

**County of Orange/Santa Ana Region  
Priority Project  
Preliminary Water Quality Management  
Plan (WQMP)**

**Project Name:**

**Alta Vista**

**APN 341-501-01 THROUGH 341-501-66**

**Prepared for:**

**Placentia Development Co., LLC, A California Limited Liability Company**

**725 W. Town & Country Road, Suite 200**

**Orange, CA 92868**

**(714) 347-1319**

**Prepared by:**

**Wilson Mikami Corporation**

**9 Corporate Park, Suite 100**

**Irvine, CA 92606**

**(949) 679-0090 / [swilson@wilsonmikami.com](mailto:swilson@wilsonmikami.com)**

**Prepared on:**

**September, 2022**

**Priority Project Water Quality Management Plan (WQMP)**  
**Alta Vista, Placentia CA**

<b>Project Owner's Certification</b>			
Planning Application No. (If applicable)		Grading Permit No.	TBD
Tract/Parcel Map and Lot(s) No.	TTM 19250	Building Permit No.	TBD
Address of Project Site and APN (If no address, specify Tract/Parcel Map and Lot Numbers)			APN 341-501-01 thru 341-501-66

This Water Quality Management Plan (WQMP) has been prepared for Placentia Development Co., LLC, A California Limited Liability Company by Wilson Mikami Corporation. The WQMP is intended to comply with the requirements of the County of Orange 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, including the ongoing operation and maintenance of all best management practices (BMPs), 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.

<b>Owner:</b>			
Title	Peter Kim, Vice President of Land Development		
Company	Placentia Development Co., LLC, A California Limited Liability Company		
Address	725 W. Town & Country Road, Suite 200, Orange, CA 92868		
Email	pkim@tollbrothers.com		
Telephone #	(714) 347-1319		
I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein.			
Owner Signature		Date	

**Water Quality Management Plan (WQMP)**  
**Alta Vista, Placentia CA**

<b>Preparer (Engineer):</b>			
Title	Principal	PE Registration #	49884
Company	Wilson Mikami Corporation		
Address	9 Corporate Park Suite 100, Irvine, Ca 92606		
Email	swilson@wilsonmikami.com		
Telephone #	949-679-0090		
I hereby certify that this Water Quality Management Plan is in compliance with, and meets the requirements set forth in, Order No. R8-2009-0030/NPDES No. CAS618030, of the Santa Ana Regional Water Quality Control Board.			
Preparer Signature		Date	
Place Stamp Here			

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## **Section I Permit(s) and Water Quality Conditions of Approval or Issuance**

Provide discretionary or grading/building permit information and water quality conditions of approval, or permit issuance, applied to the project. If conditions are unknown, please request applicable conditions from staff. Refer to Section 2.1 in the Technical Guidance Document (TGD) available on the OC Planning website ([ocplanning.net](http://ocplanning.net)).

<b>Project Information</b>	
Permit/ Application No. (If applicable)	Grading or Building Permit No. (If applicable) Pending
Address of Project Site (or Tract Map and Lot Number if no address) and APN	TTM 19250 APN 341-501-01 thru 341-501-66
<b>Water Quality Conditions of Approval or Issuance</b>	
Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.)	TBD
<b>Conceptual WQMP</b>	
Was a Conceptual Water Quality Management Plan previously approved for this project?	No
<b>Watershed-Based Plan Conditions</b>	
Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS.	N/A

<b>Project Owner's Certification</b>			
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**Water Quality Management Plan (WQMP)**  
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Project Information	
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Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.)	TBD
Conceptual WQMP	
Was a Conceptual Water Quality Management Plan previously approved for this project?	No
Watershed-Based Plan Conditions	
Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS.	N/A

## Section II Project Description

### II.1 Project Description

Description of Proposed Project				
Development Category (From Model WQMP, Table 7.11-2; or -3):	New development projects that create 10,000 square feet or more of impervious surface. This category includes commercial, industrial, residential housing subdivisions, mixed-use, and public projects on private or public property that falls under the planning and building authority or the Permittees.			
Project Area (ft <sup>2</sup> ): 585,884	Number of Dwelling Units: 100		SIC Code: N/A	
Project Area	Pervious		Impervious	
	Area (acres or sq ft)	Percentage	Area (acres or sq ft)	Percentage
Pre-Project Conditions	729,498 SF	98%	11,880 SF	2%
Post-Project Conditions	397,059 SF	54%	344,319 SF	46%
Drainage Patterns/Connections	The existing project site is currently undeveloped and surface drains from the north to the southeast corner of the property. There is a 24" existing RCP with a 36" riser at a sump location adjacent to Alta Vista St.			
Narrative Project Description: (Use as much space as necessary.)	<p>The total site area consists of approximately 17.0 acres and is located just north of Alta Vista Street in the City of Placentia, California. The site is currently a dirt lot with existing oil mining facilities. The project will consist of 100 detached condominium residential units ranging from 1,874 SF to 2,199 SF, a park, private streets and landscape.</p> <p>The entire site is treated by a single Drainage Management Area (DMA), which drains to a focal point biofiltration system with R-tank located in the park site, allowing for storm water treatment. Please refer to the WQMP Exhibit in the Appendix for the BMP locations.</p>			

## II.2 Potential Stormwater Pollutants

Determine and list expected stormwater pollutants based on land uses and site activities. Refer to Section 2.2.2 and Table 2.1 in the Technical Guidance Document (TGD) for guidance.

Pollutants of Concern			
Pollutant	Check One for each: E=Expected to be of concern N=Not Expected to be of concern		Additional Information and Comments
Suspended-Solid/ Sediment	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Tributary by Detached Residential Developments per Table 2.1 of the TGD
Nutrients	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Tributary by Detached Residential Developments per Table 2.1 of the TGD
Heavy Metals	E <input type="checkbox"/>	N <input checked="" type="checkbox"/>	Not tributary by Detached Residential Developments per Table 2.1 of the TGD
Pathogens (Bacteria/Virus)	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Tributary by Detached Residential Developments per Table 2.1 of the TGD
Pesticides	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Tributary by Detached Residential Developments per Table 2.1 of the TGD
Oil and Grease	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Tributary by Detached Residential Developments per Table 2.1 of the TGD
Toxic Organic Compounds	E <input type="checkbox"/>	N <input checked="" type="checkbox"/>	Not tributary by Detached Residential Developments per Table 2.1 of the TGD
Trash and Debris	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Tributary by Detached Residential Developments per Table 2.1 of the TGD

### II.3 Hydrologic Conditions of Concern

Determine if streams located downstream from the project area are potentially susceptible to hydromodification impacts. Refer to Section 2.2.3.1 in the Technical Guidance Document (TGD) for North Orange County or Section 2.2.3.2 for South Orange County.

No – Show map

Yes – Describe applicable hydrologic conditions of concern below. Refer to Section 2.2.3 in the Technical Guidance Document (TGD).

The post development volume for the 2 year storm event does not exceed that of the pre development condition by more than 5%. The time of concentration of the post development runoff is less than pre development condition. Per Section 5.3.1 of the Technical Guidance, the following calculations are prepared:

1.  $(V_{2 \text{ year, post}} / V_{2 \text{ year, pre}}) = \leq 1.05$   
( 5,511 cf / 6,305 cf ) = 0.87 (13% decrease)

1.  $Tc_{2 \text{ year, post}} / Tc_{2 \text{ year, pre}} = \leq 1.05$   
( 11.0 min / 28.4 min = 0.39 (61% decrease) \*

\* Reference calculations for time of concentration information for the 2 year storm event in Attachment F.

Hydrologic Conditions of Concern will not be considered for this project since the post development time of concentration is less than pre development time of concentration and the post development volume does not exceed pre development volume by more than 5%.

### II.4 Post Development Drainage Characteristics

Describe post development drainage characteristics. Refer to Section 2.2.4 in the Technical Guidance Document (TGD).

The drainage from the proposed development will surface drain to several catch basin locations. The runoff within the northerly and easterly portion of the development will be collected within a proposed Line 'A' which runs under Street A and Street B and ultimately discharges to focal point biofiltration system within the park site. The runoff within the western half of the will be collected within a proposed Line 'B' which runs under Streets C and D and ultimately joins Line "A" at the intersection of A and D Streets. All drainage from the proposed development will be treated as part of DMA A.

## II.5 Property Ownership/Management

Describe property ownership/management. *Refer to Section 2.2.5 in the Technical Guidance Document (TGD).*

The project will be maintained by the owner as described in this document and will be responsible for maintaining and providing regular inspections for all post-construction BMPs.

### Section III Site Description

#### III.1 Physical Setting

Fill out table with relevant information. *Refer to Section 2.3.1 in the Technical Guidance Document (TGD).*

Name of Planned Community/Planning Area (if applicable)	Not Applicable
Location/Address	Alta Vista Street
	Placentia, CA 92870
General Plan Land Use Designation	SP-7, Specific Plan 7
Zoning	Medium Density Residential
Acreage of Project Site	17.02
Predominant Soil Type	Soil Type C

#### III.2 Site Characteristics

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable. *Refer to Section 2.3.2 in the Technical Guidance Document (TGD).*

Site Characteristics	
Precipitation Zone	0.90" (Refer to Figure XVI-1 of the TGD located in Attachment D)
Topography	The site is terraced with larger mildly sloping areas with elevations ranging from 307 to 290. The site is primarily undeveloped.

Drainage Patterns/Connections	The site surface drains from the north to the southeast corner of the property.
Soil Type, Geology, and Infiltration Properties	<p>The predominant soil type is stated to be Type C per maps provided in Appendices XVI of the Technical Guidance Document.</p> <p>Group C soils are typically sandy clay loams. They have low infiltration rates when thoroughly wetted, consist chiefly of soils with a layer that impedes downward movement of water, and/or have moderately fine to fine soil structure.</p> <p>Geotechnical investigation, TBD.</p>
Hydrogeologic (Groundwater) Conditions	TBD
Geotechnical Conditions (relevant to infiltration)	TBD
Off-Site Drainage	Offsite drainage is not anticipated for this project.
Utility and Infrastructure Information	There is an existing storm drain system adjacent to the site on Alta Vista. Storm water will first discharge to proposed bio-treatment and detention BMP's on-site. Existing water and sewer facilities will serve the site.

### III.3 Watershed Description

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable. Refer to Section 2.3.3 in the Technical Guidance Document (TGD).

Receiving Waters	Santa Ana River, Reach 2
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303(d) Listed Impairments	There are no 303(d) listed impairments for any of the above receiving waters
Applicable TMDLs	There are no applicable TMDLs as there are no 303(d) listed impairments.
Pollutants of Concern for the Project	There are no Pollutants of Concern for the project as there are no 303(d) listed impairments.
Environmentally Sensitive and Special Biological Significant Areas	There are no Environmental Sensitive Areas (ESA) or Areas of Special Biological Significance.

## Section IV Best Management Practices (BMPs)

### IV. 1 Project Performance Criteria

Describe project performance criteria. Several steps must be followed in order to determine what performance criteria will apply to a project. These steps include:

- If the project has an approved WIHMP or equivalent, then any watershed specific criteria must be used and the project can evaluate participation in the approved regional or sub-regional opportunities. (Please ask your assigned planner or plan checker regarding whether your project is part of an approved WIHMP or equivalent.)
- Determine applicable hydromodification control performance criteria. *Refer to Section 7.II-2.4.2.2 of the Model WQMP.*
- Determine applicable LID performance criteria. *Refer to Section 7.II-2.4.3 of the Model WQMP.*
- Determine applicable treatment control BMP performance criteria. *Refer to Section 7.II-3.2.2 of the Model WQMP.*
- Calculate the LID design storm capture volume for the project. *Refer to Section 7.II-2.4.3 of the Model WQMP.*

(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 <input type="checkbox"/>	NO <input checked="" type="checkbox"/>
If yes, describe WIHMP feasibility criteria or regional/sub-regional LID opportunities.	Not Applicable		

Project Performance Criteria	
If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	Per Section II.3 of this WQMP, HCOCs do not exist.

