogging and prevent obstruction and bypass of incoming flows.
- ☐ Consult proprietors for specific criteria concerning the design and performance.
- ☐ Proprietary biotreatment may include specific media to address pollutants of concern. However, for proprietary device to be considered a biotreatment device the media must be capable of supporting rigorous growth of vegetation.
- ☐ Proprietary systems must be acceptable to the reviewing agency. Reviewing agencies shall have the discretion to request performance information. Reviewing agencies shall have the discretion to deny the use of a proprietary BMP on the grounds of performance, maintenance considerations, or other relevant factors.

☐ In right of way areas, plant selection should not impair traffic lines of site. Local jurisdictions may also limit plant selection in keeping with landscaping themes.

### *Computing Sizing Criteria for Proprietary Biotreatment Device*

- Proprietary biotreatment devices can be volume based or flow-based BMPs.
- Volume-based proprietary devices should be sized using the Simple Design Capture Volume Sizing Method described in **Appendix III.3.1** or the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs described in **Appendix III.3.2**.
- The required design flowrate for flow-based proprietary devices should be computed using the Capture Efficiency Method for Flow-based BMPs described in **Appendix III.3.3**).

### *Additional References for Design Guidance*

- Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4: http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850
- Los Angeles County Stormwater BMP Design and Maintenance Manual, Chapter 9: http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf
- Santa Barbara BMP Guidance Manual, Chapter 6: http://www.santabarbaraca.gov/NR/rdonlyres/91D1FA75-C185-491E-A882-49EE17789DF8/0/Manual_071008_Final.pdf

# Attachment F

# Time of Concentration Calculations

```
****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
          (C) Copyright 1989-2011 Advanced Engineering Software (aes)
              Ver. 18.0  Release Date: 05/01/2011  License ID 1264

                              Analysis prepared by:

                                  RBF Consulting



****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  Existing Area A
  2 year
  Sm Area Hydrograph
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    3.50
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.025
    LOW LOSS FRACTION = 0.187
    TIME OF CONCENTRATION(MIN.) =  8.15
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.46
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.14

****************************************************************************
  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
  0.11      0.0004      0.08  Q         .         .         .         .
  0.24      0.0013      0.08  Q         .         .         .         .
  0.38      0.0022      0.08  Q         .         .         .         .
  0.52      0.0031      0.08  Q         .         .         .         .
  0.65      0.0041      0.08  Q         .         .         .         .
  0.79      0.0050      0.08  Q         .         .         .         .
  0.92      0.0060      0.08  Q         .         .         .         .
  1.06      0.0069      0.08  Q         .         .         .         .
  1.19      0.0079      0.09  Q         .         .         .         .
  1.33      0.0088      0.09  Q         .         .         .         .
  1.47      0.0098      0.09  Q         .         .         .         .
  1.60      0.0108      0.09  Q         .         .         .         .
  1.74      0.0118      0.09  Q         .         .         .         .
```

| | | | |
|---|---|---|---|
| 10.16 | 0.0899 | 0.15 | Q |
| 10.30 | 0.0916 | 0.15 | Q |
| 10.43 | 0.0933 | 0.16 | Q |
| 10.57 | 0.0951 | 0.16 | Q |
| 10.70 | 0.0969 | 0.16 | Q |
| 10.84 | 0.0987 | 0.16 | Q |
| 10.97 | 0.1006 | 0.17 | Q |
| 11.11 | 0.1025 | 0.17 | Q |
| 11.25 | 0.1044 | 0.17 | Q |
| 11.38 | 0.1063 | 0.17 | Q |
| 11.52 | 0.1083 | 0.18 | Q |
| 11.65 | 0.1104 | 0.18 | Q |
| 11.79 | 0.1124 | 0.19 | Q |
| 11.93 | 0.1145 | 0.19 | Q |
| 12.06 | 0.1167 | 0.20 | Q |
| 12.20 | 0.1192 | 0.24 | Q |
| 12.33 | 0.1219 | 0.25 | Q |
| 12.47 | 0.1247 | 0.25 | Q |
| 12.60 | 0.1275 | 0.26 | .Q |
| 12.74 | 0.1304 | 0.26 | .Q |
| 12.88 | 0.1333 | 0.27 | .Q |
| 13.01 | 0.1364 | 0.27 | .Q |
| 13.15 | 0.1395 | 0.28 | .Q |
| 13.28 | 0.1426 | 0.28 | .Q |
| 13.42 | 0.1459 | 0.30 | .Q |
| 13.55 | 0.1492 | 0.30 | .Q |
| 13.69 | 0.1527 | 0.31 | .Q |
| 13.83 | 0.1562 | 0.32 | .Q |
| 13.96 | 0.1599 | 0.33 | .Q |
| 14.10 | 0.1637 | 0.34 | .Q |
| 14.23 | 0.1678 | 0.38 | .Q |
| 14.37 | 0.1721 | 0.39 | .Q |
| 14.51 | 0.1767 | 0.42 | .Q |
| 14.64 | 0.1815 | 0.44 | .Q |
| 14.78 | 0.1866 | 0.47 | .Q |
| 14.91 | 0.1920 | 0.49 | .Q |
| 15.05 | 0.1978 | 0.54 | . Q |
| 15.18 | 0.2041 | 0.57 | . Q |
| 15.32 | 0.2109 | 0.65 | . Q |
| 15.46 | 0.2183 | 0.66 | . Q |
| 15.59 | 0.2261 | 0.73 | . Q |
| 15.73 | 0.2349 | 0.83 | .  Q |
| 15.86 | 0.2465 | 1.24 | .  Q |
| 16.00 | 0.2632 | 1.72 | .  Q |
| 16.14 | 0.3027 | 5.32 | .  .Q |
| 16.27 | 0.3381 | 1.00 | .  Q |
| 16.41 | 0.3474 | 0.65 | . Q |
| 16.54 | 0.3545 | 0.61 | . Q |
| 16.68 | 0.3608 | 0.52 | . Q |
| 16.82 | 0.3662 | 0.45 | .Q |
| 16.95 | 0.3710 | 0.41 | .Q |
| 17.09 | 0.3754 | 0.37 | .Q |
| 17.22 | 0.3793 | 0.33 | .Q |
| 17.36 | 0.3828 | 0.31 | .Q |
| 17.49 | 0.3862 | 0.29 | .Q |
| 17.63 | 0.3894 | 0.28 | .Q |
| 17.77 | 0.3924 | 0.26 | .Q |
| 17.90 | 0.3953 | 0.25 | .Q |
| 18.04 | 0.3980 | 0.24 | Q |
| 18.17 | 0.4005 | 0.19 | Q |
| 18.31 | 0.4026 | 0.18 | Q |

| | |
|---|---|
| 90% | 8.1 |

```
*****************************************************************************
           NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
                     AND LOW LOSS FRACTION ESTIMATIONS
=============================================================================
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                          Analysis prepared by:

                              RBF Consulting


*****************************************************************************
-----------------------------------------------------------------------------

 Problem Descriptions:
  Area A
  2-year
  Loss Rates
=============================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
    AND LOW LOSS FRACTION ESTIMATIONS FOR AMC II:

    TOTAL 24-HOUR DURATION RAINFALL DEPTH =     2.05 (inches)

    SOIL-COVER     AREA      PERCENT OF    SCS CURVE    LOSS RATE
       TYPE      (Acres)   PERVIOUS AREA     NUMBER    Fp(in./hr.)     YIELD
         1         3.25       10.00            69.       0.250        0.812
         2         0.24       10.00            75.       0.200        0.821
         3         0.01       10.00            56.       0.300        0.802

    TOTAL AREA (Acres) =      3.50

    AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.025

    AREA-AVERAGED LOW LOSS FRACTION, Y = 0.187
=============================================================================
```

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****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                              Analysis prepared by:

                                  RBF Consulting



****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  Proposed  Area A
  2 year
  Sm Area Hydrograph
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    3.50
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.058
    LOW LOSS FRACTION = 0.289
    TIME OF CONCENTRATION(MIN.) =  8.28
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.41
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.19