<p>List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP)</p>	<p>Per 7.II 2.4.3 of the Model WQMP, the available LID Treatment BMPs to be utilized in reducing the post development impacts include infiltration, harvest and use, evapotranspire, or biotreat/biofilter, the 85th percentile of a 24 hour storm event.</p>
<p>List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP)</p>	<p>Per 7.II 3.2.2 of the Model WQMP, if the LID performance criteria is not feasibly met by retention and/or biotreatment, then sizing of onsite treatment control BMPs are required. Sizing of these treatment control BMPs will include, if applicable any Water Quality credits as calculated per the Technical Guidance Document. If the additional required volume cannot be met, however has a medium to high effectiveness, then a waiver application and participation in an alternative program may not be required. If the cost of providing treatment control BMPs greatly outweighs the pollution control benefits, a waiver of treatment control and LID requirements can be requested.</p>
<p>Calculate LID design storm capture volume for Project.</p>	<p>DMA A, VBMP = 21,941 cf *</p> <p>* Refer to Worksheet A and B in Attachment D of this report.</p>

## IV.2. Site Design and Drainage

The drainage from the proposed development will surface drain to several catch basin locations. The runoff within the northerly and easterly portion of the development will be collected within a proposed Line 'A' which runs under Street A and Street B and ultimately discharges to focal point biofiltration system within the park site. The runoff within the western half of the will be collected within a proposed Line 'B' which runs under Streets C and D and ultimately joins Line "A" at the intersection of A and D Streets. All drainage from the proposed development will be treated as part of DMA A. The drainage from the existing oil site at the easterly edge of the project will also discharge to a focal point biofiltration system within the park site as part of DMA B. Drainage from the proposed access road to the oil site be directed to a strip of permeable pavers for detention as part of DMA C. During large storm events, the storm water runoff bypasses the inlets and surface flows to the existing offsite streets which drain to a City maintained storm drain system.

The site will utilize three (3) Design Management Areas (DMA).

Refer to BMP Exhibit in Attachment B herein.

### Drainage Management Areas (DMA) Table:

Drainage Area No. (DMA)	Area (ac)	Proposed BMPs
A	13.90	Focal Point Bio-Filtration with R-Tanks

Refer to Worksheets A and B in Attachment D of this report.

## IV.3 LID BMP Selection and Project Conformance Analysis

### IV.3.1 Hydrologic Source Controls (HSCs)

Name	Included?
Localized on-lot infiltration	<input type="checkbox"/>
Impervious area dispersion (e.g. roof top disconnection)	<input checked="" type="checkbox"/>
Street trees (canopy interception)	<input type="checkbox"/>
Residential rain barrels (not actively managed)	<input type="checkbox"/>
Green roofs/Brown roofs	<input type="checkbox"/>
Blue roofs	<input type="checkbox"/>

Impervious area reduction (e.g. permeable pavers, site design)	<input type="checkbox"/>
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**Hydrologic Source Control (HSCs):**

The proposed development and site conditions were evaluated in order to select the most feasible BMP implementation for the project. The HSC BMP Selection process was determined by the following:

**HSC-1 Localized On Lot Infiltration:** Infiltration is not proposed for this site due to soil type.

**HSC-2 Impervious Area Dispersion:** Impervious Area Dispersion will be utilized for the downspout locations of the project buildings. Roof runoff will be collected in a series of roof downspouts and outlet the runoff to splash blocks which will drain into area drains which will discharge to subsurface infiltration galleries. Refer to Worksheet A in Attachment D of this report for additional information.

**HSC-3 Street Trees:** Street Trees will not be utilized as number and size has not been determined in the preliminary stage.

**HSC-4 Residential Rain Barrels:** Harvest and Reuse type BMPs are not suitable for a Southern California climate or feasible for this project type and will not be utilized.

**HSC 4 Green/ Brown Roofs:** Green and Brown Roof BMPs are not feasible for this project type and are not sustainable in Southern California climates.

**HSC 5 Blue Roofs:** Blue BMPs are not feasible for this project type and are not sustainable in Southern California climates.

### IV.3.2 Infiltration BMPs

Name	Included?
Bioretention without underdrains	<input checked="" type="checkbox"/>
Rain gardens	<input type="checkbox"/>
Porous landscaping	<input type="checkbox"/>
Infiltration planters	<input type="checkbox"/>
Retention swales	<input type="checkbox"/>
Infiltration trenches	<input type="checkbox"/>
Infiltration basins	<input type="checkbox"/>
Drywells	<input type="checkbox"/>
Subsurface infiltration galleries	<input type="checkbox"/>
French drains	<input type="checkbox"/>
Permeable asphalt	<input type="checkbox"/>
Permeable concrete	<input type="checkbox"/>
Permeable concrete pavers	<input type="checkbox"/>
Other:	<input type="checkbox"/>
Other:	<input type="checkbox"/>

Bioretention without underdrains will be used to treat storm water runoff within DMA A. Calculations for the systems are included in Appendix D.

### IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

Name	Included?
HSCs; <i>See Section IV.3.1</i>	<input checked="" type="checkbox"/>
Surface-based infiltration BMPs	<input type="checkbox"/>
Biotreatment BMPs	<input type="checkbox"/>
Above-ground cisterns and basins	<input type="checkbox"/>
Underground detention	<input type="checkbox"/>
Other:	<input type="checkbox"/>
Other:	<input type="checkbox"/>
Other:	<input type="checkbox"/>

Refer to Section IV.3.1 of this report for additional information regarding the BMP Selection.

### IV.3.4 Biotreatment BMPs

Name	Included?
Bioretention with underdrains	<input type="checkbox"/>
Stormwater planter boxes with underdrains	<input type="checkbox"/>
Rain gardens with underdrains	<input type="checkbox"/>
Constructed wetlands	<input type="checkbox"/>
Vegetated swales	<input type="checkbox"/>
Vegetated filter strips	<input type="checkbox"/>
Proprietary vegetated biotreatment systems	<input type="checkbox"/>
Wet extended detention basin	<input type="checkbox"/>
Dry extended detention basins	<input type="checkbox"/>
Other:	<input type="checkbox"/>
Other:	<input type="checkbox"/>

### IV.3.5 Hydromodification Control BMPs

Describe hydromodification control BMPs. *See Section 5 of the Technical Guidance Document (TGD).* Include sections for selection, suitability, sizing, and infeasibility, as applicable. Detail compliance with Prior Conditions of Approval (if applicable).

Hydromodification Control BMPs	
BMP Name	BMP Description
N/A	N/A

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

Regional/Sub-Regional LID BMPs
Not Applicable

### 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

Fill out non-structural source control check box forms or provide a brief narrative explaining if non-structural source controls were not used.

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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
N2	Activity Restrictions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
N3	Common Area Landscape Management	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
N4	BMP Maintenance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
N5	Title 22 CCR Compliance (How development will comply)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
N6	Local Industrial Permit Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Residential Development
N7	Spill Contingency Plan	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
N8	Underground Storage Tank Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No underground storage tanks
N9	Hazardous Materials Disclosure Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No proposed hazardous materials
N10	Uniform Fire Code Implementation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
N11	Common Area Litter Control	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
N12	Employee Training	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
N13	Housekeeping of Loading Docks	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No proposed loading dock
N14	Common Area Catch Basin Inspection	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
N15	Street Sweeping Private Streets and Parking Lots	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
N16	Retail Gasoline Outlets	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No proposed gasoline outlets

### IV.3.9 Structural Source Control BMPs

Fill out structural source control check box forms or provide a brief narrative explaining if structural source controls were not used.

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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
S2	Design and construct outdoor material storage areas to reduce pollution introduction	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No proposed outdoor storage areas
S3	Design and construct trash and waste storage areas to reduce pollution introduction	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Trash and waste will not be stored outside.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
S5	Protect slopes and channels and provide energy dissipation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not Applicable
S6	Dock areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No proposed dock areas
S7	Maintenance bays	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No proposed maintenance bays
S8	Vehicle wash areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No proposed vehicle wash areas
S9	Outdoor processing areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No proposed outdoor processing areas
S10	Equipment wash areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No proposed equipment wash areas
S11	Fueling areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No proposed fueling areas
S12	Hillside landscaping	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No proposed hillside landscaping
S13	Wash water control for food preparation areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No proposed food preparation areas
S14	Community car wash racks	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No proposed community car wash racks

#### 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):				
<input type="checkbox"/> Redevelopment projects that reduce the overall impervious footprint of the project site.	<input type="checkbox"/> 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.	<input type="checkbox"/> 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).		
<input type="checkbox"/> 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).	<input type="checkbox"/> 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		<input type="checkbox"/> 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).	
<input type="checkbox"/> Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses.	<input type="checkbox"/> Developments in a city center area.	<input type="checkbox"/> Developments in historic districts or historic preservation areas.	<input type="checkbox"/> 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.	<input type="checkbox"/> 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)	The entire DCV for the project site is being treated by LID BMPs. Water quality credits will not be used.			

**IV.4.2 Alternative Compliance Plan Information**

Not Applicable

**Section V Inspection/Maintenance Responsibility for BMPs**

Fill out information in table below. Prepare and attach an Operation and Maintenance Plan. Identify the funding mechanism through which BMPs will be maintained. Inspection and maintenance records must be kept for a minimum of five years for inspection by the regulatory agencies. Refer to Section 7.II 4.0 in the Model WQMP.

<b>BMP Inspection/Maintenance</b>			
<b>BMP</b>	<b>Reponsible Party(s)</b>	<b>Inspection/Maintenance Activities Required</b>	<b>Minimum Frequency of Activities</b>
Education of Property Owners, Tenants, Occupants & Employees	Placentia Development Co., LLC	Information to be provided to property owners, tenants, occupants and employees	As needed
Activity restrictions	Placentia Development Co., LLC	Employees are to be notified of activities that are prohibited by employees and tenants	Restrictions identified in employee manual and reviewed yearly by employees
Common Area Landscape Management	Placentia Development Co., LLC	Hire professional landscape contractor to properly maintain common areas	Landscape maintenance required on a weekly basis or as needed

**Priority Project Water Quality Management Plan (WQMP)**  
**Alta Vista, Placentia CA**

Uniform Fire Code Implementation	Placentia Development Co., LLC	Conform with fire regulations and keep informed of the latest rules and requirements	Comply with annual fire inspections and maintain building and access per the latest fire codes
Common Area Litter Control	Placentia Development Co., LLC	Provide litter removal of site parking lot and landscape areas	Once per week
Parking Lot Street Sweeping	Placentia Development Co., LLC	Hire a professional street sweeping service	Once per week
Trash Enclosures	Placentia Development Co., LLC	Hire a professional trash service to empty trash bins on a regular basis. Remove trash and clean trash enclosures as needed	Trash bins to be serviced once per week. Trash enclosures to be inspected once per week and all trash/debris removed.
Efficient Irrigation and Landscape Planting	Placentia Development Co., LLC	Hire professional landscape contractor to properly maintain landscape and control irrigation measures in common areas	Landscape maintenance required on a weekly basis or as needed. All irrigation services shall be efficient, any repairs conducted immediately. Irrigation timers shall be set according to County standard and seasonal conditions.
Subsurface Infiltration Galleries	Placentia Development Co., LLC	Hire professional contractor to properly maintain the subsurface infiltration gallery in the park area. Refer to Attachment D for additional information.	Regular maintenance prior to, during, and following the rainy season. Service a minimum of once per year and as necessary. Refer to Attachment D for additional

			information.
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## Section VI BMP Exhibit (Site Plan)

### VI.1 BMP Exhibit (Site Plan)

Include a BMP Exhibit (Site Plan), at a size no less than 24" by 36," which includes the following minimum information:

- Insert in the title block (lower right hand corner) of BMP Exhibit: the WQMP Number (assigned by staff) and the grading/building or Planning Application permit numbers
- Project location (address, tract/lot number(s), etc.)
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural BMP locations
- Drainage delineations and flow information
- Delineate the area being treated by each structural BMP
- GIS coordinates for LID and Treatment Control BMPs
- Drainage connections
- BMP details
- Preparer name and stamp

Please do not include any areas outside of the project area or any information not related to drainage or water quality. The approved BMP Exhibit (Site Plan) shall be submitted as a plan sheet on all grading and building plan sets submitted for plan check review and approval. The BMP Exhibit shall be at the same size as the rest of the plan sheets in the submittal and shall have an approval stamp and signature prior to plan check submittal.

### VI.2 Submittal and Recordation of Water Quality Management Plan

Following approval of the Final Project-Specific WQMP, three copies of the approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be submitted. In addition, these documents shall be submitted in a PDF format.

Each approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be recorded in the Orange County Clerk-Recorder's Office, prior to close-out of grading and/or building permit. Educational Materials are not required to be included.

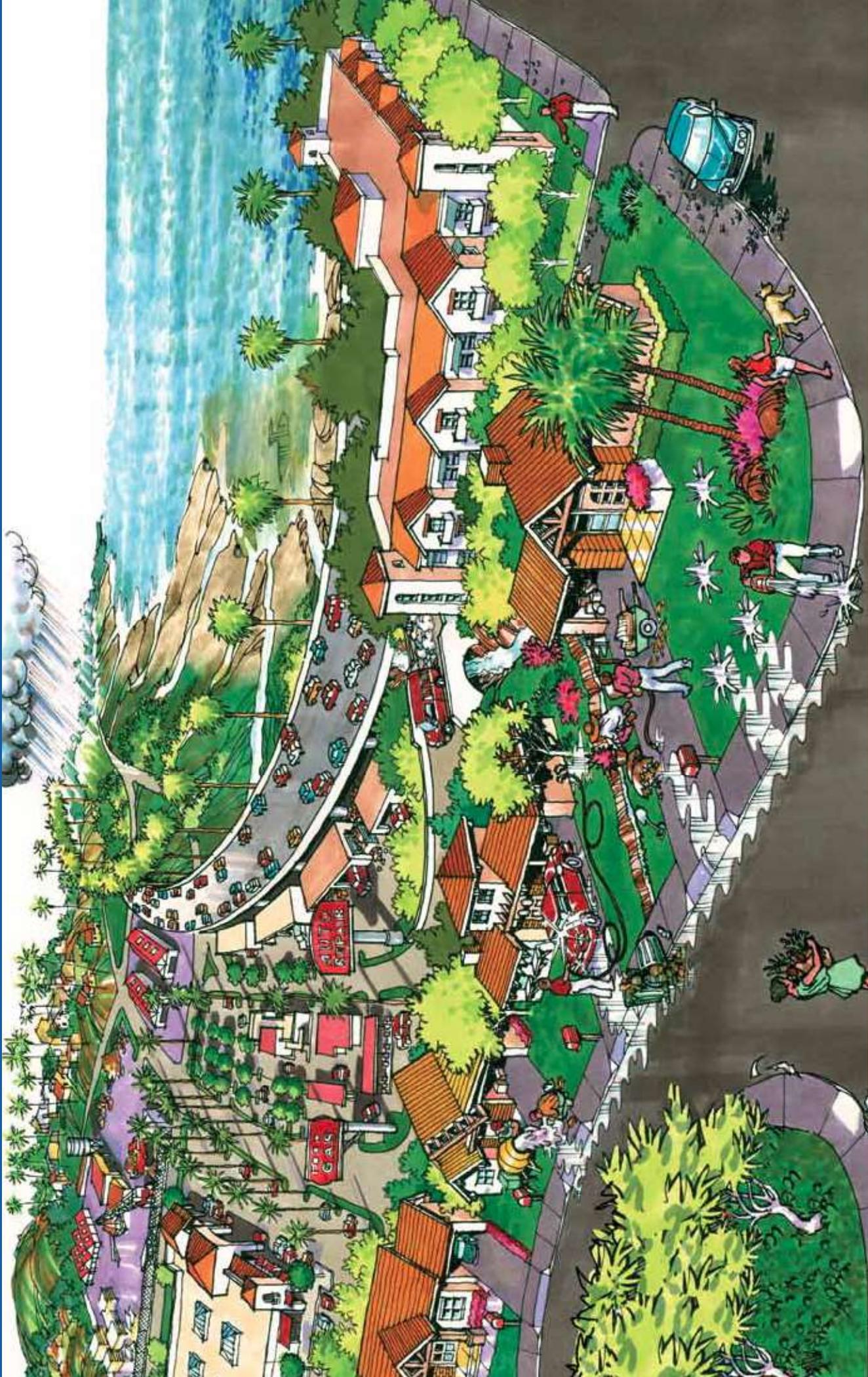
## Section VII Educational Materials

Refer to the Orange County Stormwater Program ([ocwatersheds.com](http://ocwatersheds.com)) for a library of materials available. Please only attach the educational materials specifically applicable to this project. Other materials specific to the project may be included as well and must be attached.

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

# Attachment A

# The Ocean Begins at Your Front Door



*Never allow pollutants to enter the*

Follow these simple steps to help reduce water pollution:

### Household Activities

- Do not rinse spills with water. Use dry cleanup methods such as applying cat litter or another absorbent material, sweep and dispose of in the trash. Take items such as used or excess batteries, oven cleaners, automotive fluids, painting products and cathode ray tubes, like TVs and computer monitors, to a Household Hazardous Waste Collection Center (HHWCC).
- For a HHWCC near you call (714) 834-6752 or visit [www.oclandfills.com](http://www.oclandfills.com).

- Do not hose down your driveway, sidewalk or patio to the street, gutter or storm drain. Sweep up debris and dispose of it in the trash.

### Automotive

- Take your vehicle to a commercial car wash whenever possible. If you wash your vehicle at home, choose soaps, cleaners, or detergents labeled non-toxic, phosphate-free or biodegradable. Vegetable and citrus-based products are typically safest for the environment.
- Do not allow washwater from vehicle washing to drain into the street, gutter or storm drain. Excess washwater should be disposed of in the sanitary sewer (through a sink or toilet) or onto an absorbent surface like your lawn.
- Monitor your vehicles for leaks and place a pan under leaks. Keep your vehicles well maintained to stop and prevent leaks.
- Never pour oil or antifreeze in the street, gutter or storm drain. Recycle these substances at a service station, a waste oil collection center or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit [www.1800cleanup.org](http://www.1800cleanup.org).

### Pool Maintenance

- Pool and spa water must be dechlorinated and free of excess acid, alkali or color to be allowed in the street, gutter or storm drain.
- When it is not raining, drain dechlorinated pool and spa water directly into the sanitary sewer.
- Some cities may have ordinances that do not allow pool water to be disposed of in the storm drain. Check with your city.

### Landscape and Gardening

- Do not over-water. Water your lawn and garden by hand to control the amount of water you use or set irrigation systems to reflect seasonal water needs. If water flows off your yard onto your driveway or sidewalk, your system is over-watering. 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 waste by composting, hauling it to a permitted landfill, or as green waste through your city's recycling program.
- Follow directions on pesticides and fertilizer, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Take unwanted pesticides to a HHWCC to be recycled. For locations and hours of HHWCC, call (714) 834-6752 or visit [www.oclandfills.com](http://www.oclandfills.com).

### Trash

- Place trash and litter that cannot be recycled in securely covered trash cans.
- Whenever possible, buy recycled products.
- Remember: Reduce, Reuse, Recycle.

### Pet Care

- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash. Pet waste, if left outdoors, can wash into the street, gutter or storm drain.
- If possible, bathe your pets indoors. If you must bathe your pet outside, wash it on your lawn or another absorbent/permeable surface to keep the washwater from entering the street, gutter or storm drain.
- Follow directions for use of pet care products and dispose of any unused products at a HHWCC.

### Common Pollutants

#### Home Maintenance

- Detergents, cleaners and solvents
- Oil and latex paint
- Swimming pool chemicals
- Outdoor trash and litter

#### Lawn and Garden

- Pet and animal waste
- Pesticides
- Clippings, leaves and soil
- Fertilizer

#### Automobile

- Oil and grease
- Radiator fluids and antifreeze
- Cleaning chemicals
- Brake pad dust

*Even if you live miles from the Pacific Ocean, you may be unknowingly polluting it.*

*Dumping one quart of motor oil into a storm drain can contaminate 250,000 gallons of water.*

### ***Did You Know?***

- Most people believe that the largest source of water pollution in urban areas comes from specific sources such as factories and sewage treatment plants. In fact, the largest source of water pollution comes from city streets, neighborhoods, construction sites and parking lots. This type of pollution is sometimes called “non-point source” pollution.
- There are two types of non-point source pollution: stormwater and urban runoff pollution.
- Stormwater runoff results from rainfall. When rainstorms cause large volumes of water to rinse the urban landscape, picking up pollutants along the way.
- Urban runoff can happen any time of the year when excessive water use from irrigation, vehicle washing and other sources carries trash, lawn clippings and other urban pollutants into storm drains.

### ***Where Does It Go?***

- Anything we use outside homes, vehicles and businesses – like motor oil, paint, pesticides, fertilizers and cleaners – can be blown or washed into storm drains.
- A little water from a garden hose or rain can also send materials into storm drains.
- Storm drains are separate from our sanitary sewer systems; unlike water in sanitary sewers (from sinks or toilets), water in storm drains is not treated before entering our waterways.

### ***Sources of Non-Point Source Pollution***

- Automotive leaks and spills.
- Improper disposal of used oil and other engine fluids.
- Metals found in vehicle exhaust, weathered paint, rust, metal plating and tires.
- Pesticides and fertilizers from lawns, gardens and farms.
- Improper disposal of cleaners, paint and paint removers.
- Soil erosion and dust debris from landscape and construction activities.
- Litter, lawn clippings, animal waste, and other organic matter.
- Oil stains on parking lots and paved surfaces.



### ***The Effect on the Ocean***



Non-point source pollution can have a serious impact on water quality in Orange County. Pollutants from the storm drain system can harm marine life as well as coastal and wetland habitats. They can also degrade recreation areas such as beaches, harbors and bays.

Stormwater quality management programs have been developed throughout Orange County to educate and encourage the public to protect water quality, monitor runoff in the storm drain system, investigate illegal dumping and maintain storm drains.

Support from Orange County residents and businesses is needed to improve water quality and reduce urban runoff pollution. Proper use and disposal of materials will help stop pollution before it reaches the storm drain and the ocean.



# For More Information

## California Environmental Protection Agency

[www.calepa.ca.gov](http://www.calepa.ca.gov)

- **Air Resources Board**  
[www.arb.ca.gov](http://www.arb.ca.gov)
- **Department of Pesticide Regulation**  
[www.cdpr.ca.gov](http://www.cdpr.ca.gov)
- **Department of Toxic Substances Control**  
[www.dtsc.ca.gov](http://www.dtsc.ca.gov)
- **Integrated Waste Management Board**  
[www.ciwmb.ca.gov](http://www.ciwmb.ca.gov)
- **Office of Environmental Health Hazard Assessment**  
[www.oehha.ca.gov](http://www.oehha.ca.gov)
- **State Water Resources Control Board**  
[www.waterboards.ca.gov](http://www.waterboards.ca.gov)

**Earth 911** - Community-Specific Environmental Information 1-800-cleanup or visit [www.1800cleanup.org](http://www.1800cleanup.org)

## Health Care Agency's Ocean and Bay Water Closure and Posting Hotline

(714) 433-6400 or visit [www.ocbeachinfo.com](http://www.ocbeachinfo.com)

## Integrated Waste Management Dept. of Orange County

(714) 834-6752 or visit [www.oclandfills.com](http://www.oclandfills.com) for information on household hazardous waste collection centers, recycling centers and solid waste collection

## O.C. Agriculture Commissioner

(714) 447-7100 or visit [www.ocagcomm.com](http://www.ocagcomm.com)

## Stormwater Best Management Practice Handbook

Visit [www.cabmphandbooks.com](http://www.cabmphandbooks.com)

## UC Master Gardener Hotline

(714) 708-1646 or visit [www.uccemg.com](http://www.uccemg.com)

The Orange County Stormwater Program has created and moderates an electronic mailing list to facilitate communications, take questions and exchange ideas among its users about issues and topics related to stormwater and urban runoff and the implementation of program elements. To join the list, please send an email to [ocstormwaterinfo-join@list.ocwatersheds.com](mailto:ocstormwaterinfo-join@list.ocwatersheds.com)

# The Ocean Begins at Your Front Door

## Orange County Stormwater Program

Aliso Viejo . . . . .	(949)	425-2535
Anaheim Public Works Operations . . . . .	(714)	765-6860
Brea Engineering . . . . .	(714)	990-7666
Buena Park Public Works . . . . .	(714)	562-3655
Costa Mesa Public Services . . . . .	(714)	754-5323
Cypress Public Works . . . . .	(714)	229-6740
Dana Point Public Works . . . . .	(949)	248-3584
Fountain Valley Public Works . . . . .	(714)	593-4441
Fullerton Engineering Dept. . . . .	(714)	738-6853
Garden Grove Public Works . . . . .	(714)	741-5956
Huntington Beach Public Works . . . . .	(714)	536-5431
Irvine Public Works . . . . .	(949)	724-6315
La Habra Public Services . . . . .	(562)	905-9792
La Palma Public Works . . . . .	(714)	690-3310
Laguna Beach Water Quality . . . . .	(949)	497-0378
Laguna Hills Public Services . . . . .	(949)	707-2650
Laguna Niguel Public Works . . . . .	(949)	362-4337
Laguna Woods Public Works . . . . .	(949)	639-0500
Lake Forest Public Works . . . . .	(949)	461-3480
Los Alamitos Community Dev. . . . .	(562)	431-3538
Mission Viejo Public Works . . . . .	(949)	470-3056
Newport Beach, Code & Water		
Quality Enforcement . . . . .	(949)	644-3215
Orange Public Works . . . . .	(714)	532-6480
Placentia Public Works . . . . .	(714)	993-8245
Rancho Santa Margarita . . . . .	(949)	635-1800
San Clemente Environmental Programs . . . . .	(949)	361-6143
San Juan Capistrano Engineering . . . . .	(949)	234-4413
Santa Ana Public Works . . . . .	(714)	647-3380
Seal Beach Engineering . . . . .	(562)	431-2527 x317
Stanton Public Works . . . . .	(714)	379-9222 x204
Tustin Public Works/Engineering . . . . .	(714)	573-3150
Villa Park Engineering . . . . .	(714)	998-1500
Westminster Public Works/Engineering . . . . .	(714)	898-3311 x446
Yorba Linda Engineering . . . . .	(714)	961-7138
Orange County Stormwater Program . . . . .	(877)	897-7455
Orange County 24-Hour		
Water Pollution Problem Reporting Hotline		
1-877-89-SPILL (1-877-897-7455)		

On-line Water Pollution Problem Reporting Form

[www.ocwatersheds.com](http://www.ocwatersheds.com)



Printed on Recycled Paper

## The Pollution Solution

Several residential activities can result in water pollution. Among these activities are car washing and hosing off driveways as well as leaks. Both activities can result in less 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

**Solution:** 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

**Solution:** 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 sheeting to prevent wind or rain from allowing dirt or sediment to enter the storm drain system.