****************************************************************************
  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
  0.13      0.0004      0.07  Q         .         .         .         .
  0.27      0.0012      0.07  Q         .         .         .         .
  0.41      0.0020      0.07  Q         .         .         .         .
  0.54      0.0029      0.07  Q         .         .         .         .
  0.68      0.0037      0.07  Q         .         .         .         .
  0.82      0.0045      0.07  Q         .         .         .         .
  0.96      0.0054      0.07  Q         .         .         .         .
  1.10      0.0062      0.07  Q         .         .         .         .
  1.23      0.0071      0.08  Q         .         .         .         .
  1.37      0.0079      0.08  Q         .         .         .         .
  1.51      0.0088      0.08  Q         .         .         .         .
  1.65      0.0097      0.08  Q         .         .         .         .
  1.79      0.0105      0.08  Q         .         .         .         .
```

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.92 | 0.0114 | 0.08 | Q | . | . | . | . |
| 2.06 | 0.0123 | 0.08 | Q | . | . | . | . |
| 2.20 | 0.0132 | 0.08 | Q | . | . | . | . |
| 2.34 | 0.0141 | 0.08 | Q | . | . | . | . |
| 2.48 | 0.0150 | 0.08 | Q | . | . | . | . |
| 2.61 | 0.0159 | 0.08 | Q | . | . | . | . |
| 2.75 | 0.0168 | 0.08 | Q | . | . | . | . |
| 2.89 | 0.0177 | 0.08 | Q | . | . | . | . |
| 3.03 | 0.0186 | 0.08 | Q | . | . | . | . |
| 3.17 | 0.0196 | 0.08 | Q | . | . | . | . |
| 3.30 | 0.0205 | 0.08 | Q | . | . | . | . |
| 3.44 | 0.0214 | 0.08 | Q | . | . | . | . |
| 3.58 | 0.0224 | 0.08 | Q | . | . | . | . |
| 3.72 | 0.0233 | 0.08 | Q | . | . | . | . |
| 3.86 | 0.0243 | 0.08 | Q | . | . | . | . |
| 3.99 | 0.0253 | 0.09 | Q | . | . | . | . |
| 4.13 | 0.0262 | 0.09 | Q | . | . | . | . |
| 4.27 | 0.0272 | 0.09 | Q | . | . | . | . |
| 4.41 | 0.0282 | 0.09 | Q | . | . | . | . |
| 4.55 | 0.0292 | 0.09 | Q | . | . | . | . |
| 4.68 | 0.0302 | 0.09 | Q | . | . | . | . |
| 4.82 | 0.0312 | 0.09 | Q | . | . | . | . |
| 4.96 | 0.0323 | 0.09 | Q | . | . | . | . |
| 5.10 | 0.0333 | 0.09 | Q | . | . | . | . |
| 5.24 | 0.0343 | 0.09 | Q | . | . | . | . |
| 5.37 | 0.0354 | 0.09 | Q | . | . | . | . |
| 5.51 | 0.0364 | 0.09 | Q | . | . | . | . |
| 5.65 | 0.0375 | 0.09 | Q | . | . | . | . |
| 5.79 | 0.0385 | 0.09 | Q | . | . | . | . |
| 5.93 | 0.0396 | 0.10 | Q | . | . | . | . |
| 6.06 | 0.0407 | 0.10 | Q | . | . | . | . |
| 6.20 | 0.0418 | 0.10 | Q | . | . | . | . |
| 6.34 | 0.0429 | 0.10 | Q | . | . | . | . |
| 6.48 | 0.0440 | 0.10 | Q | . | . | . | . |
| 6.62 | 0.0452 | 0.10 | Q | . | . | . | . |
| 6.75 | 0.0463 | 0.10 | Q | . | . | . | . |
| 6.89 | 0.0474 | 0.10 | Q | . | . | . | . |
| 7.03 | 0.0486 | 0.10 | Q | . | . | . | . |
| 7.17 | 0.0498 | 0.10 | Q | . | . | . | . |
| 7.31 | 0.0509 | 0.10 | Q | . | . | . | . |
| 7.44 | 0.0521 | 0.10 | Q | . | . | . | . |
| 7.58 | 0.0533 | 0.11 | Q | . | . | . | . |
| 7.72 | 0.0546 | 0.11 | Q | . | . | . | . |
| 7.86 | 0.0558 | 0.11 | Q | . | . | . | . |
| 8.00 | 0.0570 | 0.11 | Q | . | . | . | . |
| 8.13 | 0.0583 | 0.11 | Q | . | . | . | . |
| 8.27 | 0.0596 | 0.11 | Q | . | . | . | . |
| 8.41 | 0.0608 | 0.11 | Q | . | . | . | . |
| 8.55 | 0.0621 | 0.11 | Q | . | . | . | . |
| 8.69 | 0.0635 | 0.12 | Q | . | . | . | . |
| 8.82 | 0.0648 | 0.12 | Q | . | . | . | . |
| 8.96 | 0.0661 | 0.12 | Q | . | . | . | . |
| 9.10 | 0.0675 | 0.12 | Q | . | . | . | . |
| 9.24 | 0.0689 | 0.12 | Q | . | . | . | . |
| 9.38 | 0.0703 | 0.12 | Q | . | . | . | . |
| 9.51 | 0.0717 | 0.12 | Q | . | . | . | . |
| 9.65 | 0.0731 | 0.13 | Q | . | . | . | . |
| 9.79 | 0.0745 | 0.13 | Q | . | . | . | . |
| 9.93 | 0.0760 | 0.13 | Q | . | . | . | . |
| 10.07 | 0.0775 | 0.13 | Q | . | . | . | . |
| 10.20 | 0.0790 | 0.13 | Q | . | . | . | . |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10.34 | 0.0806 | 0.14 | Q | . | . | . | . |
| 10.48 | 0.0821 | 0.14 | Q | . | . | . | . |
| 10.62 | 0.0837 | 0.14 | Q | . | . | . | . |
| 10.76 | 0.0853 | 0.14 | Q | . | . | . | . |
| 10.89 | 0.0869 | 0.14 | Q | . | . | . | . |
| 11.03 | 0.0886 | 0.15 | Q | . | . | . | . |
| 11.17 | 0.0903 | 0.15 | Q | . | . | . | . |
| 11.31 | 0.0920 | 0.15 | Q | . | . | . | . |
| 11.45 | 0.0937 | 0.16 | Q | . | . | . | . |
| 11.58 | 0.0955 | 0.16 | Q | . | . | . | . |
| 11.72 | 0.0973 | 0.16 | Q | . | . | . | . |
| 11.86 | 0.0992 | 0.16 | Q | . | . | . | . |
| 12.00 | 0.1011 | 0.17 | Q | . | . | . | . |
| 12.14 | 0.1031 | 0.19 | Q | . | . | . | . |
| 12.27 | 0.1054 | 0.21 | Q | . | . | . | . |
| 12.41 | 0.1078 | 0.22 | Q | . | . | . | . |
| 12.55 | 0.1103 | 0.22 | Q | . | . | . | . |
| 12.69 | 0.1129 | 0.22 | Q | . | . | . | . |
| 12.83 | 0.1155 | 0.23 | Q | . | . | . | . |
| 12.96 | 0.1181 | 0.24 | Q | . | . | . | . |
| 13.10 | 0.1209 | 0.24 | Q | . | . | . | . |
| 13.24 | 0.1237 | 0.25 | Q | . | . | . | . |
| 13.38 | 0.1265 | 0.26 | .Q | . | . | . | . |
| 13.52 | 0.1295 | 0.26 | .Q | . | . | . | . |
| 13.65 | 0.1325 | 0.27 | .Q | . | . | . | . |
| 13.79 | 0.1356 | 0.28 | .Q | . | . | . | . |
| 13.93 | 0.1389 | 0.29 | .Q | . | . | . | . |
| 14.07 | 0.1422 | 0.30 | .Q | . | . | . | . |
| 14.21 | 0.1457 | 0.32 | .Q | . | . | . | . |
| 14.34 | 0.1495 | 0.33 | .Q | . | . | . | . |
| 14.48 | 0.1534 | 0.35 | .Q | . | . | . | . |
| 14.62 | 0.1575 | 0.36 | .Q | . | . | . | . |
| 14.76 | 0.1617 | 0.39 | .Q | . | . | . | . |
| 14.90 | 0.1663 | 0.40 | .Q | . | . | . | . |
| 15.03 | 0.1711 | 0.44 | .Q | . | . | . | . |
| 15.17 | 0.1762 | 0.47 | .Q | . | . | . | . |
| 15.31 | 0.1820 | 0.54 | . Q | . | . | . | . |
| 15.45 | 0.1883 | 0.56 | . Q | . | . | . | . |
| 15.59 | 0.1950 | 0.62 | . Q | . | . | . | . |
| 15.72 | 0.2026 | 0.72 | . Q | . | . | . | . |
| 15.86 | 0.2131 | 1.13 | .  Q | . | . | . | . |
| 16.00 | 0.2287 | 1.60 | .  Q | . | . | . | . |
| 16.14 | 0.2673 | 5.17 | . | . | Q | . | . |
| 16.28 | 0.3018 | 0.88 | .  Q | . | . | . | . |
| 16.41 | 0.3099 | 0.54 | . Q | . | . | . | . |
| 16.55 | 0.3158 | 0.50 | . Q | . | . | . | . |
| 16.69 | 0.3210 | 0.42 | .Q | . | . | . | . |
| 16.83 | 0.3256 | 0.37 | .Q | . | . | . | . |
| 16.97 | 0.3297 | 0.34 | .Q | . | . | . | . |
| 17.10 | 0.3334 | 0.31 | .Q | . | . | . | . |
| 17.24 | 0.3368 | 0.28 | .Q | . | . | . | . |
| 17.38 | 0.3399 | 0.27 | .Q | . | . | . | . |
| 17.52 | 0.3429 | 0.25 | .Q | . | . | . | . |
| 17.66 | 0.3457 | 0.24 | Q | . | . | . | . |
| 17.79 | 0.3483 | 0.23 | Q | . | . | . | . |
| 17.93 | 0.3509 | 0.22 | Q | . | . | . | . |
| 18.07 | 0.3533 | 0.21 | Q | . | . | . | . |
| 18.21 | 0.3555 | 0.17 | Q | . | . | . | . |
| 18.35 | 0.3573 | 0.16 | Q | . | . | . | . |
| 18.48 | 0.3591 | 0.15 | Q | . | . | . | . |
| 18.62 | 0.3608 | 0.15 | Q | . | . | . | . |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 18.76 | 0.3625 | 0.14 | Q | . | . | . | . |
| 18.90 | 0.3641 | 0.14 | Q | . | . | . | . |
| 19.04 | 0.3656 | 0.13 | Q | . | . | . | . |
| 19.17 | 0.3671 | 0.13 | Q | . | . | . | . |
| 19.31 | 0.3686 | 0.13 | Q | . | . | . | . |
| 19.45 | 0.3700 | 0.12 | Q | . | . | . | . |
| 19.59 | 0.3714 | 0.12 | Q | . | . | . | . |
| 19.73 | 0.3728 | 0.12 | Q | . | . | . | . |
| 19.86 | 0.3741 | 0.12 | Q | . | . | . | . |
| 20.00 | 0.3754 | 0.11 | Q | . | . | . | . |
| 20.14 | 0.3767 | 0.11 | Q | . | . | . | . |
| 20.28 | 0.3779 | 0.11 | Q | . | . | . | . |
| 20.42 | 0.3792 | 0.11 | Q | . | . | . | . |
| 20.55 | 0.3803 | 0.10 | Q | . | . | . | . |
| 20.69 | 0.3815 | 0.10 | Q | . | . | . | . |
| 20.83 | 0.3827 | 0.10 | Q | . | . | . | . |
| 20.97 | 0.3838 | 0.10 | Q | . | . | . | . |
| 21.11 | 0.3849 | 0.10 | Q | . | . | . | . |
| 21.24 | 0.3860 | 0.09 | Q | . | . | . | . |
| 21.38 | 0.3871 | 0.09 | Q | . | . | . | . |
| 21.52 | 0.3881 | 0.09 | Q | . | . | . | . |
| 21.66 | 0.3891 | 0.09 | Q | . | . | . | . |
| 21.80 | 0.3902 | 0.09 | Q | . | . | . | . |
| 21.93 | 0.3912 | 0.09 | Q | . | . | . | . |
| 22.07 | 0.3922 | 0.09 | Q | . | . | . | . |
| 22.21 | 0.3931 | 0.08 | Q | . | . | . | . |
| 22.35 | 0.3941 | 0.08 | Q | . | . | . | . |
| 22.49 | 0.3950 | 0.08 | Q | . | . | . | . |
| 22.62 | 0.3960 | 0.08 | Q | . | . | . | . |
| 22.76 | 0.3969 | 0.08 | Q | . | . | . | . |
| 22.90 | 0.3978 | 0.08 | Q | . | . | . | . |
| 23.04 | 0.3987 | 0.08 | Q | . | . | . | . |
| 23.18 | 0.3996 | 0.08 | Q | . | . | . | . |
| 23.31 | 0.4005 | 0.08 | Q | . | . | . | . |
| 23.45 | 0.4013 | 0.08 | Q | . | . | . | . |
| 23.59 | 0.4022 | 0.07 | Q | . | . | . | . |
| 23.73 | 0.4030 | 0.07 | Q | . | . | . | . |
| 23.87 | 0.4039 | 0.07 | Q | . | . | . | . |
| 24.00 | 0.4047 | 0.07 | Q | . | . | . | . |
| 24.14 | 0.4051 | 0.00 | Q | . | . | . | . |

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

| Percentile of Estimated Peak Flow Rate | Duration (minutes) |
|---|---|
| 0% | 1440.7 |
| 10% | 74.5 |
| 20% | 24.8 |
| 30% | 16.6 |
| 40% | 8.3 |
| 50% | 8.3 |
| 60% | 8.3 |
| 70% | 8.3 |
| 80% | 8.3 |
| 90% | 8.3 |

```
****************************************************************************
          NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
                    AND LOW LOSS FRACTION ESTIMATIONS
============================================================================
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                          Analysis prepared by:

                              RBF Consulting



****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  Proposed Area A
  2 year
  Loss Rates
============================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
    AND LOW LOSS FRACTION ESTIMATIONS FOR AMC II:

    TOTAL 24-HOUR DURATION RAINFALL DEPTH =     2.05 (inches)

    SOIL-COVER     AREA      PERCENT OF    SCS CURVE    LOSS RATE
       TYPE      (Acres)   PERVIOUS AREA     NUMBER    Fp(in./hr.)     YIELD
         1         1.48       10.00            69.       0.250        0.812
         2         1.28       20.00            69.       0.250        0.735
         3         0.12       80.00            69.       0.250        0.270
         4         0.13       10.00            75.       0.200        0.821
         5         0.41       70.00            69.       0.250        0.347
         6         0.04       10.00            75.       0.200        0.821
         7         0.04       10.00            56.       0.300        0.802

    TOTAL AREA (Acres) =      3.50

    AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.058

    AREA-AVERAGED LOW LOSS FRACTION, Y = 0.289
============================================================================
```

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*****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
=============================================================================
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                              Analysis prepared by:

                                  RBF Consulting



*****************************************************************************
-----------------------------------------------------------------------------

 Problem Descriptions:
  Existing N
  2 year
  Sm Area Hydrograph
-----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    5.80
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.023
    LOW LOSS FRACTION = 0.184
    TIME OF CONCENTRATION(MIN.) =  9.71
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

-----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.76
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.23

*****************************************************************************
  TIME      VOLUME        Q    0.        2.5       5.0       7.5      10.0
 (HOURS)     (AF)       (CFS)
-----------------------------------------------------------------------------
  0.14      0.0009      0.14  Q         .         .         .         .
  0.30      0.0027      0.14  Q         .         .         .         .
  0.46      0.0046      0.14  Q         .         .         .         .
  0.63      0.0064      0.14  Q         .         .         .         .
  0.79      0.0083      0.14  Q         .         .         .         .
  0.95      0.0102      0.14  Q         .         .         .         .
  1.11      0.0121      0.14  Q         .         .         .         .
  1.27      0.0140      0.14  Q         .         .         .         .
  1.43      0.0159      0.14  Q         .         .         .         .
  1.60      0.0178      0.14  Q         .         .         .         .
  1.76      0.0197      0.15  Q         .         .         .         .
  1.92      0.0217      0.15  Q         .         .         .         .
  2.08      0.0237      0.15  Q         .         .         .         .
```

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.24 | 0.0257 | 0.15 | Q | . | . | . | . |
| 2.41 | 0.0276 | 0.15 | Q | . | . | . | . |
| 2.57 | 0.0297 | 0.15 | Q | . | . | . | . |
| 2.73 | 0.0317 | 0.15 | Q | . | . | . | . |
| 2.89 | 0.0337 | 0.15 | Q | . | . | . | . |
| 3.05 | 0.0358 | 0.15 | Q | . | . | . | . |
| 3.22 | 0.0379 | 0.16 | Q | . | . | . | . |
| 3.38 | 0.0400 | 0.16 | Q | . | . | . | . |
| 3.54 | 0.0421 | 0.16 | Q | . | . | . | . |
| 3.70 | 0.0442 | 0.16 | Q | . | . | . | . |
| 3.86 | 0.0463 | 0.16 | Q | . | . | . | . |
| 4.02 | 0.0485 | 0.16 | Q | . | . | . | . |
| 4.19 | 0.0507 | 0.16 | Q | . | . | . | . |
| 4.35 | 0.0529 | 0.16 | Q | . | . | . | . |
| 4.51 | 0.0551 | 0.17 | Q | . | . | . | . |
| 4.67 | 0.0573 | 0.17 | Q | . | . | . | . |
| 4.83 | 0.0596 | 0.17 | Q | . | . | . | . |
| 5.00 | 0.0618 | 0.17 | Q | . | . | . | . |
| 5.16 | 0.0641 | 0.17 | Q | . | . | . | . |
| 5.32 | 0.0665 | 0.17 | Q | . | . | . | . |
| 5.48 | 0.0688 | 0.18 | Q | . | . | . | . |
| 5.64 | 0.0712 | 0.18 | Q | . | . | . | . |
| 5.80 | 0.0735 | 0.18 | Q | . | . | . | . |
| 5.97 | 0.0759 | 0.18 | Q | . | . | . | . |
| 6.13 | 0.0784 | 0.18 | Q | . | . | . | . |
| 6.29 | 0.0808 | 0.18 | Q | . | . | . | . |
| 6.45 | 0.0833 | 0.19 | Q | . | . | . | . |
| 6.61 | 0.0858 | 0.19 | Q | . | . | . | . |
| 6.78 | 0.0884 | 0.19 | Q | . | . | . | . |
| 6.94 | 0.0909 | 0.19 | Q | . | . | . | . |
| 7.10 | 0.0935 | 0.20 | Q | . | . | . | . |
| 7.26 | 0.0961 | 0.20 | Q | . | . | . | . |
| 7.42 | 0.0988 | 0.20 | Q | . | . | . | . |
| 7.58 | 0.1015 | 0.20 | Q | . | . | . | . |
| 7.75 | 0.1042 | 0.20 | Q | . | . | . | . |
| 7.91 | 0.1069 | 0.21 | Q | . | . | . | . |
| 8.07 | 0.1097 | 0.21 | Q | . | . | . | . |
| 8.23 | 0.1125 | 0.21 | Q | . | . | . | . |
| 8.39 | 0.1154 | 0.21 | Q | . | . | . | . |
| 8.56 | 0.1182 | 0.22 | Q | . | . | . | . |
| 8.72 | 0.1212 | 0.22 | Q | . | . | . | . |
| 8.88 | 0.1241 | 0.22 | Q | . | . | . | . |
| 9.04 | 0.1272 | 0.23 | Q | . | . | . | . |
| 9.20 | 0.1302 | 0.23 | Q | . | . | . | . |
| 9.36 | 0.1333 | 0.23 | Q | . | . | . | . |
| 9.53 | 0.1364 | 0.24 | Q | . | . | . | . |
| 9.69 | 0.1396 | 0.24 | Q | . | . | . | . |
| 9.85 | 0.1429 | 0.24 | Q | . | . | . | . |
| 10.01 | 0.1462 | 0.25 | Q | . | . | . | . |
| 10.17 | 0.1495 | 0.25 | .Q | . | . | . | . |
| 10.34 | 0.1529 | 0.26 | .Q | . | . | . | . |
| 10.50 | 0.1564 | 0.26 | .Q | . | . | . | . |
| 10.66 | 0.1599 | 0.27 | .Q | . | . | . | . |
| 10.82 | 0.1635 | 0.27 | .Q | . | . | . | . |
| 10.98 | 0.1672 | 0.28 | .Q | . | . | . | . |
| 11.15 | 0.1709 | 0.28 | .Q | . | . | . | . |
| 11.31 | 0.1748 | 0.29 | .Q | . | . | . | . |
| 11.47 | 0.1786 | 0.29 | .Q | . | . | . | . |
| 11.63 | 0.1826 | 0.30 | .Q | . | . | . | . |
| 11.79 | 0.1867 | 0.31 | .Q | . | . | . | . |
| 11.95 | 0.1909 | 0.32 | .Q | . | . | . | . |