### 3 Metals

**Solution:** 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

**Solution:** 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 pet!

### 5 Trash and Debris

**Pollution:** Trash and debris can enter waterways by wind, littering and careless disposal. 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 Intra-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 (MUDDOC) 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.ucccewatersheds.com/publicies/](http://www.ucccewatersheds.com/publicies/)

[www.mudoc.com](http://www.mudoc.com)

[www.uccce.org](http://www.uccce.org)



To report a spill, call the Orange County 24-Hour Water Pollution Prevention Reporting Hotline at 1-877-885-SPILL \ (1-877-887-7455)

**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 approximately 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.



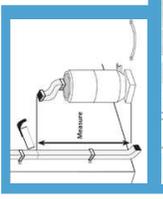
In Orange County, 60-70% of water used by residents and businesses goes to irrigation and other outdoor uses. Reusing rainwater to irrigate our lawn not only reduces the impact of water pollution from runoff, but it also is a great way to conserve our precious water resources and replenish our groundwater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

## 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 divert the runoff from roofs and downspouts to rain barrels. Rain gardens are another option; these reduce runoff, as well as encourage infiltration.



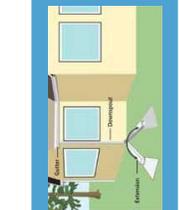
**Downspout Disconnection/Redirection**  
 Disconnecting downspouts from pipes running to the gutter prevents runoff from transporting pollutants to the storm drain. Once disconnected, downspouts can be redirected to rain gardens or other vegetated areas, or be connected to a rain barrel.

**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.ocvctd.org/mosquitoes3.php](http://www.ocvctd.org/mosquitoes3.php).

**Rain Gardens**  
 Rain gardens allow runoff to be directed from your roof downspout into a landscaped area. Vegetation and roots 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 palette, 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/](http://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](http://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 blooms 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

**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.

• **Am 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 inches of the soil. Time your sprinklers so that water begins to evaporate off your lawn, you can turn them on. Your timer can be set to water your lawn for this duration every time.

• **Water at Sunrise.**— Watering early in the morning reduces water loss due to evaporation. Additionally, winds tend to be lower 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 million 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.

# Help Prevent Ocean Pollution:

*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**

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](http://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.



## Household Tips



**The Ocean Begins at Your Front Door**

**P R O J E C T**  
**Pollution**  
**P R E V E N T I O N**

# 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

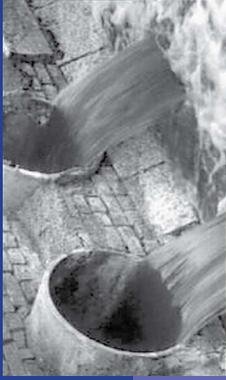
- Follow directions on pesticides and fertilizers, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Water your lawn and garden by hand to control the amount of water you use. Set irrigation systems to reflect seasonal water needs. If water flows off your yard 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 wastewater.
- **Do not dump wastewater onto your driveway, sidewalk, street, gutter or storm drain.** Excess wastewater 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](http://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.oilandfills.com](http://www.oilandfills.com).



*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

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

drain and eventually into our waterways and the ocean. In addition, hazardous waste must not be poured in the sanitary sewers (sinks and toilets).

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

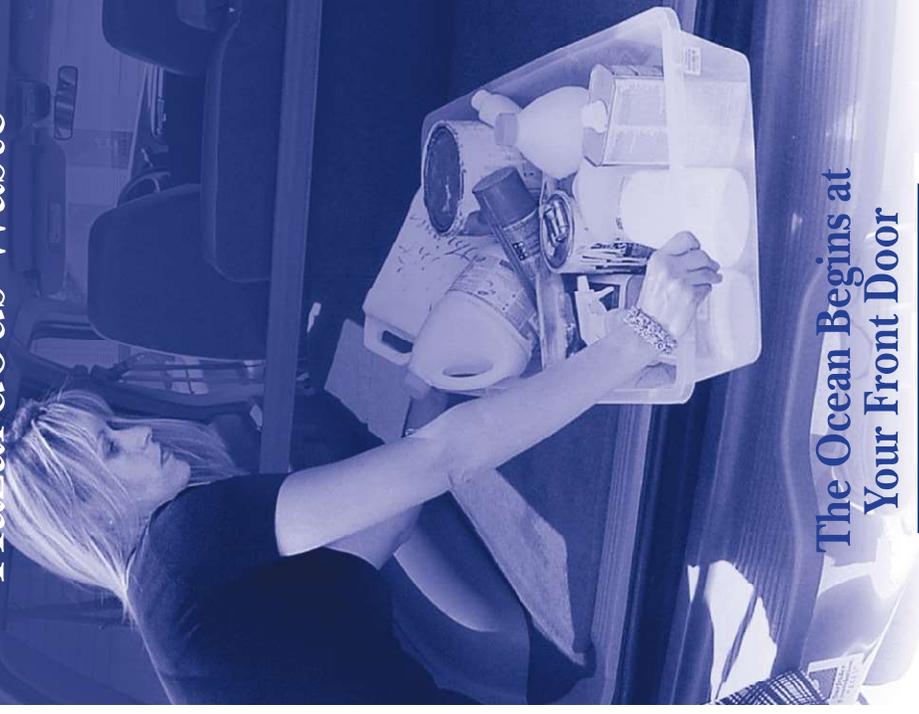
For emergencies, dial 911.



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Help Prevent Ocean Pollution:

# Proper Disposal of Household Hazardous Waste



The Ocean Begins at Your Front Door

**P R O J E C T**  
**Pollution**  
**P R E V E N T I O N**

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](http://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.



# HOMEOOWNER TIPS PROTECTING WATER

## Before Buying Pest Control Products

- Identify the pest.
- Decide if pest control products are the best control measure or if there are alternatives available.
- Are integrated pest management guidelines available for this pest?
- Read the product label:

Is the pest listed on the label?

Is it the best product for the pest?

## Before Mixing Your Sprayer

- Read the label carefully.
- Buy only enough pesticide to treat the area affected by the pest.
- Check the weather and don't apply if it's windy or about to rain.
- Measure the area you're treating.
- Calculate how much spray to mix.
- Wear long sleeve shirt, long pants, shoes and any other protective equipment listed on the label and follow all the label precautions.
- Be prepared for spills and know how to clean them up.

## When You're Ready To Spray

- Mix and load spray in an area where any spilled pesticide will not be able to drain or be washed away into storm drains, ditches, streams, ponds or other bodies of water.
- Mix sprayer on grass, not the sidewalk or driveway.
- Mix only as much as needed.

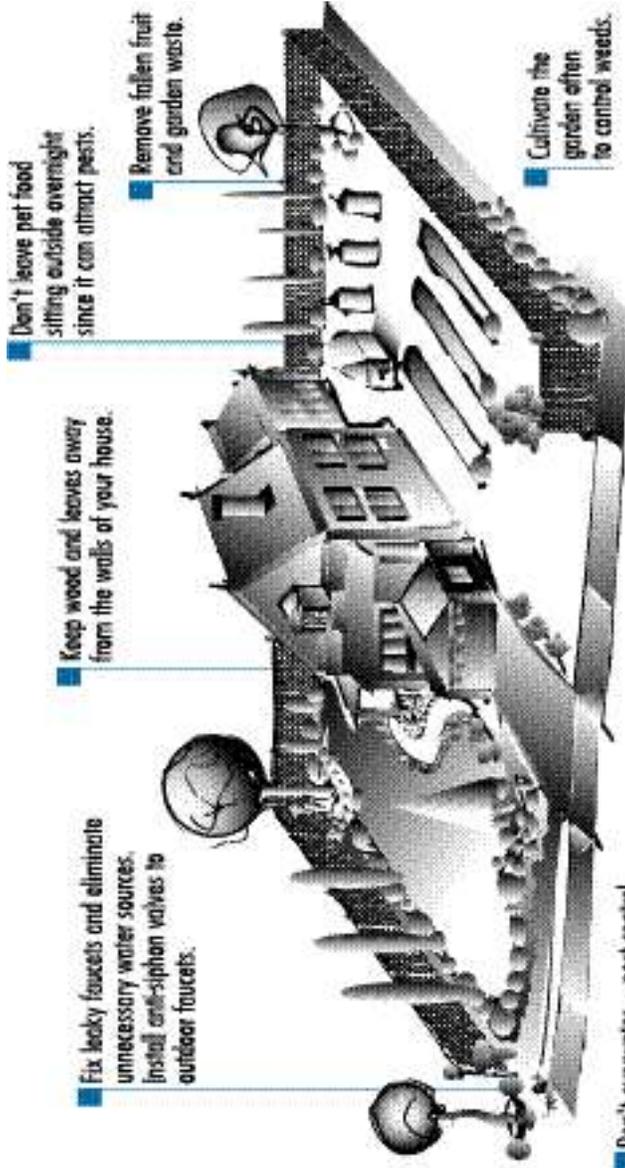
## When You're Spraying

- AVOID spraying in or near storm drains, ditches, streams, and ponds!
- Leave an untreated strip around these areas to protect the water.

## When You're done

- Never dump leftovers down any drain; Save for a future application.
- Triple-rinse sprayer and apply rinsewater to treated area.
- Take any old or unwanted pesticides to a Household Hazardous Waste Collection Center (714) 834-6752.

Using Pest Control Products.  
It's Your Responsibility To Do It Right!



Don't overwater — pest control products and fertilizer runoff can be washed into drains and waterways.

Tightly cover garbage cans.

Repair all window/door screens and seal any cracks or openings in walls.

Healthily and well-fed plants are a good defense against insect pests.

## IPM... OUTSMARTING PESTS WHILE PROTECTING WATER

With Integrated Pest Management (IPM), homeowners use common sense and nature to make it difficult for pests to survive. IPM techniques include cultural practices (such as mulching to prevent weeds), encouraging natural enemies (good bugs), and judicious use of pest control products.

- First, identify your pest problem. To find the best solution, you need to pin down the problem. Consult gardening books, your county cooperative extension office or your local nursery.
- Decide how much pest control is necessary. If you can live with some pest damage, you can avoid intensive pest control product treatments.

- Choose an effective option. Try various types of controls first: washing bugs off plants, pruning diseased parts of plants. If you need to use pest control products, choose one that targets the problem and poses the least hazard.

- Finally, it's easier to prevent pests than to control them.



**Think ahead.**

This brochure is being distributed in order to reduce the impacts of pesticides on water quality. It was produced with support from the Orange County Storm Water Program, the Coalition for Urban/Rural Environmental Stewardship (CURES) and a 319(h) grant from the State Water Resources Control Board.

**Orange County Storm Water Program Participants:**

Anaheim Public Works/Engineering .....	(714) 765-5176
Brea Engineering .....	(714) 990-7666
Buena Park Public Works .....	(714) 562-3655
Costa Mesa Public Services .....	(714) 754-5248
Cypress Engineering .....	(714) 229-6752
Dana Point Public Works .....	(949) 248-3562
Fountain Valley Public Works .....	(714) 593-4400 x347
Fullerton Engineering Dept .....	(714) 738-6853
Garden Grove Development Services .....	(714) 741-5554
Huntington Beach Public Works .....	(714) 536-5432
Invine Public Works .....	(949)724-6515
La Habra Public Services .....	(562) 905-9792
La Palma Public Works .....	(714) 523-1140 x102
Laguna Beach Municipal Services .....	(949) 497-0711
Laguna Hills Engineering .....	(949) 707-2600
Laguna Niguel Public Works .....	(949) 362-4337
Lake Forest Public Works .....	(949) 461-3480
Los Alamitos Community Dev .....	(562) 431-3538 x301
Mission Viejo Public Works .....	(949) 470-3095
Newport Beach Public works .....	(949) 644-3311
Orange Public Works .....	(714) 744-5551
Placentia Engineering .....	(714) 993-8131
San Clemente Engineering .....	(949) 361-6100
San Juan Capistrano Engineering .....	(949) 493-1171
Santa Ana Public Works .....	(714) 647-3380
Seal Beach Engineering .....	(562) 431-2527 x318
Stanton Public Works .....	(714) 379-9222 x204
Tustin Public Works Engineering .....	(714) 573-3150
Villa Park Engineering .....	(714) 998-1500
Westminster Public Works Eng. ....	(714) 898-3311 x215
Yorba Linda Engineering .....	(714) 961-7170 x174
O.C. Storm Water Program .....	1-877-89-SPILL (1-877-897-7455)
24 Hour Water Pollution Hotline .....	(714) 567-6363 or ashbyk@pfrd.co.orange.ca.us

Chemical and Hazardous Material Spill Emergencies ..... 911  
 Other Important Phone Numbers:  
 For Additional Brochures .....1-877-89-SPILL (1-877-897-7455)  
 UC Masters & Coop Extension ..... (714) 708-1646  
 ucmastergardeners@yahoo.com

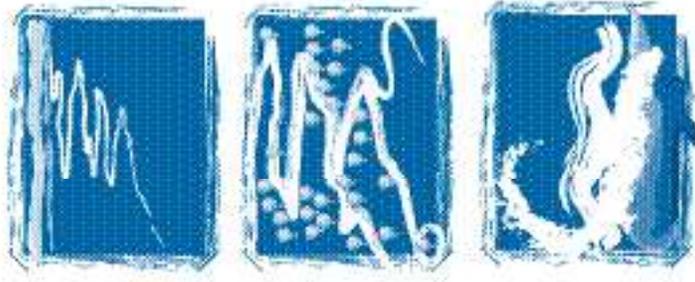
O.C. Household Hazardous Waste Information ..... (714) 834-6752  
 or [www.oc.ca.gov/IWMD](http://www.oc.ca.gov/IWMD)

Information on agriculture chemicals, pesticides and possible alternatives, O.C. Agriculture Commissioner ..... (714) 447-7115

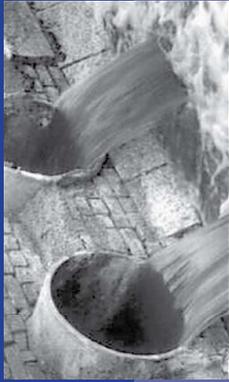
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 Western Crop Protection Association (WCPA)  
 Responsible Industry for a Sound Environment (RISE)



**Keeping  
Pest Control Products  
Out of  
Creeks, Rivers and The Ocean**



**HOMEOWNER TIPS  
PROTECTING  
WATER**



**C**lean beaches and healthy creeks, rivers, bays and oceans 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.

# Help Prevent Ocean Pollution: Responsible Pest Control

For more information,  
please call

University of California Cooperative  
Extension Master Gardeners at  
(714) 708-1646

or visit these Web sites:

[www.uccemg.org](http://www.uccemg.org)

[www.ipm.ucdavis.edu](http://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](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

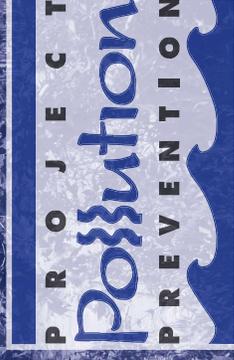
Darren Haver.

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Costa-Machado Water Act of 2000 (Prop. 13).



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The Ocean Begins  
at Your Front Door



# 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.



**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](http://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](http://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 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.oilandfills.com](http://www.oilandfills.com)





**C**lean 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](http://www.ocwatersheds.com)

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**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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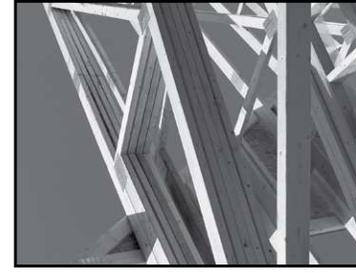
# Help Prevent Ocean Pollution: Tips for Home Improvement Projects



# 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

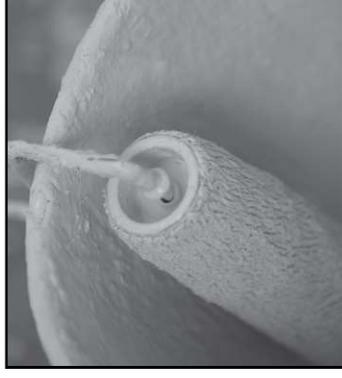
- Never hose materials into a street, gutter or storm drain.
- Exposed piles of construction material should not be stored on the street or sidewalk.
- Minimize waste by ordering only the amount of materials needed to complete the job.
- Do not mix more fresh concrete than is needed for each project.
- 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.oilandfills.com](http://www.oilandfills.com).

## Erosion Control

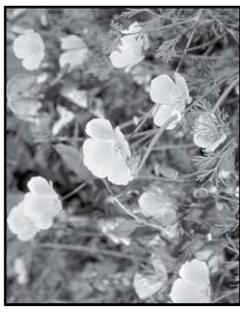
- Schedule grading and excavation projects for dry weather.
- When temporarily removing soil, pile it in a contained, covered area where it cannot spill into the street, or obtain the required temporary encroachment or street closure permit and follow the conditions instructed by the permit.

- 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](http://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](http://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](http://www.ocwatersheds.com) to fill out an incident reporting form.

Help Prevent Ocean Pollution:

# Tips for Landscape & Gardening



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](http://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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# 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](http://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.oilandfills.com](http://www.oilandfills.com)

## Tips for Pet Care

**C**lean 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](http://www.ocwatersheds.com)

To report a spill, call the

**Orange County 24-Hour  
Water Pollution Problem  
Reporting Hotline**

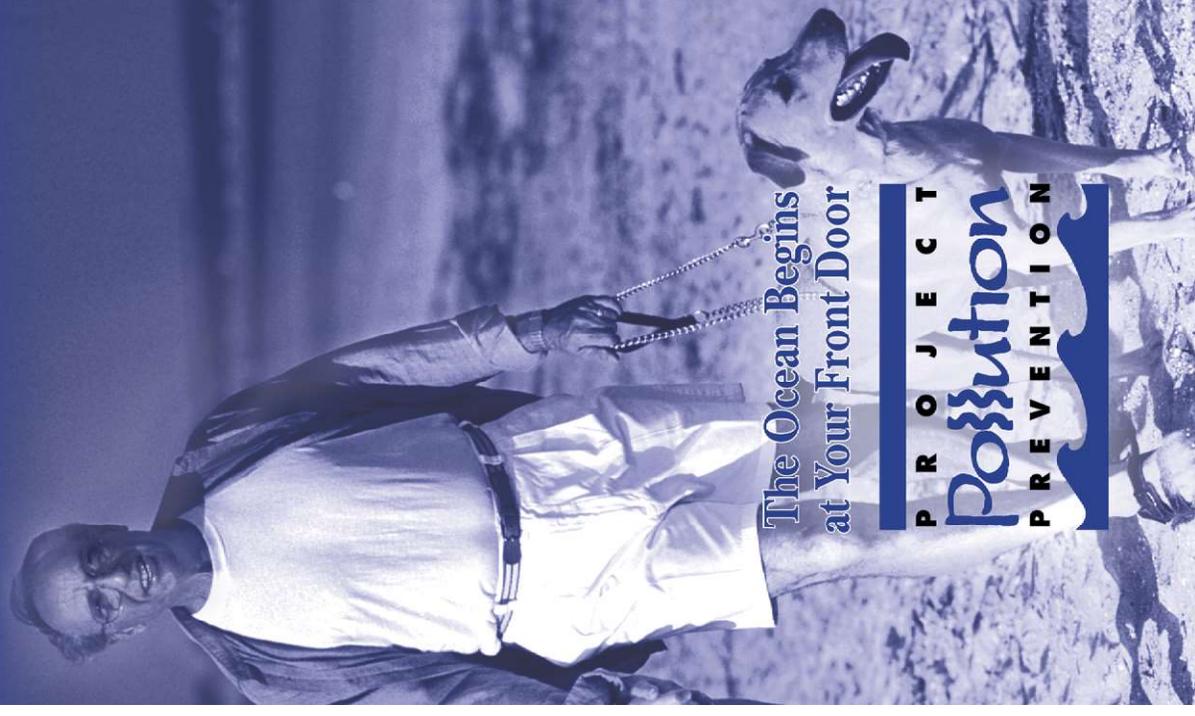
**1-877-89-SPILL** (1-877-897-7455).

**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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# 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.





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. 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



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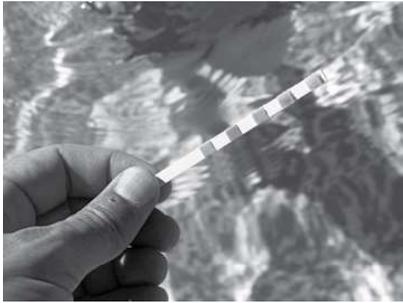


# Tips for Residential Pool, Landscape and Hardscape Drains

## 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.oilandfills.com](http://www.oilandfills.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](http://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.



# Tips for Projects Using Paint



**C**lean 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](http://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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**Pollution**  
PREVENTION

# 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.oilandfills.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.



**C**lean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. Fats, oils and grease from restaurants and food service facilities can cause sewer line blockages that may result in sewage overflow into your facility and into storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways and should never contain wastewater, trash, grease or other materials.

You would never dump oil and trash into the ocean, so don't let it 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](http://www.ocwatersheds.com)

Report sewage spills and discharges that are not contained to your site to the  
**Orange County 24-Hour Water Pollution Problem Reporting Hotline**  
at **1-877-89-SPILL** (1-877-897-7455)

For emergencies, dial **911**.



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Help Prevent Ocean Pollution:

## Tips for the Food Service Industry

# DELA



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# Best Kitchen Practices

## *Food Waste Disposal*

- Scrape food waste off of plates, utensils, pots, food preparation and cooking areas and dispose of it in the trash.
- Never put food waste down the drain. Food scraps often contain grease, which can clog sewer pipes and result in sewage backups and overflows.

## *Grease & Oil Disposal*

- Never put oil or grease down the drain. Contain grease and oil by using covered grease storage containers or installing a grease interceptor.
- Never overfill your grease storage container or transport it without a cover.
- Grease control devices must be emptied and cleaned by permitted companies.
- Keep maintenance records on site.



- For a list of oil/grease recycling companies, contact the CIWMB at [www.ciwmb.ca.gov/foodwaste/render.htm](http://www.ciwmb.ca.gov/foodwaste/render.htm) or contact your local sanitation district.

## *Minor Spill Cleanup*

- Always use dry cleanup methods, such as a rag, damp mop or broom.
- Never hose a spill into the street, gutter or storm drain.



## *Major Spill Cleanup*

- Have spill containment and cleanup kits readily available, and train all employees on how to use them.
- Immediately contain and clean the spill using dry methods.
- If the spill leaves your site, call (714) 567-6363.

## *Dumpster Cleanup*



- Pick up all debris around the dumpster.
- Always keep the lid on the dumpster closed.
- Never pour liquids into the dumpster or hose it out.

## *Floor Mat Cleaning*



- Sweep the floor mats regularly, discarding the debris into the trash.
- Hose off the mats in a mop sink, at a floor drain, or in an outdoor area that can contain the water.

- Never hose the mats in an area where the wastewater can flow to the street, gutter or storm drain.

## *Washwater Disposal*

- Dispose of washwater in a mop sink or an area with a floor drain.
- Never dispose of washwater in the street, gutter or storm drain.



## *Preventing water pollution at your commercial/industrial site*

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many landscape and building maintenance activities can lead to water pollution if you're not careful. Paint, chemicals, plant clippings and other materials can be blown or washed into 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 pour soap or fertilizers into the ocean, so why would you let them enter the storm drains? Follow these easy tips to help prevent water pollution.

Some types of industrial facilities are required to obtain coverage under the State General Industrial Permit. For more information visit: [www.swrcb.ca.gov/stormwater/industrial.html](http://www.swrcb.ca.gov/stormwater/industrial.html)

For more information, please call the

**Orange County Stormwater Program**  
at 1-877-89-SPILL (1-877-897-7455)

or visit

[www.ocwatersheds.com](http://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.