| | | | |
|---|---|---|---|
| 12.12 | 0.1952 | 0.33 | .Q . . . . |
| 12.28 | 0.2001 | 0.40 | .Q . . . . |
| 12.44 | 0.2055 | 0.41 | .Q . . . . |
| 12.60 | 0.2111 | 0.42 | .Q . . . . |
| 12.76 | 0.2168 | 0.43 | .Q . . . . |
| 12.93 | 0.2227 | 0.45 | .Q . . . . |
| 13.09 | 0.2287 | 0.45 | .Q . . . . |
| 13.25 | 0.2349 | 0.47 | .Q . . . . |
| 13.41 | 0.2413 | 0.48 | .Q . . . . |
| 13.57 | 0.2479 | 0.51 | . Q . . . . |
| 13.73 | 0.2547 | 0.52 | . Q . . . . |
| 13.90 | 0.2619 | 0.55 | . Q . . . . |
| 14.06 | 0.2693 | 0.57 | . Q . . . . |
| 14.22 | 0.2773 | 0.63 | . Q . . . . |
| 14.38 | 0.2859 | 0.66 | . Q . . . . |
| 14.54 | 0.2951 | 0.71 | . Q . . . . |
| 14.71 | 0.3048 | 0.74 | . Q . . . . |
| 14.87 | 0.3153 | 0.82 | . Q . . . . |
| 15.03 | 0.3266 | 0.87 | . Q . . . . |
| 15.19 | 0.3389 | 0.98 | . Q . . . . |
| 15.35 | 0.3526 | 1.06 | . Q . . . . |
| 15.51 | 0.3669 | 1.09 | . Q . . . . |
| 15.68 | 0.3825 | 1.24 | . Q . . . . |
| 15.84 | 0.4032 | 1.86 | . Q . . . . |
| 16.00 | 0.4328 | 2.57 | . Q . . . |
| 16.16 | 0.5032 | 7.95 | . . . .Q . |
| 16.32 | 0.5662 | 1.46 | . Q . . . . |
| 16.49 | 0.5835 | 1.12 | . Q . . . . |
| 16.65 | 0.5971 | 0.92 | . Q . . . . |
| 16.81 | 0.6085 | 0.78 | . Q . . . . |
| 16.97 | 0.6183 | 0.68 | . Q . . . . |
| 17.13 | 0.6268 | 0.60 | . Q . . . . |
| 17.29 | 0.6344 | 0.53 | . Q . . . . |
| 17.46 | 0.6412 | 0.49 | .Q . . . . |
| 17.62 | 0.6476 | 0.46 | .Q . . . . |
| 17.78 | 0.6537 | 0.44 | .Q . . . . |
| 17.94 | 0.6594 | 0.42 | .Q . . . . |
| 18.10 | 0.6648 | 0.40 | .Q . . . . |
| 18.27 | 0.6696 | 0.31 | .Q . . . . |
| 18.43 | 0.6737 | 0.30 | .Q . . . . |
| 18.59 | 0.6776 | 0.29 | .Q . . . . |
| 18.75 | 0.6813 | 0.27 | .Q . . . . |
| 18.91 | 0.6849 | 0.26 | .Q . . . . |
| 19.07 | 0.6884 | 0.25 | .Q . . . . |
| 19.24 | 0.6917 | 0.25 | Q . . . . |
| 19.40 | 0.6950 | 0.24 | Q . . . . |
| 19.56 | 0.6981 | 0.23 | Q . . . . |
| 19.72 | 0.7012 | 0.22 | Q . . . . |
| 19.88 | 0.7041 | 0.22 | Q . . . . |
| 20.05 | 0.7070 | 0.21 | Q . . . . |
| 20.21 | 0.7098 | 0.21 | Q . . . . |
| 20.37 | 0.7126 | 0.20 | Q . . . . |
| 20.53 | 0.7153 | 0.20 | Q . . . . |
| 20.69 | 0.7179 | 0.19 | Q . . . . |
| 20.86 | 0.7204 | 0.19 | Q . . . . |
| 21.02 | 0.7229 | 0.19 | Q . . . . |
| 21.18 | 0.7254 | 0.18 | Q . . . . |
| 21.34 | 0.7278 | 0.18 | Q . . . . |
| 21.50 | 0.7302 | 0.17 | Q . . . . |
| 21.66 | 0.7325 | 0.17 | Q . . . . |
| 21.83 | 0.7348 | 0.17 | Q . . . . |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 21.99 | 0.7370 | 0.17 | Q | . | . | . | . |
| 22.15 | 0.7392 | 0.16 | Q | . | . | . | . |
| 22.31 | 0.7413 | 0.16 | Q | . | . | . | . |
| 22.47 | 0.7435 | 0.16 | Q | . | . | . | . |
| 22.64 | 0.7456 | 0.16 | Q | . | . | . | . |
| 22.80 | 0.7476 | 0.15 | Q | . | . | . | . |
| 22.96 | 0.7497 | 0.15 | Q | . | . | . | . |
| 23.12 | 0.7516 | 0.15 | Q | . | . | . | . |
| 23.28 | 0.7536 | 0.15 | Q | . | . | . | . |
| 23.44 | 0.7556 | 0.14 | Q | . | . | . | . |
| 23.61 | 0.7575 | 0.14 | Q | . | . | . | . |
| 23.77 | 0.7594 | 0.14 | Q | . | . | . | . |
| 23.93 | 0.7612 | 0.14 | Q | . | . | . | . |
| 24.09 | 0.7631 | 0.14 | Q | . | . | . | . |
| 24.25 | 0.7640 | 0.00 | Q | . | . | . | . |

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

| Percentile of Estimated Peak Flow Rate | Duration (minutes) |
|---|---|
| 0% | 1446.8 |
| 10% | 116.5 |
| 20% | 29.1 |
| 30% | 19.4 |
| 40% | 9.7 |
| 50% | 9.7 |
| 60% | 9.7 |
| 70% | 9.7 |
| 80% | 9.7 |
| 90% | 9.7 |

```
****************************************************************************
          NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
                    AND LOW LOSS FRACTION ESTIMATIONS
============================================================================
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            Ver. 18.0  Release Date: 05/01/2011  License ID 1264

                          Analysis prepared by:

                              RBF Consulting



****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  Existing Area N
  2 year
  Loss Rates
============================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
    AND LOW LOSS FRACTION ESTIMATIONS FOR AMC II:

    TOTAL 24-HOUR DURATION RAINFALL DEPTH =     2.05 (inches)

    SOIL-COVER     AREA      PERCENT OF    SCS CURVE    LOSS RATE
       TYPE      (Acres)   PERVIOUS AREA     NUMBER    Fp(in./hr.)     YIELD
        1          2.96       10.00            69.       0.250        0.812
        2          2.84       10.00            75.       0.200        0.821

    TOTAL AREA (Acres) =      5.80

    AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.023

    AREA-AVERAGED LOW LOSS FRACTION, Y = 0.184
============================================================================

 Problem Descriptions:
  Existing Area N
  2 year
  Loss Rates
============================================================================
```

```
****************************************************************************
                        SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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             Ver. 18.0  Release Date: 05/01/2011  License ID 1264

                              Analysis prepared by:

                                  RBF Consulting



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----------------------------------------------------------------------------

 Problem Descriptions:
  Proposed Area N
  2 year
  Sm Area Hydrograph
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    5.80
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.053
    LOW LOSS FRACTION = 0.282
    TIME OF CONCENTRATION(MIN.) =  9.30
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.68
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.31

****************************************************************************
  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
  0.03      0.0000      0.00  Q         .         .         .         .
  0.19      0.0008      0.12  Q         .         .         .         .
  0.34      0.0023      0.12  Q         .         .         .         .
  0.50      0.0039      0.12  Q         .         .         .         .
  0.65      0.0054      0.12  Q         .         .         .         .
  0.81      0.0070      0.12  Q         .         .         .         .
  0.96      0.0086      0.12  Q         .         .         .         .
  1.12      0.0102      0.12  Q         .         .         .         .
  1.27      0.0118      0.13  Q         .         .         .         .
  1.43      0.0134      0.13  Q         .         .         .         .
  1.58      0.0150      0.13  Q         .         .         .         .
  1.74      0.0167      0.13  Q         .         .         .         .
  1.89      0.0183      0.13  Q         .         .         .         .
```

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.05 | 0.0200 | 0.13 | Q | . | . | . | . |
| 2.20 | 0.0216 | 0.13 | Q | . | . | . | . |
| 2.36 | 0.0233 | 0.13 | Q | . | . | . | . |
| 2.51 | 0.0250 | 0.13 | Q | . | . | . | . |
| 2.67 | 0.0267 | 0.13 | Q | . | . | . | . |
| 2.82 | 0.0284 | 0.13 | Q | . | . | . | . |
| 2.98 | 0.0302 | 0.14 | Q | . | . | . | . |
| 3.13 | 0.0319 | 0.14 | Q | . | . | . | . |
| 3.29 | 0.0336 | 0.14 | Q | . | . | . | . |
| 3.44 | 0.0354 | 0.14 | Q | . | . | . | . |
| 3.60 | 0.0372 | 0.14 | Q | . | . | . | . |
| 3.75 | 0.0390 | 0.14 | Q | . | . | . | . |
| 3.91 | 0.0408 | 0.14 | Q | . | . | . | . |
| 4.06 | 0.0426 | 0.14 | Q | . | . | . | . |
| 4.22 | 0.0445 | 0.14 | Q | . | . | . | . |
| 4.38 | 0.0463 | 0.15 | Q | . | . | . | . |
| 4.53 | 0.0482 | 0.15 | Q | . | . | . | . |
| 4.68 | 0.0501 | 0.15 | Q | . | . | . | . |
| 4.84 | 0.0520 | 0.15 | Q | . | . | . | . |
| 4.99 | 0.0539 | 0.15 | Q | . | . | . | . |
| 5.15 | 0.0558 | 0.15 | Q | . | . | . | . |
| 5.30 | 0.0578 | 0.15 | Q | . | . | . | . |
| 5.46 | 0.0598 | 0.15 | Q | . | . | . | . |
| 5.61 | 0.0617 | 0.16 | Q | . | . | . | . |
| 5.77 | 0.0637 | 0.16 | Q | . | . | . | . |
| 5.93 | 0.0658 | 0.16 | Q | . | . | . | . |
| 6.08 | 0.0678 | 0.16 | Q | . | . | . | . |
| 6.23 | 0.0699 | 0.16 | Q | . | . | . | . |
| 6.39 | 0.0720 | 0.16 | Q | . | . | . | . |
| 6.54 | 0.0741 | 0.17 | Q | . | . | . | . |
| 6.70 | 0.0762 | 0.17 | Q | . | . | . | . |
| 6.86 | 0.0783 | 0.17 | Q | . | . | . | . |
| 7.01 | 0.0805 | 0.17 | Q | . | . | . | . |
| 7.16 | 0.0827 | 0.17 | Q | . | . | . | . |
| 7.32 | 0.0849 | 0.17 | Q | . | . | . | . |
| 7.47 | 0.0872 | 0.18 | Q | . | . | . | . |
| 7.63 | 0.0894 | 0.18 | Q | . | . | . | . |
| 7.78 | 0.0917 | 0.18 | Q | . | . | . | . |
| 7.94 | 0.0941 | 0.18 | Q | . | . | . | . |
| 8.09 | 0.0964 | 0.18 | Q | . | . | . | . |
| 8.25 | 0.0988 | 0.19 | Q | . | . | . | . |
| 8.40 | 0.1012 | 0.19 | Q | . | . | . | . |
| 8.56 | 0.1036 | 0.19 | Q | . | . | . | . |
| 8.71 | 0.1061 | 0.19 | Q | . | . | . | . |
| 8.87 | 0.1086 | 0.20 | Q | . | . | . | . |
| 9.02 | 0.1111 | 0.20 | Q | . | . | . | . |
| 9.18 | 0.1137 | 0.20 | Q | . | . | . | . |
| 9.34 | 0.1163 | 0.21 | Q | . | . | . | . |
| 9.49 | 0.1189 | 0.21 | Q | . | . | . | . |
| 9.65 | 0.1216 | 0.21 | Q | . | . | . | . |
| 9.80 | 0.1243 | 0.21 | Q | . | . | . | . |
| 9.95 | 0.1271 | 0.22 | Q | . | . | . | . |
| 10.11 | 0.1299 | 0.22 | Q | . | . | . | . |
| 10.26 | 0.1328 | 0.23 | Q | . | . | . | . |
| 10.42 | 0.1357 | 0.23 | Q | . | . | . | . |
| 10.57 | 0.1386 | 0.23 | Q | . | . | . | . |
| 10.73 | 0.1416 | 0.24 | Q | . | . | . | . |
| 10.88 | 0.1447 | 0.24 | Q | . | . | . | . |
| 11.04 | 0.1478 | 0.24 | Q | . | . | . | . |
| 11.20 | 0.1510 | 0.25 | .Q | . | . | . | . |
| 11.35 | 0.1542 | 0.25 | .Q | . | . | . | . |