RECYCLE  
USED OIL



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# Help Prevent Ocean Pollution:

# Proper Maintenance Practices for Your Business



## The Ocean Begins at Your Front Door



# Proper Maintenance Practices for your Business

## *Landscape Maintenance*

- Compost grass clippings, leaves, sticks and other vegetation, or dispose of it at a permitted landfill or in green waste containers. Do not dispose of these materials in the street, gutter or storm drain.
- Irrigate slowly and inspect the system for leaks, overspraying and runoff. Adjust automatic timers to avoid overwatering.
- Follow label directions for the use and disposal of fertilizers and pesticides.
- Do not apply pesticides or fertilizers if rain is expected within 48 hours or if wind speeds are above 5 mph.
- Do not spray pesticides within 100 feet of waterways.
- Fertilizers should be worked into the soil rather than dumped onto the surface.
- If fertilizer is spilled on the pavement or sidewalk, sweep it up immediately and place it back in the container.

## *Building Maintenance*

- Never allow washwater, sweepings or sediment to enter the storm drain.
- Sweep up dry spills and use cat litter, towels or similar materials to absorb wet spills. Dispose of it in the trash.
- If you wash your building, sidewalk or parking lot, you **must** contain the water. Use a shop vac to collect the water and contact your city or sanitation agency for proper disposal information. Do not let water enter the street, gutter or storm drain.
- Use drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of materials in the trash.
- Use a ground cloth or oversized tub for mixing paint and cleaning tools.
- Use a damp mop or broom to clean floors.
- Cover dumpsters to keep insects, animals, rainwater and sand from entering. Keep the area around the dumpster clear of trash and debris. Do not overfill the dumpster.

- Call your trash hauler to replace leaking dumpsters.

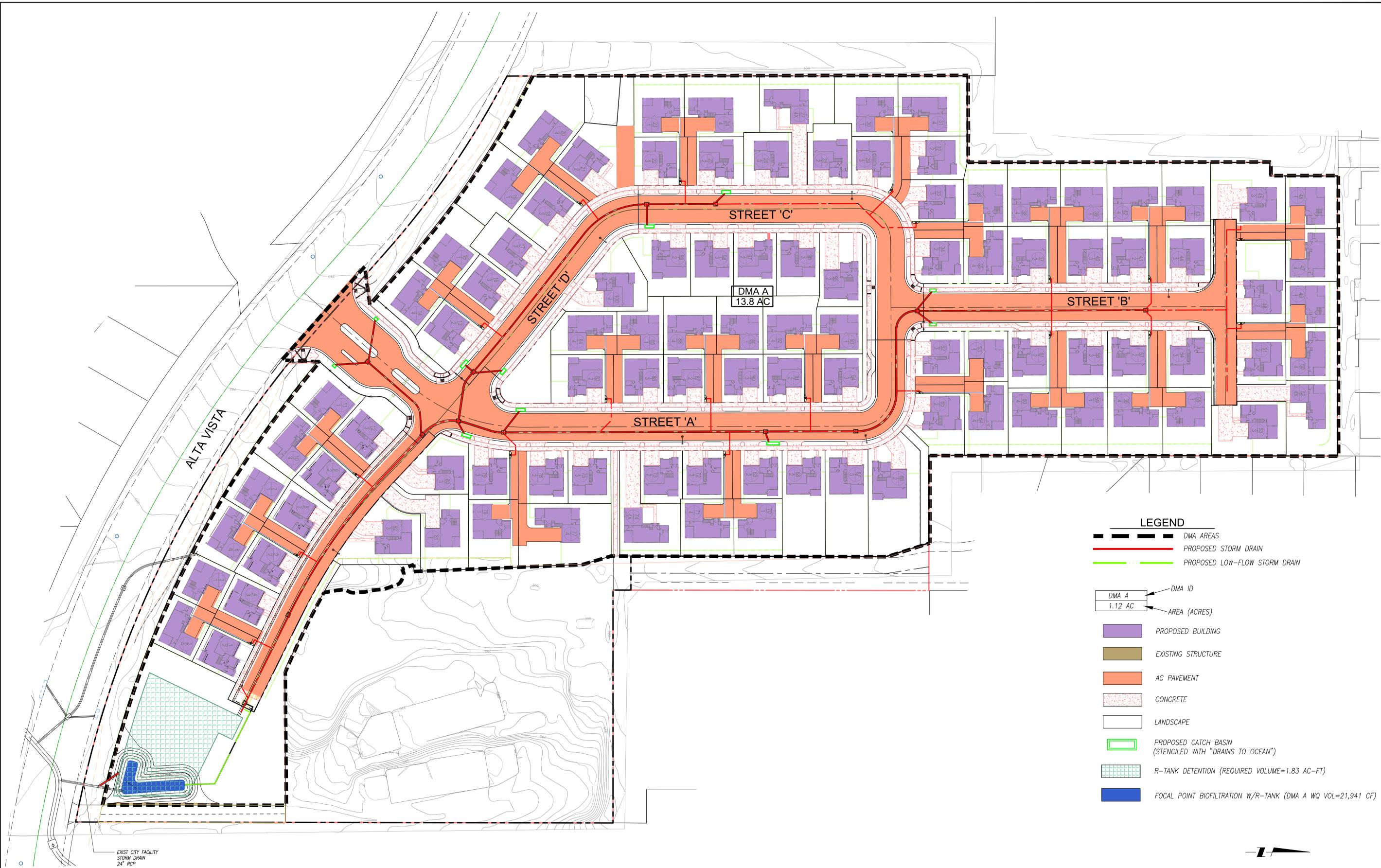
- Do not dump any toxic substance or liquid waste on the pavement, the ground, or near a storm drain. Even materials that seem harmless such as latex paint or biodegradable cleaners can damage the environment.

NEVER DISPOSE  
OF ANYTHING  
IN THE STORM  
DRAIN.

- Recycle paints, solvents and other materials. For more information about recycling and collection centers, visit [www.oclandfills.com](http://www.oclandfills.com).
- Store materials indoors or under cover and away from storm drains.
- Use a construction and demolition recycling company to recycle lumber, paper, cardboard, metals, masonry, carpet, plastic, pipes, drywall, rocks, dirt, and green waste. For a listing of construction and demolition recycling locations in your area, visit [www.ciwmb.ca.gov/recycle](http://www.ciwmb.ca.gov/recycle).
- Properly label materials. Familiarize employees with Material Safety Data Sheets.



# Attachment B



### DMA AREA SUMMARY

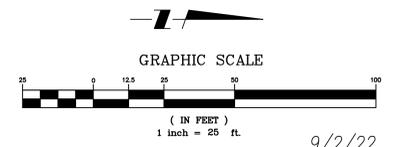
DMA AREA	PERVIOUS AREA (SF)	IMPERVIOUS AREA (SF)	TOTAL AREA (SF)	TOTAL AREA (AC)	EFF. IMP. FRACTION	MIN. BMP FOOTPRINT (SF)	MIN. BMP VOLUME (CF)
DMA A	277,249	327,791	605,040	13.9	0.54	10,532	21,941

NO.	DATE	REVISIONS

DESIGNED BY: \_\_\_\_\_  
 DRAFTED BY: \_\_\_\_\_  
 CHECKED BY: SMW  
 DATE: 9/22



PROJECT NO. 10367.00  
 SHEET 1 OF 1  
 ALTA VISTA-PLACENTA TRACT NO. 19250 WQMP EXHIBIT



EXIST CITY FACILITY STORM DRAIN 24" RCP

# Attachment C

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](http://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  $\leq$  2 percent and path lengths of  $\geq$  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.

**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



<sup>1</sup> Pervious area used in calculation should only include the pervious area receiving flow, not pervious area receiving only direct rainfall or upslope pervious drainage.

**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](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](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](http://www.co.thurston.wa.us/stormwater/manual/docs-faqs/DG-5-Roof-Runoff-Control_Rev11Jan24.pdf)

INF-3: Bioretention with no Underdrain

Bioretention stormwater treatment facilities are landscaped shallow depressions that capture and filter stormwater runoff. These facilities function as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. The facilities normally consist of a ponding area, mulch layer, planting soils, and plants. As stormwater passes down through the planting soil, pollutants are filtered, adsorbed, and biodegraded by the soil and plants. For areas with low permeability native soils or steep slopes, bioretention areas can be designed with an underdrain system that routes the treated runoff to the storm drain system rather than depending entirely on infiltration.



**Feasibility Screening Considerations**

- Bioretention with no underdrains shall pass infiltration infeasibility screening criteria to be considered for use.

**Opportunity Criteria**

- Land use may include commercial, residential, mixed use, institutional, and subdivisions. Bioretention may also be applied in parking lot islands, cul-de-sacs, traffic circles, road shoulders, and road medians.
- Drainage area is ≤ 5 acres, preferably ≤ 1 acre.
- Area available for infiltration.
- Soils are adequate for infiltration or can be amended to improve infiltration capacity. Site slope is less than 15 percent.

**OC-Specific Design Criteria and Considerations**

- Placement of BMPs should observe geotechnical recommendations with respect to geological hazards (e.g. landslides, liquefaction zones, erosion, etc.) and set-backs (e.g., foundations, utilities, roadways, etc.)
- Depth to mounded seasonally high groundwater shall not be less than 5 feet.
- If sheet flow is conveyed to the treatment area over stabilized grassed areas, the site must be graded in such a way that minimizes erosive conditions; sheet flow velocities should not exceed 1 foot per second.
- Ponding depth should not exceed 18 inches; fencing may be required if ponding depth exceeds 6 inches to mitigate the risk of drowning.
- Planting/storage media shall be based on the recommendations contained in MISC-1: Planting/Storage Media
- The minimum amended soil depth is 1.5 feet (3 feet is preferred).
- The maximum drawdown time of the planting soil is 48 hours.

- Infiltration pathways may need to be restricted due to the close proximity of roads, foundations, or other infrastructure. A geomembrane liner, or other equivalent water proofing, may be placed along the vertical walls to reduce lateral flows. This liner should have a minimum thickness of 30 mils.
- Plant materials should be tolerant of summer drought, ponding fluctuations, and saturated soil conditions for 48 hours; native plant species and/or hardy cultivars that are not invasive and do not require chemical fertilizers or pesticides should be used to the maximum extent feasible.
- The bioretention area should be covered with 2-4 inches (average 3 inches) of mulch at startup and an additional placement of 1-2 inches of mulch should be added annually.
- An optional gravel drainage layer may be installed below planting media to augment storage volume.
- An overflow device is required at the top of the ponding depth.
- Dispersed flow or energy dissipation (i.e. splash rocks) for piped inlets should be provided at basin inlet to prevent erosion.

#### ***Simple Sizing Method for Bioretention with no Underdrain***

If the Simple Design Capture Volume Sizing Method described in **Appendix III.3.1** is used to size a bioretention area with underdrains, the user calculates the DCV and designs the system with geometry required to draw down the DCV in 48 hours. The sizing steps are as follows:

#### **Step 1: Determine the Bioretention Design Capture Volume**

Calculate the DCV using the Simple Design Capture Volume Sizing Method described in **Appendix III.3.1**.

#### **Step 2: Determine the 48-hour Ponding Depth**

The depth of effective storage depth that can be drawn down in 48 hours can be calculated using the following equation:

$$d_{48} = K_{\text{DESIGN}} \times 4$$

Where:

$d_{48}$  = bioretention 48-hour effective depth, ft

$K_{\text{DESIGN}}$  = bioretention design infiltration rate, in/hr (See **Appendix VII**)

This is the maximum effective depth of the basin below the overflow device to achieve drawdown in 48 hours. Effective depth includes ponding water and media/aggregate pore space.

#### **Step 3: Design System Geometry to Provide $d_{48}$**

Design system geometry such that

$$d_{48} \geq d_{\text{EFFECTIVE}} = (d_P + n_M d_M + n_G d_G)$$

Where:

$d_{48}$  = depth of water that can drain in 48 hours

$d_{\text{EFFECTIVE}}$  = total effective depth of water stored in bioretention area, ft

$d_P$  = bioretention ponding depth, ft (should be less than or equal to 1.5 ft)

$n_M$  = bioretention media porosity

$d_M$  = bioretention media depth, ft

$n_G$  = bioretention gravel layer porosity; 0.35 may be assumed where other information is not available

$d_G$  = bioretention gravel layer depth, ft

**Step 4: Calculate the Required Infiltrating Area**

The required infiltrating area (i.e. measured at the media surface) can be calculated using the following equation:

$$A = DCV / d_{EFFECTIVE}$$

Where:

A = required infiltrating area, sq-ft (measured as the media surface area)

DCV = design capture volume, cu-ft (see Step 1)

$d_{EFFECTIVE}$  = total effective depth of water stored in bioretention area, ft (from Step 3)

This does not include the side slopes, access roads, etc. which would increase bioretention footprint.

**Capture Efficiency Method for Bioretention with no Underdrain**

If BMP geometry has already been defined and deviates from the 48 hour drawdown time, the designer can use the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs (See [Appendix III.3.2](#)) to determine the fraction of the DCV that must be provided to manage 80 percent of average annual runoff volume. This method accounts for drawdown time different than 48 hours.

**Step 1: Determine the drawdown time associated with the selected basin geometry**

$$DD = (d_{EFFECTIVE} / K_{DESIGN}) \times 12 \text{ in/ft}$$

Where:

DD = time to completely drain infiltration basin ponding depth, hours

$$d_{EFFECTIVE} \leq (d_P + n_M d_M + n_G d_G)$$

$d_P$  = bioretention ponding depth, ft (should be less than or equal to 1.5 ft)

$n_M$  = bioretention media porosity

$d_M$  = bioretention media depth, ft

$n_G$  = bioretention gravel layer porosity; 0.35 may be assumed where other information is not available

$d_G$  = bioretention gravel layer depth, ft

$K_{DESIGN}$  = basin design infiltration rate, in/hr (See [Appendix VII](#))

**Step 2: Determine the Required Adjusted DCV for this Drawdown Time**

Use the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs (See [Appendix III.3.2](#)) to calculate the fraction of the DCV the basin must hold to achieve 80 percent capture of average annual stormwater runoff volume based on the basin drawdown time calculated above.

**Step 4: Check that the Bioretention Effective Depth Drains in no Greater than 96 Hours**

$$DD = (d_{EFFECTIVE} / K_{DESIGN}) \times 12$$

Where:

DD = time to completely drain bioretention facility, hours

$d_{EFFECTIVE}$  = total effective depth of water stored in bioretention area, ft (from Step 3)

$K_{DESIGN}$  = basin design infiltration rate, in/hr (See [Appendix VII](#))

If  $DD_{ALL}$  is greater than 96 hours, adjust bioretention media depth and/or gravel layer depth until DD is less than 96 hours. This duration is based on preventing extended periods of saturation from causing plant mortality.

### Step 5: Determine the Basin Infiltrating Area Needed

The required infiltrating area (i.e. the surface area of the top of the media layer) can be calculated using the following equation:

$$A = DCV / d_{EFFECTIVE}$$

Where:

A = required infiltrating area, sq-ft (measured at the media surface)

DCV = design capture volume, adjusted for drawdown time, cu-ft (see Step 1)

$d_{EFFECTIVE}$  = total effective depth of water stored in bioretention area, ft (from Step 3)

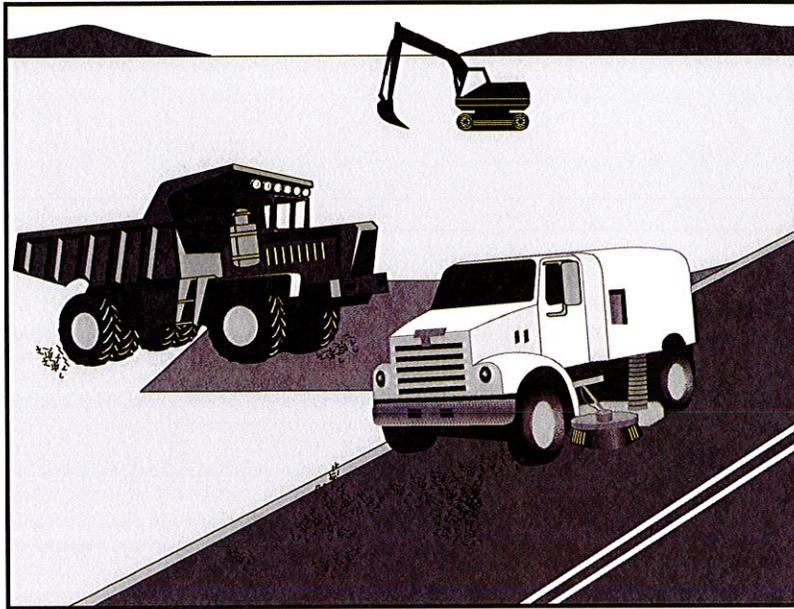
This does not include the side slopes, access roads, etc. which would increase bioretention footprint. If the area required is greater than the selected basin area, adjust surface area or adjust ponding depth and recalculate required area until the required area is achieved.

### Configuration for Use in a Treatment Train

- Bioretention areas may be preceded in a treatment train by HSCs in the drainage area, which would reduce the required volume of the bioretention cell.
- Bioretention areas can be incorporated in a treatment train to provide enhanced water quality treatment and reductions in runoff volume and rate. For example, runoff can be collected from a roadway in a vegetated swale that then flows to a bioretention area. Similarly, bioretention could be used to manage overflow from a cistern.

### Additional References for Design Guidance

- CASQA BMP Handbook for New and Redevelopment:  
<http://www.cabmphandbooks.com/Documents/Development/TC-32.pdf>
  - SMC LID Manual (pp 68):  
[http://www.lowimpactdevelopment.org/guest75/pub/All\\_Projects/SoCal\\_LID\\_Manual/SoCalLID\\_Manual\\_FINAL\\_040910.pdf](http://www.lowimpactdevelopment.org/guest75/pub/All_Projects/SoCal_LID_Manual/SoCalLID_Manual_FINAL_040910.pdf)
  - Los Angeles County Stormwater BMP Design and Maintenance Manual, Chapter 5:  
[http://dpw.lacounty.gov/DES/design\\_manuals/StormwaterBMPDesignandMaintenance.pdf](http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf)
  - San Diego County LID Handbook Appendix 4 (Factsheet 7):  
<http://www.sdcounty.ca.gov/dplu/docs/LID-Appendices.pdf>
  - 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](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)
- County of Los Angeles Low Impact Development Standards Manual, Chapter 5:  
[http://dpw.lacounty.gov/wmd/LA\\_County\\_LID\\_Manual.pdf](http://dpw.lacounty.gov/wmd/LA_County_LID_Manual.pdf)



## Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

## Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

## Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

## Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.
- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.

## Categories

EC	Erosion Control	
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	<input checked="" type="checkbox"/>
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

### Legend:

- Primary Objective
- Secondary Objective

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	

## Potential Alternatives

None



- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

## Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from \$58/hour (3 yd<sup>3</sup> hopper) to \$88/hour (9 yd<sup>3</sup> hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

## Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

## References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

# Site Design & Landscape Planning SD-10

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- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

## ***Minimizing and Disconnecting Impervious Areas***

- Refer to Fact Sheet SD-10 – Minimizing and Disconnecting Impervious Areas for information on spill cleanup.



Figure 1. Swale at city hall in Brisbane, CA.

# Site Design & Landscape Planning SD-10

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*Figure 2. Railroad rails and rip rap to slow stormwater flows in a creek daylighting project in Paso Robles, CA.*

# Site Design & Landscape Planning SD-10

## ***Redeveloping Existing Installations***

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas, and incorporate other applicable recommendations described above.



## **Other Resources**

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.



*Figure 3. Energy dissipation, erosion control, and stream buffers at Strawberry Creek in Berkeley, CA.*

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



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## Design Objectives

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- Maximize Infiltration
  - Provide Retention
  - Slow Runoff
- Minimize Impervious Land Coverage
- 



## Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

## Approach

Project plan designs for development and redevelopment should include application methods of irrigation water, plant selection, and landscape design that minimize runoff of excess irrigation water into the stormwater conveyance system.

## Applicability

This fact sheet is applicable to planting and irrigation systems of residential, commercial, and industrial areas in new development and redevelopment projects as defined by various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.). These plans define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land distributing activities with structural or impervious surfaces.

## Design Considerations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where applicable and feasible:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area’s specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.

- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.
- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species).
- Consider design features such as:
  - Using mulches (such as wood chips or bark) in planter areas without ground cover to minimize sediment in runoff;
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect;
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible; and
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth.
- Employ other comparable, equally effective methods to reduce irrigation water runoff.
- Note that Assembly Bill 1881, the Model Water Efficiency Landscape Ordinance, requires the use of efficient irrigation and compatible plantings for any project over 2055 square feet.



Figure 1. Swale at San Diego Airport with rock mulch, low-water plantings, and irrigation controls.

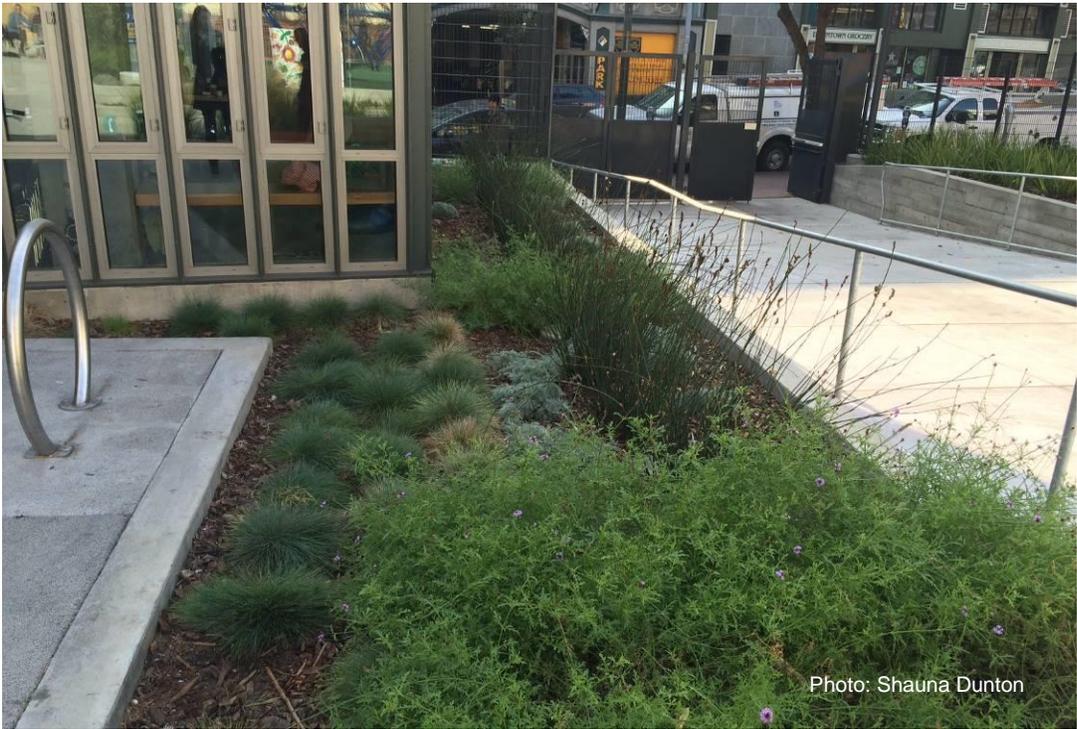


Photo: Shauna Dunton

Figure 2. Mulched landscape area adjacent to permeable concrete at a public park in San Francisco.



Photo: SFPUC Urban Watershed Management

Figure 3. Downspout to mulched flow-through planter bed in project courtyard.

## **Other Resources**

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



[http://www.svcw.org/facilities/sitePages/discharge to sf bay.aspx](http://www.svcw.org/facilities/sitePages/discharge%20to%20sf%20bay.aspx)

## Description

Waste materials dumped into storm drain inlets can have impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

## Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

## Applicability

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas as well as any other area where contributions or dumping to storm drains is likely.

Design considerations provided are applicable to new development and redevelopment as defined by various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.). These plans define “redevelopment” in terms of amounts of additional impervious

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### Design Objectives

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- Cover
- Contain
- Reduce/Minimize
- Prohibit Dumping
- Collect & Convey

---

### Targeted Constituents

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- Sediment
  - Nutrients
  - Trash
  - Metals
  - Bacteria
  - Oil & Grease
  - Synthetic Organics
  - Pesticides
- 



area, increases in gross floor area and/or exterior construction, and land distributing activities with structural or impervious surfaces.

## **Design Considerations**

Storm drain message markers or placards are recommended at all storm drain inlets. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include “NO DUMPING – DRAINS TO OCEAN” and/or other graphical icons to discourage illegal dumping.
- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note that some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

## **Additional Information**

### ***Maintenance Considerations***

Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner’s association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

### ***Examples***

Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

### **Other Resources**

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



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### Design Objectives

---

- Cover
- Contain
  - Reduce/Minimize
- Prohibit Dumping
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---

### Targeted Constituents

---

- Sediment
  - Nutrients
  - Trash
  - Metals
  - Bacteria
  - Oil & Grease
  - Synthetic Organics
  - Pesticides
- 

## Description

Spills and leaks are one of the largest contributors of stormwater pollutants. Many activities that occur at a new development or redevelopment site have the potential to cause accidental spills. Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from the tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

- Installation problems;
- Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves);
- External corrosion and structural failure; and
- Spills and overfills due to operator error.