| | | | |
|---|---|---|---|
| 11.51 | 0.1575 | 0.26 | .Q . . . . |
| 11.66 | 0.1609 | 0.27 | .Q . . . . |
| 11.82 | 0.1643 | 0.27 | .Q . . . . |
| 11.97 | 0.1679 | 0.28 | .Q . . . . |
| 12.12 | 0.1718 | 0.33 | .Q . . . . |
| 12.28 | 0.1761 | 0.35 | .Q . . . . |
| 12.43 | 0.1807 | 0.36 | .Q . . . . |
| 12.59 | 0.1854 | 0.37 | .Q . . . . |
| 12.74 | 0.1902 | 0.38 | .Q . . . . |
| 12.90 | 0.1951 | 0.39 | .Q . . . . |
| 13.05 | 0.2002 | 0.40 | .Q . . . . |
| 13.21 | 0.2054 | 0.41 | .Q . . . . |
| 13.37 | 0.2108 | 0.43 | .Q . . . . |
| 13.52 | 0.2163 | 0.44 | .Q . . . . |
| 13.68 | 0.2220 | 0.46 | .Q . . . . |
| 13.83 | 0.2279 | 0.47 | .Q . . . . |
| 13.98 | 0.2340 | 0.49 | .Q . . . . |
| 14.14 | 0.2404 | 0.51 | . Q . . . . |
| 14.30 | 0.2472 | 0.55 | . Q . . . . |
| 14.45 | 0.2544 | 0.57 | . Q . . . . |
| 14.60 | 0.2620 | 0.61 | . Q . . . . |
| 14.76 | 0.2700 | 0.63 | . Q . . . . |
| 14.91 | 0.2785 | 0.69 | . Q . . . . |
| 15.07 | 0.2876 | 0.73 | . Q . . . . |
| 15.23 | 0.2977 | 0.85 | . Q . . . . |
| 15.38 | 0.3092 | 0.93 | . Q . . . . |
| 15.53 | 0.3213 | 0.96 | . Q . . . . |
| 15.69 | 0.3346 | 1.12 | . Q . . . . |
| 15.85 | 0.3529 | 1.75 | . Q . . . . |
| 16.00 | 0.3801 | 2.49 | . Q. . . . |
| 16.16 | 0.4473 | 8.00 | . . . . Q . |
| 16.31 | 0.5072 | 1.35 | . Q . . . . |
| 16.47 | 0.5219 | 0.94 | . Q . . . . |
| 16.62 | 0.5330 | 0.79 | . Q . . . . |
| 16.77 | 0.5422 | 0.66 | . Q . . . . |
| 16.93 | 0.5503 | 0.59 | . Q . . . . |
| 17.08 | 0.5575 | 0.54 | . Q . . . . |
| 17.24 | 0.5640 | 0.48 | .Q . . . . |
| 17.39 | 0.5699 | 0.44 | .Q . . . . |
| 17.55 | 0.5754 | 0.42 | .Q . . . . |
| 17.70 | 0.5806 | 0.39 | .Q . . . . |
| 17.86 | 0.5856 | 0.38 | .Q . . . . |
| 18.02 | 0.5902 | 0.36 | .Q . . . . |
| 18.17 | 0.5943 | 0.28 | .Q . . . . |
| 18.33 | 0.5979 | 0.27 | .Q . . . . |
| 18.48 | 0.6012 | 0.26 | .Q . . . . |
| 18.64 | 0.6045 | 0.25 | Q . . . . |
| 18.79 | 0.6076 | 0.24 | Q . . . . |
| 18.94 | 0.6106 | 0.23 | Q . . . . |
| 19.10 | 0.6135 | 0.22 | Q . . . . |
| 19.26 | 0.6163 | 0.22 | Q . . . . |
| 19.41 | 0.6190 | 0.21 | Q . . . . |
| 19.57 | 0.6217 | 0.20 | Q . . . . |
| 19.72 | 0.6243 | 0.20 | Q . . . . |
| 19.88 | 0.6268 | 0.19 | Q . . . . |
| 20.03 | 0.6292 | 0.19 | Q . . . . |
| 20.18 | 0.6316 | 0.18 | Q . . . . |
| 20.34 | 0.6339 | 0.18 | Q . . . . |
| 20.49 | 0.6362 | 0.18 | Q . . . . |
| 20.65 | 0.6384 | 0.17 | Q . . . . |
| 20.81 | 0.6405 | 0.17 | Q . . . . |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 20.96 | 0.6427 | 0.16 | Q | . | . | . | . |
| 21.11 | 0.6448 | 0.16 | Q | . | . | . | . |
| 21.27 | 0.6468 | 0.16 | Q | . | . | . | . |
| 21.42 | 0.6488 | 0.16 | Q | . | . | . | . |
| 21.58 | 0.6508 | 0.15 | Q | . | . | . | . |
| 21.73 | 0.6527 | 0.15 | Q | . | . | . | . |
| 21.89 | 0.6546 | 0.15 | Q | . | . | . | . |
| 22.05 | 0.6565 | 0.14 | Q | . | . | . | . |
| 22.20 | 0.6583 | 0.14 | Q | . | . | . | . |
| 22.36 | 0.6601 | 0.14 | Q | . | . | . | . |
| 22.51 | 0.6619 | 0.14 | Q | . | . | . | . |
| 22.67 | 0.6637 | 0.14 | Q | . | . | . | . |
| 22.82 | 0.6654 | 0.13 | Q | . | . | . | . |
| 22.98 | 0.6671 | 0.13 | Q | . | . | . | . |
| 23.13 | 0.6688 | 0.13 | Q | . | . | . | . |
| 23.28 | 0.6704 | 0.13 | Q | . | . | . | . |
| 23.44 | 0.6721 | 0.13 | Q | . | . | . | . |
| 23.59 | 0.6737 | 0.13 | Q | . | . | . | . |
| 23.75 | 0.6753 | 0.12 | Q | . | . | . | . |
| 23.91 | 0.6769 | 0.12 | Q | . | . | . | . |
| 24.06 | 0.6784 | 0.12 | Q | . | . | . | . |
| 24.22 | 0.6792 | 0.00 | Q | . | . | . | . |

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

| Percentile of Estimated Peak Flow Rate | Duration (minutes) |
|---|---|
| 0% | 1441.5 |
| 10% | 83.7 |
| 20% | 27.9 |
| 30% | 18.6 |
| 40% | 9.3 |
| 50% | 9.3 |
| 60% | 9.3 |
| 70% | 9.3 |
| 80% | 9.3 |
| 90% | 9.3 |

```
****************************************************************************
          NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
                    AND LOW LOSS FRACTION ESTIMATIONS
============================================================================
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                          Analysis prepared by:

                              RBF Consulting


****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  Proposed Area N
  2 year
  Loss Rate
============================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
    AND LOW LOSS FRACTION ESTIMATIONS FOR AMC II:

    TOTAL 24-HOUR DURATION RAINFALL DEPTH =     2.05 (inches)
```

| SOIL-COVER TYPE | AREA (Acres) | PERCENT OF PERVIOUS AREA | SCS CURVE NUMBER | LOSS RATE Fp(in./hr.) | YIELD |
|---|---|---|---|---|---|
| 1 | 1.38 | 10.00 | 69. | 0.250 | 0.812 |
| 2 | 1.12 | 20.00 | 69. | 0.250 | 0.735 |
| 3 | 0.03 | 50.00 | 69. | 0.250 | 0.502 |
| 4 | 0.87 | 10.00 | 75. | 0.200 | 0.821 |
| 5 | 0.42 | 70.00 | 69. | 0.250 | 0.347 |
| 6 | 1.37 | 10.00 | 75. | 0.200 | 0.821 |
| 7 | 0.40 | 70.00 | 75. | 0.200 | 0.405 |
| 8 | 0.10 | 85.00 | 69. | 0.250 | 0.231 |
| 9 | 0.10 | 85.00 | 75. | 0.200 | 0.302 |
| 10 | 0.01 | 50.00 | 69. | 0.250 | 0.502 |

```
    TOTAL AREA (Acres) =      5.80

    AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.053

    AREA-AVERAGED LOW LOSS FRACTION, Y = 0.282
============================================================================
```

```
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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            Ver. 18.0  Release Date: 07/01/2011  License ID 1264

                         Analysis prepared by:

                             RBF Consulting



 ************************* DESCRIPTION OF STUDY *************************
* Existing A - 2-year storm                                              *
*                                                                        *
*                                                                        *
 ************************************************************************

  FILE NAME: 8112EA02.DAT
  TIME/DATE OF STUDY: 10:23 05/15/2012
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  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 0.0312 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    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   250.00
  ELEVATION DATA: UPSTREAM(FEET) =    790.80  DOWNSTREAM(FEET) =    783.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.610
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.119
  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                  C       0.50      0.25     0.100    69    5.61
```



```
  COMMERCIAL                  D       0.15      0.20     0.100    75    5.61
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.24
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =       1.23
  TOTAL AREA(ACRES) =       0.65   PEAK FLOW RATE(CFS) =       1.23

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    783.50
  DOWNSTREAM NODE ELEVATION(FEET) =    783.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   139.00
  "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.125
  PAVEMENT LIP(FEET) =  0.020   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   2.00
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.828
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C       0.62      0.25     0.100    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.73
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.41
  AVERAGE FLOW DEPTH(FEET) =   0.26   FLOOD WIDTH(FEET) =   14.32
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.65   Tc(MIN.) =    7.26
  SUBAREA AREA(ACRES) =    0.62       SUBAREA RUNOFF(CFS) =    1.01
  EFFECTIVE AREA(ACRES) =    1.27     AREA-AVERAGED Fm(INCH/HR) =   0.02
  AREA-AVERAGED Fp(INCH/HR) =   0.24  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        1.3         PEAK FLOW RATE(CFS) =       2.06

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.27   FLOOD WIDTH(FEET) =   15.77
  FLOW VELOCITY(FEET/SEC.) =   1.43   DEPTH*VELOCITY(FT*FT/SEC) =   0.39
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     389.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   779.73  DOWNSTREAM(FEET) =   774.60
  FLOW LENGTH(FEET) =   223.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.99
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        2.06
  PIPE TRAVEL TIME(MIN.) =   0.62    Tc(MIN.) =    7.88
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     612.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.88
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.744
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
```

```
        LAND USE              GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                    C       1.02      0.25      0.100    69
  COMMERCIAL                    D       0.02      0.20      0.100    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     1.04      SUBAREA RUNOFF(CFS) =     1.61
  EFFECTIVE AREA(ACRES) =       2.31   AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =         2.3       PEAK FLOW RATE(CFS) =       3.57

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   774.60  DOWNSTREAM(FEET) =   768.70
  FLOW LENGTH(FEET) =   141.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.68
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        3.57
  PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =    8.15
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =     753.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.15
  RAINFALL INTENSITY(INCH/HR) =   1.71
  AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.25
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =        2.31
  TOTAL STREAM AREA(ACRES) =        2.31
  PEAK FLOW RATE(CFS) AT CONFLUENCE =        3.57

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 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) =    790.80  DOWNSTREAM(FEET) =    785.80

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.148
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.844
  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                    C       0.29      0.25      0.100    69    7.15
  COMMERCIAL                    D       0.04      0.20      0.100    75    7.15
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.24
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =       0.54
  TOTAL AREA(ACRES) =       0.33   PEAK FLOW RATE(CFS) =       0.54
```



```
****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  785.80  DOWNSTREAM ELEVATION(FEET) =  776.60
  STREET LENGTH(FEET) =   300.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 32.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  27.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.84
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.20
    HALFSTREET FLOOD WIDTH(FEET) =    2.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.80
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.75
  STREET FLOW TRAVEL TIME(MIN.) =   1.32   Tc(MIN.) =    8.46
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.674
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                    C       0.40      0.25      0.100    69
  COMMERCIAL                    B       0.01      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.41      SUBAREA RUNOFF(CFS) =    0.61
  EFFECTIVE AREA(ACRES) =       0.74    AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =         0.7        PEAK FLOW RATE(CFS) =       1.10

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.24   HALFSTREET FLOOD WIDTH(FEET) =   3.85
  FLOW VELOCITY(FEET/SEC.) =  3.25   DEPTH*VELOCITY(FT*FT/SEC.) =   0.77
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =     630.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    104.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  776.60  DOWNSTREAM ELEVATION(FEET) =  774.00
  STREET LENGTH(FEET) =   280.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 32.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  27.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.37
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    7.13
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.96
```

```
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.59
  STREET FLOW TRAVEL TIME(MIN.) =   2.38   Tc(MIN.) =   10.84
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.452
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        0.42      0.25     0.100    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.42      SUBAREA RUNOFF(CFS) =    0.54
  EFFECTIVE AREA(ACRES) =      1.16    AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        1.2        PEAK FLOW RATE(CFS) =       1.49

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =   7.48
  FLOW VELOCITY(FEET/SEC.) =  1.99   DEPTH*VELOCITY(FT*FT/SEC.) =   0.61
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    104.00 =     910.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.84
  RAINFALL INTENSITY(INCH/HR) =   1.45
  AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.25
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.16
  TOTAL STREAM AREA(ACRES) =       1.16
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.49

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1        3.57    8.15    1.710  0.25( 0.02) 0.10       2.3     100.00
      2        1.49   10.84    1.452  0.25( 0.02) 0.10       1.2     120.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1        4.90    8.15    1.710  0.25( 0.02) 0.10       3.2     100.00
      2        4.52   10.84    1.452  0.25( 0.02) 0.10       3.5     120.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       4.90    Tc(MIN.) =     8.15
  EFFECTIVE AREA(ACRES) =       3.18   AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        3.5
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    104.00 =     910.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =        3.5  TC(MIN.) =      8.15
  EFFECTIVE AREA(ACRES) =       3.18  AREA-AVERAGED Fm(INCH/HR)=  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)    =       4.90
```



```
  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1        4.90    8.15    1.710  0.25( 0.02) 0.10       3.2     100.00
      2        4.52   10.84    1.452  0.25( 0.02) 0.10       3.5     120.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 18.0  Release Date: 07/01/2011  License ID 1264

                          Analysis prepared by:

                              RBF Consulting


 ************************* DESCRIPTION OF STUDY *************************
* Proposed Area A - 2-year                                               *
*                                                                        *
*                                                                        *
 ************************************************************************

  FILE NAME: 8112PA02.DAT
  TIME/DATE OF STUDY: 13:30 05/02/2012
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  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 0.0312 0.167 0.0150
  2   13.0      8.0    0.020/0.020/ ---    0.33    1.00 0.0312 0.125 0.0150
  3   32.0     27.0    0.020/0.020/ ---    0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  1.00 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    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   200.00
  ELEVATION DATA: UPSTREAM(FEET) =    789.50  DOWNSTREAM(FEET) =    787.08

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.120
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.016
  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                  C       0.05      0.25      0.100    69    6.12
  APARTMENTS                  C       0.15      0.25      0.200    69    6.52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.175
  SUBAREA RUNOFF(CFS) =      0.35
  TOTAL AREA(ACRES) =      0.20   PEAK FLOW RATE(CFS) =      0.35

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    101.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.12
  RAINFALL INTENSITY(INCH/HR) =   2.02
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.25
  AREA-AVERAGED Ap =  0.17
  EFFECTIVE STREAM AREA(ACRES) =       0.20
  TOTAL STREAM AREA(ACRES) =       0.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.35

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   136.00
  ELEVATION DATA: UPSTREAM(FEET) =    789.00  DOWNSTREAM(FEET) =    787.08

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.086
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.242
  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                  C       0.04      0.25      0.100    69    5.09
  APARTMENTS                  C       0.15      0.25      0.200    69    5.42
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.179
  SUBAREA RUNOFF(CFS) =      0.38
  TOTAL AREA(ACRES) =      0.19   PEAK FLOW RATE(CFS) =      0.38

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    101.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.09
  RAINFALL INTENSITY(INCH/HR) =   2.24
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.25
  AREA-AVERAGED Ap =  0.18
  EFFECTIVE STREAM AREA(ACRES) =       0.19
  TOTAL STREAM AREA(ACRES) =       0.19
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.38

  ** CONFLUENCE DATA **
```

```
 STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1       0.35    6.12    2.016  0.25( 0.04) 0.17       0.2     100.00
    2       0.38    5.09    2.242  0.25( 0.04) 0.18       0.2     102.00

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

** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1       0.70    5.09    2.242  0.25( 0.04) 0.18       0.4     102.00
    2       0.69    6.12    2.016  0.25( 0.04) 0.18       0.4     100.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       0.70    Tc(MIN.) =     5.09
EFFECTIVE AREA(ACRES) =       0.36   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.18
TOTAL AREA(ACRES) =        0.4
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    101.00 =     200.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    101.00 TO NODE    101.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =    5.09
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.242
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"          C        0.12      0.25     0.800    69
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.800
SUBAREA AREA(ACRES) =    0.12      SUBAREA RUNOFF(CFS) =    0.22
EFFECTIVE AREA(ACRES) =      0.48   AREA-AVERAGED Fm(INCH/HR) =  0.08
AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.33
TOTAL AREA(ACRES) =        0.5       PEAK FLOW RATE(CFS) =       0.92

****************************************************************************
FLOW PROCESS FROM NODE    101.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   781.08  DOWNSTREAM(FEET) =   776.84
FLOW LENGTH(FEET) =   294.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.01
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       0.92
PIPE TRAVEL TIME(MIN.) =   1.22    Tc(MIN.) =    6.31
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     494.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  10
----------------------------------------------------------------------------
>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  21
```



```
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =   142.00
ELEVATION DATA: UPSTREAM(FEET) =    789.50  DOWNSTREAM(FEET) =    787.60

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.230
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.206
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                 C        0.04      0.25     0.100    69    5.23
APARTMENTS                 C        0.10      0.25     0.200    69    5.57
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.171
SUBAREA RUNOFF(CFS) =       0.27
TOTAL AREA(ACRES) =       0.14   PEAK FLOW RATE(CFS) =       0.27

****************************************************************************
FLOW PROCESS FROM NODE    111.00 TO NODE    111.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =    5.23
RAINFALL INTENSITY(INCH/HR) =   2.21
AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.25
AREA-AVERAGED Ap =  0.17
EFFECTIVE STREAM AREA(ACRES) =       0.14
TOTAL STREAM AREA(ACRES) =       0.14
PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.27

****************************************************************************
FLOW PROCESS FROM NODE    112.00 TO NODE    111.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =   198.00
ELEVATION DATA: UPSTREAM(FEET) =    790.60  DOWNSTREAM(FEET) =    787.60

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.210
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.999
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.)
APARTMENTS                 C        0.05      0.25     0.200    69    6.21
APARTMENTS                 D        0.13      0.20     0.200    75    6.21
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.21
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
SUBAREA RUNOFF(CFS) =       0.32
TOTAL AREA(ACRES) =       0.18   PEAK FLOW RATE(CFS) =       0.32

****************************************************************************
FLOW PROCESS FROM NODE    111.00 TO NODE    111.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
```

```
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 6.21
RAINFALL INTENSITY(INCH/HR) = 2.00
AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.21
AREA-AVERAGED Ap = 0.20
EFFECTIVE STREAM AREA(ACRES) = 0.18
TOTAL STREAM AREA(ACRES) = 0.18
PEAK FLOW RATE(CFS) AT CONFLUENCE = 0.32

** CONFLUENCE DATA **
 STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1       0.27    5.23    2.206  0.25( 0.04) 0.17      0.1     110.00
    2       0.32    6.21    1.999  0.21( 0.04) 0.20      0.2     112.00

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

** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1       0.57    5.23    2.206  0.23( 0.04) 0.19      0.3     110.00
    2       0.56    6.21    1.999  0.23( 0.04) 0.19      0.3     112.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 0.57  Tc(MIN.) = 5.23
EFFECTIVE AREA(ACRES) = 0.29  AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.23  AREA-AVERAGED Ap = 0.19
TOTAL AREA(ACRES) = 0.3
LONGEST FLOWPATH FROM NODE  112.00 TO NODE  111.00 = 198.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE  111.00 TO NODE  111.00 IS CODE = 81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) = 5.23
*  2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.206
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 C       0.03      0.25      0.100    69
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.03  SUBAREA RUNOFF(CFS) = 0.06
EFFECTIVE AREA(ACRES) = 0.32  AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.23  AREA-AVERAGED Ap = 0.18
TOTAL AREA(ACRES) = 0.3  PEAK FLOW RATE(CFS) = 0.63

****************************************************************************
FLOW PROCESS FROM NODE  111.00 TO NODE  113.00 IS CODE = 62
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) = 787.60  DOWNSTREAM ELEVATION(FEET) = 782.29
STREET LENGTH(FEET) = 235.00  CURB HEIGHT(INCHES) = 4.0
STREET HALFWIDTH(FEET) = 13.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 8.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020
```



```
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.69
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) = 0.23
  HALFSTREET FLOOD WIDTH(FEET) = 4.61
  AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.34
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.53
STREET FLOW TRAVEL TIME(MIN.) = 1.67  Tc(MIN.) = 6.90
*  2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.881
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 C       0.08      0.25      0.100    69
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.08  SUBAREA RUNOFF(CFS) = 0.13
EFFECTIVE AREA(ACRES) = 0.40  AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.23  AREA-AVERAGED Ap = 0.16
TOTAL AREA(ACRES) = 0.4  PEAK FLOW RATE(CFS) = 0.67

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.23  HALFSTREET FLOOD WIDTH(FEET) = 4.52
FLOW VELOCITY(FEET/SEC.) = 2.32  DEPTH*VELOCITY(FT*FT/SEC.) = 0.52
LONGEST FLOWPATH FROM NODE  112.00 TO NODE  113.00 = 433.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE  113.00 TO NODE  113.00 IS CODE = 81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) = 6.90
*  2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.881
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
APARTMENTS                 C       0.16      0.25      0.200    69
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA AREA(ACRES) = 0.16  SUBAREA RUNOFF(CFS) = 0.26
EFFECTIVE AREA(ACRES) = 0.56  AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.24  AREA-AVERAGED Ap = 0.17
TOTAL AREA(ACRES) = 0.6  PEAK FLOW RATE(CFS) = 0.93

****************************************************************************
FLOW PROCESS FROM NODE  113.00 TO NODE  113.00 IS CODE = 81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) = 6.90
*  2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.881
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 C       0.05      0.25      0.100    69
APARTMENTS                 C       0.15      0.25      0.200    69
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.175
SUBAREA AREA(ACRES) = 0.20  SUBAREA RUNOFF(CFS) = 0.33
EFFECTIVE AREA(ACRES) = 0.76  AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.24  AREA-AVERAGED Ap = 0.17
TOTAL AREA(ACRES) = 0.8  PEAK FLOW RATE(CFS) = 1.26
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.90
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.881
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "2 DWELLINGS/ACRE"          C        0.15      0.25      0.700    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA AREA(ACRES) =    0.15       SUBAREA RUNOFF(CFS) =    0.23
  EFFECTIVE AREA(ACRES) =       0.91   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.26
  TOTAL AREA(ACRES) =         0.9       PEAK FLOW RATE(CFS) =       1.49

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   777.30  DOWNSTREAM(FEET) =   776.84
  FLOW LENGTH(FEET) =   171.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.53
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        1.49
  PIPE TRAVEL TIME(MIN.) =   1.13    Tc(MIN.) =    8.03
  LONGEST FLOWPATH FROM NODE    112.00 TO NODE    103.00 =     604.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 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         1.49    8.03    1.725  0.25( 0.06) 0.26        0.9     110.00
      2         1.42    9.06    1.609  0.24( 0.06) 0.26        0.9     112.00
  LONGEST FLOWPATH FROM NODE    112.00 TO NODE    103.00 =     604.00 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         0.92    6.31    1.981  0.25( 0.08) 0.33        0.5     102.00
      2         0.89    7.35    1.814  0.25( 0.08) 0.32        0.5     100.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     494.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
      1         2.28    6.31    1.981  0.25( 0.07) 0.29        1.2     102.00
      2         2.33    7.35    1.814  0.25( 0.07) 0.28        1.3     100.00
      3         2.33    8.03    1.725  0.25( 0.07) 0.28        1.4     110.00
      4         2.20    9.06    1.609  0.25( 0.07) 0.28        1.5     112.00
    TOTAL AREA(ACRES) =          1.5
```



```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =        2.33  Tc(MIN.) =    8.029
  EFFECTIVE AREA(ACRES) =      1.42  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.29
  TOTAL AREA(ACRES) =        1.5
  LONGEST FLOWPATH FROM NODE    112.00 TO NODE    103.00 =     604.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   776.84  DOWNSTREAM(FEET) =   774.78
  FLOW LENGTH(FEET) =   146.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.21
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        2.33
  PIPE TRAVEL TIME(MIN.) =   0.47    Tc(MIN.) =    8.50
  LONGEST FLOWPATH FROM NODE    112.00 TO NODE    104.00 =     750.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.50
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.670
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        0.18      0.25      0.100    69
  APARTMENTS                  C        0.24      0.25      0.200    69
  RESIDENTIAL
  "2 DWELLINGS/ACRE"          C        0.15      0.25      0.700    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.300
  SUBAREA AREA(ACRES) =    0.57       SUBAREA RUNOFF(CFS) =    0.82
  EFFECTIVE AREA(ACRES) =       1.99   AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.29
  TOTAL AREA(ACRES) =         2.0       PEAK FLOW RATE(CFS) =       2.86

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
      1         2.90    6.78    1.901  0.25( 0.07) 0.29        1.8     102.00
      2         2.89    7.82    1.751  0.25( 0.07) 0.29        1.9     100.00
      3         2.86    8.50    1.670  0.25( 0.07) 0.29        2.0     110.00
      4         2.71    9.54    1.562  0.25( 0.07) 0.29        2.0     112.00
  NEW PEAK FLOW DATA ARE:
  PEAK FLOW RATE(CFS) =        2.90  Tc(MIN.) =    6.78
  AREA-AVERAGED Fm(INCH/HR) =  0.07  AREA-AVERAGED Fp(INCH/HR) =  0.25
  AREA-AVERAGED Ap =  0.29  EFFECTIVE AREA(ACRES) =        1.76

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

```
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  31
 ----------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
 ======================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   774.78  DOWNSTREAM(FEET) =   773.00
  FLOW LENGTH(FEET) =   126.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.54
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.90
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =    7.16
  LONGEST FLOWPATH FROM NODE    112.00 TO NODE    105.00 =     876.00 FEET.

 **********************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
 ----------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
 ======================================================================
  MAINLINE Tc(MIN.) =    7.16
  *   2 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                  C       0.07      0.25      0.100    69
  APARTMENTS                  C       0.28      0.25      0.200    69
  RESIDENTIAL
  "2 DWELLINGS/ACRE"          C       0.11      0.25      0.700    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.304
  SUBAREA AREA(ACRES) =    0.46      SUBAREA RUNOFF(CFS) =    0.73
  EFFECTIVE AREA(ACRES) =      2.22   AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.30
  TOTAL AREA(ACRES) =        2.5       PEAK FLOW RATE(CFS) =       3.54

 **********************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  31
 ----------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
 ======================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   773.00  DOWNSTREAM(FEET) =   768.00
  FLOW LENGTH(FEET) =    57.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.26
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.54
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    7.24
  LONGEST FLOWPATH FROM NODE    112.00 TO NODE    106.00 =     933.00 FEET.

 **********************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =   1
 ----------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 ======================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.24
  RAINFALL INTENSITY(INCH/HR) =   1.83
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.25
  AREA-AVERAGED Ap =  0.30
```



```
  EFFECTIVE STREAM AREA(ACRES) =       2.22
  TOTAL STREAM AREA(ACRES) =       2.48
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.54

 **********************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    141.00 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) =    790.80  DOWNSTREAM(FEET) =    785.80

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.148
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.844
  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                  C       0.28      0.25      0.100    69    7.15
  COMMERCIAL                  D       0.04      0.20      0.100    75    7.15
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.24
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =       0.52
  TOTAL AREA(ACRES) =       0.32   PEAK FLOW RATE(CFS) =       0.52

 **********************************************************************
  FLOW PROCESS FROM NODE    141.00 TO NODE    142.00 IS CODE =  62
 ----------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
 ======================================================================
  UPSTREAM ELEVATION(FEET) =  785.80  DOWNSTREAM ELEVATION(FEET) =  776.60
  STREET LENGTH(FEET) =   300.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 32.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  27.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.75
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.20
    HALFSTREET FLOOD WIDTH(FEET) =    2.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.80
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.75
  STREET FLOW TRAVEL TIME(MIN.) =   1.32   Tc(MIN.) =    8.46
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.674
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C       0.29      0.25      0.100    69
  COMMERCIAL                  B       0.01      0.30      0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.30      SUBAREA RUNOFF(CFS) =    0.45
  EFFECTIVE AREA(ACRES) =      0.62   AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        0.6       PEAK FLOW RATE(CFS) =       0.92

  END OF SUBAREA STREET FLOW HYDRAULICS:
```

```
DEPTH(FEET) = 0.21   HALFSTREET FLOOD WIDTH(FEET) =   2.79
FLOW VELOCITY(FEET/SEC.) =  3.44   DEPTH*VELOCITY(FT*FT/SEC.) =   0.74
LONGEST FLOWPATH FROM NODE    140.00 TO NODE    142.00 =     630.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    142.00 TO NODE    106.00 IS CODE =  62
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  776.60  DOWNSTREAM ELEVATION(FEET) =  774.00
STREET LENGTH(FEET) =   280.00   CURB HEIGHT(INCHES) =  8.0
STREET HALFWIDTH(FEET) = 32.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  27.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.16
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.29
  HALFSTREET FLOOD WIDTH(FEET) =    6.48
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.90
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.55
STREET FLOW TRAVEL TIME(MIN.) =   2.46   Tc(MIN.) =   10.92
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.446
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 C        0.37      0.25      0.100    69
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    0.37      SUBAREA RUNOFF(CFS) =    0.47
EFFECTIVE AREA(ACRES) =       0.99    AREA-AVERAGED Fm(INCH/HR) =  0.02
AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =         1.0        PEAK FLOW RATE(CFS) =       1.27

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   6.83
FLOW VELOCITY(FEET/SEC.) =  1.93   DEPTH*VELOCITY(FT*FT/SEC.) =   0.57
LONGEST FLOWPATH FROM NODE    140.00 TO NODE    106.00 =     910.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   10.92
RAINFALL INTENSITY(INCH/HR) =   1.45
AREA-AVERAGED Fm(INCH/HR) =  0.02
AREA-AVERAGED Fp(INCH/HR) =  0.25
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =       0.99
TOTAL STREAM AREA(ACRES) =       0.99
PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.27

** CONFLUENCE DATA **
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
```



```
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1        3.54    7.24    1.830  0.25( 0.07) 0.30       2.2     102.00
    1        3.49    8.28    1.694  0.25( 0.07) 0.29       2.4     100.00
    1        3.43    8.96    1.619  0.25( 0.07) 0.29       2.5     110.00
    1        3.25   10.01    1.520  0.25( 0.07) 0.29       2.5     112.00
    2        1.27   10.92    1.446  0.25( 0.02) 0.10       1.0     140.00

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

** PEAK FLOW RATE TABLE **
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1        4.60    7.24    1.830  0.25( 0.06) 0.25       2.9     102.00
    2        4.62    8.28    1.694  0.25( 0.06) 0.25       3.1     100.00
    3        4.60    8.96    1.619  0.25( 0.06) 0.24       3.3     110.00
    4        4.47   10.01    1.520  0.25( 0.06) 0.24       3.4     112.00
    5        4.35   10.92    1.446  0.25( 0.06) 0.24       3.5     140.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       4.62    Tc(MIN.) =     8.28
EFFECTIVE AREA(ACRES) =       3.13   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.25
TOTAL AREA(ACRES) =        3.5
LONGEST FLOWPATH FROM NODE    112.00 TO NODE    106.00 =     933.00 FEET.
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =        3.5  TC(MIN.) =      8.28
EFFECTIVE AREA(ACRES) =       3.13  AREA-AVERAGED Fm(INCH/HR)=  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap = 0.246
PEAK FLOW RATE(CFS)    =       4.62

** PEAK FLOW RATE TABLE **
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1        4.60    7.24    1.830  0.25( 0.06) 0.25       2.9     102.00
    2        4.62    8.28    1.694  0.25( 0.06) 0.25       3.1     100.00
    3        4.60    8.96    1.619  0.25( 0.06) 0.24       3.3     110.00
    4        4.47   10.01    1.520  0.25( 0.06) 0.24       3.4     112.00
    5        4.35   10.92    1.446  0.25( 0.06) 0.24       3.5     140.00
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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            Ver. 18.0  Release Date: 07/01/2011  License ID 1264

                         Analysis prepared by:

                             RBF Consulting



 ************************* DESCRIPTION OF STUDY *************************
 * Existing Area N  2-year                                              *
 *                                                                      *
 *                                                                      *
 ************************************************************************

  FILE NAME: 8112EN02.DAT
  TIME/DATE OF STUDY: 11:28 05/15/2012
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  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 0.0312 0.167 0.0150
  2   32.0     27.0    0.020/0.020/ ---    0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  1.00 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    200.00 TO NODE    201.00 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) =    790.80  DOWNSTREAM(FEET) =    784.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.722
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.910
  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      0.100    75    6.72
  COMMERCIAL                 C        0.04      0.25      0.100    69    6.72
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.45
  TOTAL AREA(ACRES) =      0.85   PEAK FLOW RATE(CFS) =      1.45

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    784.00
  DOWNSTREAM NODE ELEVATION(FEET) =    783.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   173.00
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.123
  PAVEMENT LIP(FEET) =  0.020   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   2.00
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.696
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.31      0.25      0.100    69
  COMMERCIAL                 D        0.95      0.20      0.100    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.21
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.40
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.86
  AVERAGE FLOW DEPTH(FEET) =   0.23   FLOOD WIDTH(FEET) =   14.16
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.55   Tc(MIN.) =    8.27
  SUBAREA AREA(ACRES) =    1.26       SUBAREA RUNOFF(CFS) =    1.90
  EFFECTIVE AREA(ACRES) =    2.11     AREA-AVERAGED Fm(INCH/HR) =   0.02
  AREA-AVERAGED Fp(INCH/HR) =   0.21  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        2.1         PEAK FLOW RATE(CFS) =       3.18

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.26   FLOOD WIDTH(FEET) =   16.33
  FLOW VELOCITY(FEET/SEC.) =   1.97   DEPTH*VELOCITY(FT*FT/SEC) =   0.50
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     503.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    783.00
  DOWNSTREAM NODE ELEVATION(FEET) =    780.40
  CHANNEL LENGTH THRU SUBAREA(FEET) =   172.00
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.123
  PAVEMENT LIP(FEET) =  0.020   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   2.00
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.592
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.40      0.25      0.100    69
  COMMERCIAL                 D        0.19      0.20      0.100    75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.23
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.60
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.98
  AVERAGE FLOW DEPTH(FEET) =   0.23   FLOOD WIDTH(FEET) =   13.61
```

```
"V" GUTTER FLOW TRAVEL TIME(MIN.) =   0.96   Tc(MIN.) =    9.23
SUBAREA AREA(ACRES) =    0.59       SUBAREA RUNOFF(CFS) =    0.83
EFFECTIVE AREA(ACRES) =    2.70     AREA-AVERAGED Fm(INCH/HR) =   0.02
AREA-AVERAGED Fp(INCH/HR) =   0.21  AREA-AVERAGED Ap =   0.10
TOTAL AREA(ACRES) =        2.7        PEAK FLOW RATE(CFS) =       3.82

END OF SUBAREA "V" GUTTER HYDRAULICS:
DEPTH(FEET) =  0.23   FLOOD WIDTH(FEET) =   13.98
FLOW VELOCITY(FEET/SEC.) =   3.03   DEPTH*VELOCITY(FT*FT/SEC) =   0.71
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     675.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   780.40  DOWNSTREAM(FEET) =   775.50
FLOW LENGTH(FEET) =   234.00   MANNING'S N =  0.009
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   8.98
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =        3.82
PIPE TRAVEL TIME(MIN.) =   0.43    Tc(MIN.) =    9.67
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =     909.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =    9.67
RAINFALL INTENSITY(INCH/HR) =   1.55
AREA-AVERAGED Fm(INCH/HR) =  0.02
AREA-AVERAGED Fp(INCH/HR) =  0.21
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =        2.70
TOTAL STREAM AREA(ACRES) =        2.70
PEAK FLOW RATE(CFS) AT CONFLUENCE =        3.82

****************************************************************************
FLOW PROCESS FROM NODE    210.00 TO NODE    211.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =   236.00
ELEVATION DATA: UPSTREAM(FEET) =    784.50  DOWNSTREAM(FEET) =    777.50

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.465
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.151
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                 C        0.40      0.25      0.100    69    5.47
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA RUNOFF(CFS) =       0.77
TOTAL AREA(ACRES) =       0.40   PEAK FLOW RATE(CFS) =       0.77
```



```
****************************************************************************
FLOW PROCESS FROM NODE    211.00 TO NODE    212.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  777.50  DOWNSTREAM ELEVATION(FEET) =  776.00
STREET LENGTH(FEET) =   108.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 80.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  75.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.13
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.25
  HALFSTREET FLOOD WIDTH(FEET) =    6.37
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.15
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.55
STREET FLOW TRAVEL TIME(MIN.) =   0.84   Tc(MIN.) =    6.30
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.982
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 C        0.41      0.25      0.100    69
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    0.41      SUBAREA RUNOFF(CFS) =    0.72
EFFECTIVE AREA(ACRES) =       0.81    AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       1.43

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   7.21
FLOW VELOCITY(FEET/SEC.) =  2.24   DEPTH*VELOCITY(FT*FT/SEC.) =   0.60
LONGEST FLOWPATH FROM NODE    210.00 TO NODE    212.00 =     344.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    212.00 TO NODE    204.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   776.00  DOWNSTREAM(FEET) =   775.50
FLOW LENGTH(FEET) =    69.00   MANNING'S N =  0.009
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.63
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =        1.43
PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =    6.55
LONGEST FLOWPATH FROM NODE    210.00 TO NODE    204.00 =     413.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
```

```
  TIME OF CONCENTRATION(MIN.) =     6.55
  RAINFALL INTENSITY(INCH/HR) =   1.94
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.25
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =        0.81
  TOTAL STREAM AREA(ACRES) =        0.81
  PEAK FLOW RATE(CFS) AT CONFLUENCE =        1.43

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    204.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   240.00
  ELEVATION DATA: UPSTREAM(FEET) =    782.70  DOWNSTREAM(FEET) =    775.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.490
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.146
  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                  C        0.65      0.25      0.100    69    5.49
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.24
  TOTAL AREA(ACRES) =      0.65   PEAK FLOW RATE(CFS) =      1.24

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =     5.49
  RAINFALL INTENSITY(INCH/HR) =   2.15
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.25
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =        0.65
  TOTAL STREAM AREA(ACRES) =        0.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =        1.24

  ** CONFLUENCE DATA **
   STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
      1         3.82    9.67    1.551  0.21( 0.02) 0.10       2.7     200.00
      2         1.43    6.55    1.939  0.25( 0.03) 0.10       0.8     210.00
      3         1.24    5.49    2.146  0.25( 0.03) 0.10       0.6     220.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
   NUMBER      (CFS)   (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
      1         5.58    5.49    2.146  0.23( 0.02) 0.10       2.9     220.00
      2         5.79    6.55    1.939  0.23( 0.02) 0.10       3.3     210.00
      3         5.85    9.67    1.551  0.23( 0.02) 0.10       4.2     200.00
```



```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       5.85    Tc(MIN.) =     9.67
  EFFECTIVE AREA(ACRES) =       4.16   AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.23  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.2
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =     909.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   775.50  DOWNSTREAM(FEET) =   769.80
  FLOW LENGTH(FEET) =    41.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.34
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.85
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    9.71
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    205.00 =     950.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =     9.71
  RAINFALL INTENSITY(INCH/HR) =   1.55
  AREA-AVERAGED Fm(INCH/HR) =  0.02
  AREA-AVERAGED Fp(INCH/HR) =  0.23
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =        4.16
  TOTAL STREAM AREA(ACRES) =        4.16
  PEAK FLOW RATE(CFS) AT CONFLUENCE =        5.85

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    231.00 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) =    790.80  DOWNSTREAM(FEET) =    786.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.367
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.812
  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      0.100    75    7.37
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      0.52
  TOTAL AREA(ACRES) =      0.32   PEAK FLOW RATE(CFS) =      0.52

****************************************************************************
  FLOW PROCESS FROM NODE    231.00 TO NODE    232.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
>>>>>(STREET TABLE SECTION #  2 USED)<<<<<
==========================================================================
UPSTREAM ELEVATION(FEET) =  786.50  DOWNSTREAM ELEVATION(FEET) =  781.20
STREET LENGTH(FEET) =   330.00   CURB HEIGHT(INCHES) =  8.0
STREET HALFWIDTH(FEET) = 32.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  27.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.75
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.23
  HALFSTREET FLOOD WIDTH(FEET) =    3.55
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.38
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.54
STREET FLOW TRAVEL TIME(MIN.) =   2.32   Tc(MIN.) =    9.68
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.549
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  D        0.34      0.20      0.100    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    0.34      SUBAREA RUNOFF(CFS) =    0.47
EFFECTIVE AREA(ACRES) =       0.66    AREA-AVERAGED Fm(INCH/HR) =  0.02
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =         0.7        PEAK FLOW RATE(CFS) =       0.91

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.25   HALFSTREET FLOOD WIDTH(FEET) =   4.43
FLOW VELOCITY(FEET/SEC.) =  2.35   DEPTH*VELOCITY(FT*FT/SEC.) =   0.58
LONGEST FLOWPATH FROM NODE    230.00 TO NODE    232.00 =     660.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    232.00 TO NODE    205.00 IS CODE =  62
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION #  2 USED)<<<<<
==========================================================================
UPSTREAM ELEVATION(FEET) =  781.20  DOWNSTREAM ELEVATION(FEET) =  769.80
STREET LENGTH(FEET) =   336.00   CURB HEIGHT(INCHES) =  8.0
STREET HALFWIDTH(FEET) = 32.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  27.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.18
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.24
  HALFSTREET FLOOD WIDTH(FEET) =    3.90
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.44
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.81
STREET FLOW TRAVEL TIME(MIN.) =   1.63   Tc(MIN.) =   11.31
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.417
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
```



```
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  C        0.25      0.25      0.100    69
COMMERCIAL                  D        0.18      0.20      0.100    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.23
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    0.43      SUBAREA RUNOFF(CFS) =    0.54
EFFECTIVE AREA(ACRES) =       1.09    AREA-AVERAGED Fm(INCH/HR) =  0.02
AREA-AVERAGED Fp(INCH/HR) =  0.21  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =         1.1        PEAK FLOW RATE(CFS) =       1.37

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.25   HALFSTREET FLOOD WIDTH(FEET) =   4.55
FLOW VELOCITY(FEET/SEC.) =  3.45   DEPTH*VELOCITY(FT*FT/SEC.) =   0.86
LONGEST FLOWPATH FROM NODE    230.00 TO NODE    205.00 =     996.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==========================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   11.31
RAINFALL INTENSITY(INCH/HR) =   1.42
AREA-AVERAGED Fm(INCH/HR) =  0.02
AREA-AVERAGED Fp(INCH/HR) =  0.21
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =       1.09
TOTAL STREAM AREA(ACRES) =       1.09
PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.37

** CONFLUENCE DATA **
 STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1        5.58    5.53    2.135  0.23( 0.02) 0.10       2.9     220.00
    1        5.79    6.59    1.931  0.23( 0.02) 0.10       3.3     210.00
    1        5.85    9.71    1.547  0.23( 0.02) 0.10       4.2     200.00
    2        1.37   11.31    1.417  0.21( 0.02) 0.10       1.1     230.00

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

** PEAK FLOW RATE TABLE **
 STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1        6.59    5.53    2.135  0.23( 0.02) 0.10       3.4     220.00
    2        6.88    6.59    1.931  0.23( 0.02) 0.10       3.9     210.00
    3        7.13    9.71    1.547  0.22( 0.02) 0.10       5.1     200.00
    4        6.72   11.31    1.417  0.22( 0.02) 0.10       5.2     230.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       7.13    Tc(MIN.) =     9.71
EFFECTIVE AREA(ACRES) =       5.10   AREA-AVERAGED Fm(INCH/HR) =  0.02
AREA-AVERAGED Fp(INCH/HR) =  0.22  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =         5.2
LONGEST FLOWPATH FROM NODE    230.00 TO NODE    205.00 =     996.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
MAINLINE Tc(MIN.) =    9.71
```

```
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.547
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  C       0.50      0.25      0.100    69
COMMERCIAL                  D       0.01      0.20      0.100    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    0.51      SUBAREA RUNOFF(CFS) =    0.70
EFFECTIVE AREA(ACRES) =      5.61   AREA-AVERAGED Fm(INCH/HR) =  0.02
AREA-AVERAGED Fp(INCH/HR) =  0.23  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =         5.8       PEAK FLOW RATE(CFS) =       7.69
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =        5.8  TC(MIN.) =      9.71
EFFECTIVE AREA(ACRES) =      5.61  AREA-AVERAGED Fm(INCH/HR)=  0.02
AREA-AVERAGED Fp(INCH/HR) =  0.23  AREA-AVERAGED Ap = 0.100
PEAK FLOW RATE(CFS)    =       7.69

** PEAK FLOW RATE TABLE **
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1        7.43    5.53    2.135  0.23( 0.02) 0.10       3.9     220.00
    2        7.62    6.59    1.931  0.23( 0.02) 0.10       4.4     210.00
    3        7.69    9.71    1.547  0.23( 0.02) 0.10       5.6     200.00
    4        7.23   11.31    1.417  0.23( 0.02) 0.10       5.8     230.00
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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            Ver. 18.0  Release Date: 07/01/2011  License ID 1264

                        Analysis prepared by:

                            RBF Consulting


 ************************* DESCRIPTION OF STUDY *************************
* Proposed Area N  2-year                                                *
*                                                                        *
*                                                                        *
 ************************************************************************

  FILE NAME: 8112PN02.DAT
  TIME/DATE OF STUDY: 08:12 05/18/2012
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  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 0.0312 0.167 0.0150
  2   32.0     27.0    0.020/0.020/ ---    0.67    2.00 0.0312 0.167 0.0150
  3   13.0      8.0    0.020/0.020/ ---    0.33    1.00 0.0312 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  1.00 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    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   196.00
  ELEVATION DATA: UPSTREAM(FEET) =    789.30  DOWNSTREAM(FEET) =    787.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.108
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.018
  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.)
  APARTMENTS                 D       0.15      0.20      0.200    75    6.51
  COMMERCIAL                 D       0.05      0.20      0.100    75    6.11
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.175
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.20   PEAK FLOW RATE(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    201.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.11
  RAINFALL INTENSITY(INCH/HR) =   2.02
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.17
  EFFECTIVE STREAM AREA(ACRES) =       0.20
  TOTAL STREAM AREA(ACRES) =       0.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.36

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   158.00
  ELEVATION DATA: UPSTREAM(FEET) =    788.50  DOWNSTREAM(FEET) =    787.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.846
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.069
  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.)
  APARTMENTS                 D       0.14      0.20      0.200    75    6.23
  COMMERCIAL                 D       0.05      0.20      0.100    75    5.85
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.174
  SUBAREA RUNOFF(CFS) =      0.35
  TOTAL AREA(ACRES) =      0.19   PEAK FLOW RATE(CFS) =      0.35

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    201.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.85
  RAINFALL INTENSITY(INCH/HR) =   2.07
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.20
  AREA-AVERAGED Ap =  0.17
  EFFECTIVE STREAM AREA(ACRES) =       0.19
  TOTAL STREAM AREA(ACRES) =       0.19
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.35

  ** CONFLUENCE DATA **
```

```
 STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1       0.36    6.11    2.018  0.20( 0.04) 0.17       0.2     200.00
    2       0.35    5.85    2.069  0.20( 0.03) 0.17       0.2     202.00

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

** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1       0.70    5.85    2.069  0.20( 0.03) 0.17       0.4     202.00
    2       0.70    6.11    2.018  0.20( 0.03) 0.17       0.4     200.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       0.70    Tc(MIN.) =     5.85
EFFECTIVE AREA(ACRES) =       0.38   AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.17
TOTAL AREA(ACRES) =        0.4
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    201.00 =     196.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    201.00 TO NODE    201.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =    5.85
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.069
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
"2 DWELLINGS/ACRE"          D        0.13      0.20      0.700    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
SUBAREA AREA(ACRES) =    0.13      SUBAREA RUNOFF(CFS) =    0.23
EFFECTIVE AREA(ACRES) =      0.51   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.31
TOTAL AREA(ACRES) =        0.5       PEAK FLOW RATE(CFS) =       0.92

****************************************************************************
FLOW PROCESS FROM NODE    201.00 TO NODE    203.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   781.00  DOWNSTREAM(FEET) =   777.71
FLOW LENGTH(FEET) =   295.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   3.66
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       0.92
PIPE TRAVEL TIME(MIN.) =   1.34    Tc(MIN.) =    7.19
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     491.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  10
----------------------------------------------------------------------------
>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
FLOW PROCESS FROM NODE    210.00 TO NODE    211.00 IS CODE =  21
```



```
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =   125.00
ELEVATION DATA: UPSTREAM(FEET) =    789.30  DOWNSTREAM(FEET) =    787.30

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
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.)
APARTMENTS                  D        0.09      0.20      0.200    75    5.11
COMMERCIAL                  D        0.04      0.20      0.100    75    5.00
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.169
SUBAREA RUNOFF(CFS) =       0.26
TOTAL AREA(ACRES) =       0.13   PEAK FLOW RATE(CFS) =       0.26

****************************************************************************
FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =    5.00
RAINFALL INTENSITY(INCH/HR) =   2.26
AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.20
AREA-AVERAGED Ap =  0.17
EFFECTIVE STREAM AREA(ACRES) =       0.13
TOTAL STREAM AREA(ACRES) =       0.13
PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.26

****************************************************************************
FLOW PROCESS FROM NODE    212.00 TO NODE    211.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =   202.00
ELEVATION DATA: UPSTREAM(FEET) =    790.60  DOWNSTREAM(FEET) =    787.30

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.786
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.082
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.)
APARTMENTS                  D        0.08      0.20      0.200    75    6.17
COMMERCIAL                  D        0.10      0.20      0.100    75    5.79
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.144
SUBAREA RUNOFF(CFS) =       0.33
TOTAL AREA(ACRES) =       0.18   PEAK FLOW RATE(CFS) =       0.33

****************************************************************************
FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
```

```
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 5.79
RAINFALL INTENSITY(INCH/HR) = 2.08
AREA-AVERAGED Fm(INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.14
EFFECTIVE STREAM AREA(ACRES) = 0.18
TOTAL STREAM AREA(ACRES) = 0.18
PEAK FLOW RATE(CFS) AT CONFLUENCE = 0.33

** CONFLUENCE DATA **
 STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1       0.26   5.00    2.264  0.20( 0.03) 0.17      0.1     210.00
    2       0.33   5.79    2.082  0.20( 0.03) 0.14      0.2     212.00

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

** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1       0.57   5.00    2.264  0.20( 0.03) 0.16      0.3     210.00
    2       0.57   5.79    2.082  0.20( 0.03) 0.15      0.3     212.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 0.57  Tc(MIN.) = 5.00
EFFECTIVE AREA(ACRES) = 0.29  AREA-AVERAGED Fm(INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.20  AREA-AVERAGED Ap = 0.16
TOTAL AREA(ACRES) = 0.3
LONGEST FLOWPATH FROM NODE  212.00 TO NODE  211.00 = 202.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE  211.00 TO NODE  211.00 IS CODE = 81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) = 5.00
*  2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.264
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/      SCS SOIL   AREA     Fp        Ap     SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 D       0.02     0.20      0.100    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.02  SUBAREA RUNOFF(CFS) = 0.04
EFFECTIVE AREA(ACRES) = 0.31  AREA-AVERAGED Fm(INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.20  AREA-AVERAGED Ap = 0.15
TOTAL AREA(ACRES) = 0.3  PEAK FLOW RATE(CFS) = 0.61

****************************************************************************
FLOW PROCESS FROM NODE  211.00 TO NODE  213.00 IS CODE = 62
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) = 787.30  DOWNSTREAM ELEVATION(FEET) = 784.10
STREET LENGTH(FEET) = 220.00  CURB HEIGHT(INCHES) = 4.0
STREET HALFWIDTH(FEET) = 13.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 8.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020
```



```
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150

 **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.78
 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
 STREET FLOW DEPTH(FEET) = 0.25
 HALFSTREET FLOOD WIDTH(FEET) = 5.55
 AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.00
 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.49
STREET FLOW TRAVEL TIME(MIN.) = 1.84  Tc(MIN.) = 6.84
*  2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.892
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/      SCS SOIL   AREA     Fp        Ap     SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
APARTMENTS                 D       0.12     0.20      0.200    75
COMMERCIAL                 D       0.08     0.20      0.100    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.160
SUBAREA AREA(ACRES) = 0.20  SUBAREA RUNOFF(CFS) = 0.33
EFFECTIVE AREA(ACRES) = 0.51  AREA-AVERAGED Fm(INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.20  AREA-AVERAGED Ap = 0.16
TOTAL AREA(ACRES) = 0.5  PEAK FLOW RATE(CFS) = 0.85

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.25  HALFSTREET FLOOD WIDTH(FEET) = 5.83
FLOW VELOCITY(FEET/SEC.) = 2.00  DEPTH*VELOCITY(FT*FT/SEC.) = 0.51
LONGEST FLOWPATH FROM NODE  212.00 TO NODE  213.00 = 422.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE  213.00 TO NODE  213.00 IS CODE = 81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) = 6.84
*  2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.892
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/      SCS SOIL   AREA     Fp        Ap     SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
APARTMENTS                 D       0.12     0.20      0.200    75
COMMERCIAL                 D       0.04     0.20      0.100    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.175
SUBAREA AREA(ACRES) = 0.16  SUBAREA RUNOFF(CFS) = 0.27
EFFECTIVE AREA(ACRES) = 0.67  AREA-AVERAGED Fm(INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.20  AREA-AVERAGED Ap = 0.16
TOTAL AREA(ACRES) = 0.7  PEAK FLOW RATE(CFS) = 1.11

****************************************************************************
FLOW PROCESS FROM NODE  213.00 TO NODE  213.00 IS CODE = 81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) = 6.84
*  2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.892
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/      SCS SOIL   AREA     Fp        Ap     SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
"2 DWELLINGS/ACRE"         D       0.14     0.20      0.700    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.700
SUBAREA AREA(ACRES) = 0.14  SUBAREA RUNOFF(CFS) = 0.22
EFFECTIVE AREA(ACRES) = 0.81  AREA-AVERAGED Fm(INCH/HR) = 0.05
```

```
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.25
TOTAL AREA(ACRES) =        0.8       PEAK FLOW RATE(CFS) =       1.33

****************************************************************************
FLOW PROCESS FROM NODE     213.00 TO NODE     203.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   778.10  DOWNSTREAM(FEET) =   776.71
FLOW LENGTH(FEET) =   141.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   3.90
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =        1.33
PIPE TRAVEL TIME(MIN.) =   0.60    Tc(MIN.) =    7.44
LONGEST FLOWPATH FROM NODE    212.00 TO NODE    203.00 =     563.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     203.00 TO NODE     203.00 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        1.33     7.44    1.802  0.20( 0.05) 0.25       0.8     210.00
    2        1.29     8.27    1.696  0.20( 0.05) 0.25       0.8     212.00
LONGEST FLOWPATH FROM NODE    212.00 TO NODE    203.00 =     563.00 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        0.92     7.19    1.838  0.20( 0.06) 0.31       0.5     202.00
    2        0.92     7.46    1.800  0.20( 0.06) 0.31       0.5     200.00
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     491.00 FEET.

** PEAK FLOW RATE TABLE **
 STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.) (INCH/HR)  (INCH/HR)           (ACRES)    NODE
    1        2.24     7.19    1.838  0.20( 0.06) 0.28       1.3     202.00
    2        2.25     7.44    1.802  0.20( 0.05) 0.27       1.3     210.00
    3        2.25     7.46    1.800  0.20( 0.05) 0.27       1.3     200.00
    4        2.15     8.27    1.696  0.20( 0.05) 0.27       1.3     212.00
  TOTAL AREA(ACRES) =          1.3

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =        2.25  Tc(MIN.) =    7.440
EFFECTIVE AREA(ACRES) =      1.33  AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.28
TOTAL AREA(ACRES) =        1.3
LONGEST FLOWPATH FROM NODE    212.00 TO NODE    203.00 =     563.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     203.00 TO NODE     203.00 IS CODE =  12
----------------------------------------------------------------------------
>>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
FLOW PROCESS FROM NODE     203.00 TO NODE     204.00 IS CODE =  31
----------------------------------------------------------------------------
```



```
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   776.71  DOWNSTREAM(FEET) =   775.58
FLOW LENGTH(FEET) =   146.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.16
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =        2.25
PIPE TRAVEL TIME(MIN.) =   0.58    Tc(MIN.) =    8.03
LONGEST FLOWPATH FROM NODE    212.00 TO NODE    204.00 =     709.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     204.00 TO NODE     204.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =    8.03
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.725
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
APARTMENTS                 D       0.15      0.20      0.200    75
COMMERCIAL                 D       0.08      0.20      0.100    75
APARTMENTS                 C       0.11      0.25      0.200    69
COMMERCIAL                 C       0.08      0.25      0.100    69
RESIDENTIAL
"2 DWELLINGS/ACRE"         D       0.13      0.20      0.700    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.21
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.289
SUBAREA AREA(ACRES) =    0.55      SUBAREA RUNOFF(CFS) =     0.82
EFFECTIVE AREA(ACRES) =      1.88   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.28
TOTAL AREA(ACRES) =        1.9       PEAK FLOW RATE(CFS) =       2.82

****************************************************************************
FLOW PROCESS FROM NODE     204.00 TO NODE     204.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =    8.03
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.725
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
PUBLIC PARK                C       0.08      0.25      0.850    69
APARTMENTS                 C       0.29      0.25      0.200    69
COMMERCIAL                 C       0.18      0.25      0.100    69
APARTMENTS                 D       0.01      0.20      0.200    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.261
SUBAREA AREA(ACRES) =    0.56      SUBAREA RUNOFF(CFS) =     0.84
EFFECTIVE AREA(ACRES) =      2.44   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.21  AREA-AVERAGED Ap =  0.27
TOTAL AREA(ACRES) =        2.5       PEAK FLOW RATE(CFS) =       3.65

** PEAK FLOW RATE TABLE **
 STREAM        Q       Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
 NUMBER      (CFS)   (MIN.) (INCH/HR)  (INCH/HR)           (ACRES)    NODE
    1        3.67     7.78    1.757  0.21( 0.06) 0.28       2.4     202.00
    2        3.65     8.03    1.725  0.21( 0.06) 0.27       2.4     210.00
    3        3.65     8.04    1.723  0.21( 0.06) 0.27       2.4     200.00
    4        3.48     8.86    1.630  0.21( 0.06) 0.27       2.5     212.00
```

```
NEW PEAK FLOW DATA ARE:
PEAK FLOW RATE(CFS) =       3.67  Tc(MIN.) =    7.78
AREA-AVERAGED Fm(INCH/HR) =  0.06  AREA-AVERAGED Fp(INCH/HR) =  0.21
AREA-AVERAGED Ap =  0.28  EFFECTIVE AREA(ACRES) =       2.40

****************************************************************************
FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   774.58  DOWNSTREAM(FEET) =   774.39
FLOW LENGTH(FEET) =    81.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   3.01
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       3.67
PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =    8.23
LONGEST FLOWPATH FROM NODE    212.00 TO NODE    205.00 =     790.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =    8.23
*   2 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
PUBLIC PARK                 D        0.10      0.20      0.850    75
COMMERCIAL                  D        0.09      0.20      0.100    75
RESIDENTIAL
"5-7 DWELLINGS/ACRE"        D        0.01      0.20      0.500    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.495
SUBAREA AREA(ACRES) =    0.20      SUBAREA RUNOFF(CFS) =    0.29
EFFECTIVE AREA(ACRES) =       2.60   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.21  AREA-AVERAGED Ap =  0.29
TOTAL AREA(ACRES) =        2.7       PEAK FLOW RATE(CFS) =       3.84

****************************************************************************
FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =    8.23
*   2 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
PUBLIC PARK                 C        0.02      0.25      0.850    69
COMMERCIAL                  C        0.18      0.25      0.100    69
RESIDENTIAL
"5-7 DWELLINGS/ACRE"        C        0.03      0.25      0.500    69
APARTMENTS                  C        0.28      0.25      0.200    69
RESIDENTIAL
"2 DWELLINGS/ACRE"          C        0.17      0.25      0.700    69
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.331
SUBAREA AREA(ACRES) =    0.68      SUBAREA RUNOFF(CFS) =    0.99
EFFECTIVE AREA(ACRES) =       3.28   AREA-AVERAGED Fm(INCH/HR) =  0.07
AREA-AVERAGED Fp(INCH/HR) =  0.22  AREA-AVERAGED Ap =  0.30
TOTAL AREA(ACRES) =        3.3       PEAK FLOW RATE(CFS) =       4.83
```



```
****************************************************************************
FLOW PROCESS FROM NODE    205.00 TO NODE    206.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   773.39  DOWNSTREAM(FEET) =   773.21
FLOW LENGTH(FEET) =    81.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   3.17
ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       4.83
PIPE TRAVEL TIME(MIN.) =   0.43    Tc(MIN.) =    8.65
LONGEST FLOWPATH FROM NODE    212.00 TO NODE    206.00 =     871.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    206.00 TO NODE    206.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =    8.65
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.652
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  C        0.09      0.25      0.100    69
APARTMENTS                  C        0.06      0.25      0.200    69
APARTMENTS                  D        0.01      0.20      0.200    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.144
SUBAREA AREA(ACRES) =    0.16      SUBAREA RUNOFF(CFS) =    0.23
EFFECTIVE AREA(ACRES) =       3.44   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.22  AREA-AVERAGED Ap =  0.29
TOTAL AREA(ACRES) =        3.5       PEAK FLOW RATE(CFS) =       4.92

****************************************************************************
FLOW PROCESS FROM NODE    206.00 TO NODE    207.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   772.21  DOWNSTREAM(FEET) =   769.00
FLOW LENGTH(FEET) =   220.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.47
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       4.92
PIPE TRAVEL TIME(MIN.) =   0.57    Tc(MIN.) =    9.22
LONGEST FLOWPATH FROM NODE    212.00 TO NODE    207.00 =    1091.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    207.00 TO NODE    207.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =    9.22
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.593
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  C        0.19      0.25      0.100    69
APARTMENTS                  C        0.38      0.25      0.200    69
```

```
RESIDENTIAL
"2 DWELLINGS/ACRE"          C        0.25      0.25      0.700     69
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.329
SUBAREA AREA(ACRES) =     0.82      SUBAREA RUNOFF(CFS) =     1.12
EFFECTIVE AREA(ACRES) =       4.26   AREA-AVERAGED Fm(INCH/HR) =  0.07
AREA-AVERAGED Fp(INCH/HR) =  0.23  AREA-AVERAGED Ap =  0.30
TOTAL AREA(ACRES) =         4.3       PEAK FLOW RATE(CFS) =       5.85

****************************************************************************
FLOW PROCESS FROM NODE    207.00 TO NODE    208.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   769.00  DOWNSTREAM(FEET) =   760.00
FLOW LENGTH(FEET) =     75.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  14.55
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =        5.85
PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    9.30
LONGEST FLOWPATH FROM NODE    212.00 TO NODE    208.00 =    1166.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    208.00 TO NODE    208.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =    9.30
RAINFALL INTENSITY(INCH/HR) =   1.58
AREA-AVERAGED Fm(INCH/HR) =  0.07
AREA-AVERAGED Fp(INCH/HR) =  0.23
AREA-AVERAGED Ap =  0.30
EFFECTIVE STREAM AREA(ACRES) =        4.26
TOTAL STREAM AREA(ACRES) =        4.32
PEAK FLOW RATE(CFS) AT CONFLUENCE =        5.85

****************************************************************************
FLOW PROCESS FROM NODE    270.00 TO NODE    271.00 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) =    790.80  DOWNSTREAM(FEET) =    786.50

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.367
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.812
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      0.100    75    7.37
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA RUNOFF(CFS) =       0.52
TOTAL AREA(ACRES) =       0.32   PEAK FLOW RATE(CFS) =       0.52

****************************************************************************
FLOW PROCESS FROM NODE    271.00 TO NODE    272.00 IS CODE =  62
```



```
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  786.50  DOWNSTREAM ELEVATION(FEET) =  781.20
STREET LENGTH(FEET) =   330.00   CURB HEIGHT(INCHES) =  8.0
STREET HALFWIDTH(FEET) = 32.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  27.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.74
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.23
  HALFSTREET FLOOD WIDTH(FEET) =    3.44
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.39
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.54
STREET FLOW TRAVEL TIME(MIN.) =   2.30   Tc(MIN.) =    9.66
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.551
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      0.100    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     0.32      SUBAREA RUNOFF(CFS) =     0.44
EFFECTIVE AREA(ACRES) =       0.64    AREA-AVERAGED Fm(INCH/HR) =  0.02
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =         0.6       PEAK FLOW RATE(CFS) =       0.88

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.24   HALFSTREET FLOOD WIDTH(FEET) =   4.26
FLOW VELOCITY(FEET/SEC.) =  2.38   DEPTH*VELOCITY(FT*FT/SEC.) =   0.58
LONGEST FLOWPATH FROM NODE    270.00 TO NODE    272.00 =     660.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    272.00 TO NODE    208.00 IS CODE =  62
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  781.20  DOWNSTREAM ELEVATION(FEET) =  769.80
STREET LENGTH(FEET) =   336.00   CURB HEIGHT(INCHES) =  8.0
STREET HALFWIDTH(FEET) = 32.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  27.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.11
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.23
  HALFSTREET FLOOD WIDTH(FEET) =    3.67
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.44
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.80
STREET FLOW TRAVEL TIME(MIN.) =   1.63   Tc(MIN.) =   11.29
*   2 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
COMMERCIAL                  C       0.20      0.25      0.100    69
COMMERCIAL                  D       0.17      0.20      0.100    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.23
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     0.37      SUBAREA RUNOFF(CFS) =     0.46
EFFECTIVE AREA(ACRES) =       1.01    AREA-AVERAGED Fm(INCH/HR) =  0.02
AREA-AVERAGED Fp(INCH/HR) =  0.21  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =         1.0        PEAK FLOW RATE(CFS) =       1.27

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.24   HALFSTREET FLOOD WIDTH(FEET) =   4.26
FLOW VELOCITY(FEET/SEC.) =  3.43   DEPTH*VELOCITY(FT*FT/SEC.) =   0.83
LONGEST FLOWPATH FROM NODE    270.00 TO NODE    208.00 =     996.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    208.00 TO NODE    208.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   11.29
RAINFALL INTENSITY(INCH/HR) =   1.42
AREA-AVERAGED Fm(INCH/HR) =  0.02
AREA-AVERAGED Fp(INCH/HR) =  0.21
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =       1.01
TOTAL STREAM AREA(ACRES) =       1.01
PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.27

** CONFLUENCE DATA **
 STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1        5.85    9.30    1.585  0.23( 0.07) 0.30       4.3     202.00
    1        5.80    9.56    1.561  0.23( 0.07) 0.30       4.3     210.00
    1        5.80    9.57    1.559  0.23( 0.07) 0.30       4.3     200.00
    1        5.54   10.42    1.485  0.23( 0.07) 0.30       4.3     212.00
    2        1.27   11.29    1.418  0.21( 0.02) 0.10       1.0     270.00

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

** PEAK FLOW RATE TABLE **
 STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1        7.02    9.30    1.585  0.23( 0.06) 0.27       5.1     202.00
    2        6.99    9.56    1.561  0.23( 0.06) 0.27       5.1     210.00
    3        6.98    9.57    1.559  0.23( 0.06) 0.27       5.2     200.00
    4        6.77   10.42    1.485  0.23( 0.06) 0.26       5.3     212.00
    5        6.55   11.29    1.418  0.23( 0.06) 0.26       5.3     270.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       7.02    Tc(MIN.) =     9.30
EFFECTIVE AREA(ACRES) =       5.09   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.23  AREA-AVERAGED Ap =  0.27
TOTAL AREA(ACRES) =        5.3
LONGEST FLOWPATH FROM NODE    212.00 TO NODE    208.00 =    1166.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    208.00 TO NODE    208.00 IS CODE =  81
```



```
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN.) =    9.30
*   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.585
SUBAREA LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  C       0.46      0.25      0.100    69
COMMERCIAL                  D       0.01      0.20      0.100    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =     0.47      SUBAREA RUNOFF(CFS) =     0.66
EFFECTIVE AREA(ACRES) =       5.56   AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.23  AREA-AVERAGED Ap =  0.25
TOTAL AREA(ACRES) =         5.8        PEAK FLOW RATE(CFS) =       7.65
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)        =        5.8  TC(MIN.) =      9.30
EFFECTIVE AREA(ACRES) =       5.56  AREA-AVERAGED Fm(INCH/HR)=  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.23  AREA-AVERAGED Ap = 0.253
PEAK FLOW RATE(CFS)    =       7.65

** PEAK FLOW RATE TABLE **
 STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1        7.65    9.30    1.585  0.23( 0.06) 0.25       5.6     202.00
    2        7.61    9.56    1.561  0.23( 0.06) 0.25       5.6     210.00
    3        7.60    9.57    1.559  0.23( 0.06) 0.25       5.6     200.00
    4        7.36   10.42    1.485  0.23( 0.06) 0.25       5.7     212.00
    5        7.11   11.29    1.418  0.23( 0.06) 0.25       5.8     270.00
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

# Attachment G

# Infiltration BMP Feasibility Worksheet

**Table 2.7: Infiltration BMP Feasibility Worksheet**

| | Infeasibility Criteria | Yes | No |
|---|---|---|---|
| 1 | **Would Infiltration BMPs pose significant risk for groundwater related concerns?** Refer to Appendix VIII (Worksheet I) for guidance on groundwater-related infiltration feasibility criteria. | | X |
| Provide basis:<br>Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability. | | | |
| 2 | Would Infiltration BMPs pose significant risk of increasing risk of geotechnical hazards that cannot be mitigated to an acceptable level? (Yes if the answer to any of the following questions is yes, as established by ageotechnical expert):<br>• The BMP can only be located less than 50 feet away from slopes steeper than 15 percent<br>• The BMP can only be located less than eight feet from building foundations or an alternative setback.<br>• A study prepared by a geotechnical professional or an available watershed study substantiates that stormwater infiltration would potentially result in significantly increased risks of geotechnical hazards that cannot be mitigated to an acceptable level. | | X |
| Provide basis:<br><br>Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability. | | | |
| 3 | Would infiltration of the DCV from drainage area violate **downstream water rights?** | | X |
| Provide basis:<br><br>Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide | | | |

**Table 2.7: Infiltration BMP Feasibility Worksheet (continued)**

| | Partial Infeasibility Criteria | Yes | No |
|---|---|---|---|
| 4 | Is proposed infiltration facility **located on HSG D soils** or the site geotechnical investigation identifies presence of soil characteristics which support categorization as D soils? | X | |
| Preliminary Geotechnical Evaluation For Proposed Residential Development Tract No. 17439, Paseos Project, City of Lake Forest, Orange County, California, Prepared By GeoTek, Inc. states, "Engineered fill soils are reported to underlie a majority of the site, with the exception of the northeastern one-third (±) of the property (PSE, 2002)." The Natural Resource Conservation Service indentifies the underlying soil onsite to consist of Soil Group C and Soil Group D. Engineer fill, Soil Group C and D, unit density and 2:1 slopes in vegetated areas cause the site to be infeasible for infiltration. | | | |
| 5 | **Is measured infiltration rate below proposed facility less than 0.3 inches per hour?** This calculation shall be based on the methods described in Appendix VII. | | |
| Provide basis:<br><br>Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability. | | | |
| 6 | **Would reduction of over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?** | | |
| Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible:<br><br>Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability. | | | |
| 7 | **Would an increase in infiltration over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?** | | |
| Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible:<br><br>Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability. | | | |

**Table 2.7: Infiltration BMP Feasibility Worksheet (continued)**

| Infeasibility Screening Results (check box corresponding to result): | | |
|---|---|---|
| 8 | Is there substantial evidence that infiltration from the project would result in a significant increase in I&I to the sanitary sewer that cannot be sufficiently mitigated? (See Appendix XVII)<br><br>Provide narrative discussion and supporting evidence:<br><br>Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability. | |
| 9 | If any answer from row 1-3 is yes: infiltration of any volume is **not feasible** within the DMA or equivalent.<br><br>Provide basis:<br><br>Summarize findings of infeasibility screening | |
| 10 | If any answer from row 4-7 is yes, infiltration is **permissible but is not presumed to be feasible for the entire DCV**. Criteria for designing biotreatment BMPs to achieve the maximum feasible infiltration and ET shall apply.<br><br>Provide basis:<br><br>Summarize findings of infeasibility screening | **X** |
| 11 | If all answers to rows 1 through 11 are no, infiltration of the full DCV is potentially feasible, BMPs must be designed to infiltrate the full DCV to the maximum extent practicable. | |