Preparation for accidental spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures



that identify hazardous material storage areas, specify material handling procedures, and provide locations of spill clean-up equipment and materials.

### **Approach**

Structural measures such as covering, berming, and double containment should be used to prevent spills from reaching storm drains. A spill prevention plan should be developed in order to identify potential spills, characterize the potential pollutants, eliminate the potential for spills, train employees on spill prevention and cleanup, and respond to spills when they occur.

### **Applicability**

Appropriate applications for spill prevention, control, and cleanup include residential, commercial, and industrial areas planned for development or redevelopment.

Design considerations provided are applicable to new development and redevelopment as defined by various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.). These plans define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land distributing activities with structural or impervious surfaces.

### **Design Considerations**

- Post emergency hotline telephone numbers in appropriate locations to contact in case of accidental spills.
- Provide double containment facilities for hazardous chemicals.
- If possible, provide material handling areas indoors, under cover, or away from storm drains or sensitive water bodies.
- Berm storage areas so that if a spill or leak occurs the material is contained.
- Cover outside storage areas either with a permanent structure or with a seasonal one such as a tarp so that rain cannot come into contact with the materials.

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- Provide designated area for tanks. Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.
- Liquid materials should be stored in UL approved double-walled tanks or surrounded by a curb or dike to provide the volume to contain 10% of the volume of all of the containers or 110% of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.

- For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.
- If the liquid is oil, gas, or other material will be used onsite that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.

### **Additional Information**

#### ***Designing for Operation and Maintenance Considerations***

#### ***Spill and Leak Prevention and Response***

- Develop and post procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- If illegal dumping is observed at the facility:
  - Post “No Dumping” signs with phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
  - Landscaping and beautification efforts may also discourage illegal dumping.
  - Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.
- Store and contain liquid materials in such a manner that if the container is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.

### **Other Resources**

California’s Nonpoint Source Program Plan. <http://www.swrcb.ca.gov/nps/index.html>.

Clark County Storm Water Pollution Control Manual, <http://www.co.clark.wa.us/pubworks/bmpman.pdf>.

King County Storm Water Pollution Control Manual, <http://dnr.metrokc.gov/wlr/dss/spcm.htm>.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities, <http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities>

Santa Clara Valley Urban Runoff Pollution Prevention Program, <http://www.scvurppp.org>.

The Stormwater Managers Resource Center, <http://www.stormwatercenter.net/>.



Photo Credit: GSM Landscape Architects

## Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

## Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

## Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design considerations provided are applicable to new development and redevelopment as defined by various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.). These plans define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land distributing activities with structural or impervious surfaces.

## Design Objectives

- Cover
- Contain
- Reduce/Minimize
- Prohibit Dumping
- Collect & Convey

## Targeted Constituents

- Sediment
- Nutrients
- Trash
- Metals
- Bacteria
- Oil & Grease
- Synthetic Organics
- Pesticides



## Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash and minimize pest entry options.
- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

## Additional Information

### *Maintenance Considerations*

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

## **Other Resources**

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



Photo Credit: Geoff Brosseau

## Description

Vehicle washing, equipment washing, and steam cleaning may contribute high concentrations of metals, oil and grease, solvents, phosphates, and suspended solids to wash waters that drain to stormwater conveyance systems.

## Approach

Project plans should include appropriately designed area(s) for washing-steam cleaning of vehicles and equipment. Depending on the size and other parameters of the wastewater facility, wash water may be conveyed to a sewer, an infiltration system, recycling system or other alternative. Pretreatment may be required for conveyance to a sanitary sewer.

## Applicability

Appropriate applications include commercial developments, restaurants, retail gasoline outlets, automotive repair shops and others.

Design considerations provided are applicable to new development and redevelopment as defined by various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.). These plans define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land distributing activities with structural or impervious surfaces.

## Design Considerations

Design requirements for vehicle maintenance are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. Design criteria described in this fact sheet

### Design Objectives

- Cover
- Contain
- Reduce/Minimize
- Prohibit Dumping
- Collect & Convey

### Targeted Constituents

- Sediment
- Nutrients
- Trash
- Metals
- Bacteria
- Oil & Grease
- Synthetic Organics
- Pesticides



are meant to enhance and be consistent with these code requirements.

Areas for washing/steam cleaning should incorporate one of the following features:

- Be self-contained and/or covered with a roof or overhang.
- Be equipped with a clarifier or other pretreatment facility.
- Have a proper connection to a sanitary sewer.
- Include other features which are comparable and equally effective.

**CAR WASH AREAS** - Some jurisdictions' stormwater management plans include vehicle-cleaning area source control design requirements for community car wash racks in complexes with a large number of dwelling units. In these cases, wash water from the areas may be directed to the sanitary sewer, to an engineered infiltration system, or to an equally effective alternative. Pre-treatment may also be required.

Depending on the jurisdiction, developers may be directed to divert surface water runoff away from the exposed area around the wash pad (parking lot, storage areas), and wash pad itself to alternatives other than the sanitary sewer. Roofing may be required for exposed wash pads.

It is generally advisable to cover areas used for regular washing of vehicles, trucks, or equipment, surround them with a perimeter berm, and clearly mark them as a designated washing area. Sumps or drain lines can be installed to collect wash water, which may be treated for reuse or recycling, or for discharge to the sanitary sewer. Jurisdictions may require some form of pretreatment, such as a trap, for these areas.

## **Additional Information**

### ***Maintenance Considerations***

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

### **Other Resources**

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



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## Design Objectives

---

- Cover
- Contain
- Reduce/Minimize
- Prohibit Dumping
- Collect & Convey

---

## Targeted Constituents

---

- Sediment
  - Nutrients
  - Trash
  - Metals
  - Bacteria
  - Oil & Grease
  - Synthetic Organics
  - Pesticides
- 

## Description

Proper design of outdoor storage areas for materials reduces opportunity for toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter the stormwater conveyance system. Materials may be in the form of raw products, by-products, finished products, and waste products. The type of pollutants associated with the materials will vary depending on the type of commercial or industrial activity.

## Approach

Outdoor storage areas require a drainage approach different from the typical infiltration/detention strategy. In outdoor storage areas, infiltration is discouraged. Containment is encouraged. Preventative measures include enclosures, secondary containment structures and impervious surfaces.

## Applicability

Appropriate applications include residential, commercial, and industrial areas planned for development or redevelopment.

Design considerations provided are applicable to new development and redevelopment as defined by various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.). These plans define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land distributing activities with structural or impervious surfaces.



## Design Considerations

Some materials are more of a concern than others. Toxic and hazardous materials must be prevented from coming in contact with stormwater. Non-toxic or non-hazardous materials do not have to be prevented from stormwater contact. However, these materials may have toxic effects on receiving waters if allowed to be discharged with stormwater in significant quantities. Accumulated material on an impervious surface could result in significant impact on the rivers or streams that receive the runoff.

Material may be stored in a variety of ways including bulk piles, containers, shelving, stacking, and tanks. Stormwater contamination may be prevented by eliminating the possibility of stormwater contact with the material storage areas either through diversion, cover, or capture of the stormwater. Control measures may also include minimizing the storage area. Design requirements for material storage areas are governed by Building and Fire Codes, and by current City or County ordinances and zoning requirements. Control measures are site specific and must meet local agency requirements.

Where proposed project plans include outdoor areas for storage of materials that may contribute pollutants to the stormwater conveyance system, the following structural or treatment BMPs should be considered:

- Materials with the potential to contaminate stormwater should be: (1) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with runoff or spillage to the stormwater conveyance system, or (2) protected by secondary containment structures such as berms, dikes, or curbs.
- The storage area should be paved and sufficiently impervious to contain leaks and spills.
- The storage area should slope towards a dead-end sump to contain spills and direct runoff from downspouts/roofs should be directed away from storage areas.
- The storage area should have a roof or awning that extends beyond the storage area to minimize collection of stormwater within the secondary containment area. A manufactured storage shed may be used for small containers.

Note that the location(s) of installations of where these preventative measures will be employed must be included on the map or plans identifying BMPs.

## Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permits.

## **Other Resources**

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



## Description

Proper design of outdoor work areas for materials reduces opportunity for toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter the stormwater conveyance system.

## Approach

Outdoor work areas require a drainage approach different from the typical infiltration/detention strategy. In outdoor work areas, infiltration is discouraged; collection and conveyance are encouraged. In outdoor work areas, infiltration is discouraged and runoff is often routed directly to the sanitary sewer, not the storm drain. Because this runoff is being added to the loads normally received by the wastewater treatment plants, municipal stormwater programs and/or private developers must work with the local plant to develop solutions that minimize effects on the treatment facility. These concerns are best addressed in the planning and design stage of the outdoor work area.

## Applicability

Appropriate applications include residential, commercial, and industrial areas planned for development or redevelopment.

Design considerations provided are applicable to new development and redevelopment as defined by various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.). These plans define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land distributing activities with structural or impervious surfaces.

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## Design Objectives

---

- Cover
- Contain
- Reduce/Minimize
- Prohibit Dumping
- Collect & Convey

---

## Targeted Constituents

---

- Sediment
  - Nutrients
  - Trash
  - Metals
  - Bacteria
  - Oil & Grease
  - Synthetic Organics
  - Pesticides
- 



## Design Considerations

Design requirements for outdoor work areas are governed by Building and Fire Codes, current local agency ordinances, and zoning requirements.

Outdoor work areas can be designed in particular ways to reduce impacts on both stormwater quality and sewage treatment plants.

- Create an impermeable surface such as concrete or asphalt, or a prefabricated metal drip pan, depending on the use.
- Cover the area with a roof. This prevents rain from falling on the work area and becoming polluted runoff.
- Berm or perform mounding around the perimeter of the area to prevent water from adjacent areas from flowing on to the surface of the work area.
- Directly connect runoff. Unlike other areas, runoff from work areas is directly connected to the sanitary sewer or other specialized containment systems. This allows the more highly concentrated pollutants from these areas to receive special treatment that removes particular constituents. Approval for this connection must be obtained from the appropriate sanitary sewer agency.
- Locate the work area away from storm drains or catch basins.

## Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



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## Design Objectives

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- 

## Description

Outdoor process equipment operations such as rock grinding or crushing, painting or coating, grinding or sanding, degreasing or parts cleaning, landfills, waste piles, wastewater and solid waste treatment and disposal, and other operations may contribute a variety of toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to the storm conveyance system.

## Approach

Outdoor processing areas require a drainage approach different from the typical infiltration/detention strategy. In outdoor process equipment areas, infiltration is discouraged. Containment is encouraged, accompanied by collection and conveyance. Preventative measures include enclosures, secondary containment structures, dead-end sumps, and conveyance to treatment facilities in accordance with conditions established by the applicable sewer agency.

## Suitable Applications

Appropriate applications include commercial and industrial areas planned for development or redevelopment.

Design considerations provided are applicable to new development and redevelopment as defined by various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.). These plans define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land distributing activities with structural or impervious surfaces.



## Design Considerations

Design requirements for outdoor processing areas are governed by Building and Fire codes, current local agency ordinances, and zoning requirements.

Operations determined to be a potential threat to water quality should consider to the following recommendations:

- Cover or enclose areas that would be the most significant source of pollutants, slope the area toward a dead-end sump, or discharge to the sanitary sewer system following appropriate treatment in accordance with conditions established by the applicable sewer agency.
- Grade or berm area to prevent run-on from surrounding areas.
- Do not install storm drains in areas of equipment repair.
- Consider other features that are comparable or equally effective.
- Provide secondary containment structures (not double wall containers) where wet material processing occurs (e.g., electroplating), to hold spills resulting from accidents, leaking tanks, or equipment, or any other unplanned releases. (Note that if these are plumbed to the sanitary sewer, they must be with the prior approval of the sewer agency.)

## Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

## Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



### Description

Food service facilities for new development and redevelopment can include restaurants, food truck commissaries, grocery stores, bakeries, delicatessens, and any facility requiring a Health Department permit for food preparation. Pollutant-generating sources and activities include: equipment cleaning, grease handling and disposals, spills, surface cleaning, cooling and refrigeration equipment maintenance, landscaping and grounds maintenance, dumpster and loading dock areas, parking lots, and illicit connections to the storm drain system. Pollutants include organic materials (food wastes), oil and grease, and toxic chemicals in cleaning products, disinfectants, and pesticides.

### Approach

Minimize exposure of rain and runoff to outdoor cleaning and storage areas by using cover and containment. In and around these areas use good housekeeping to minimize the generation of pollutants. Make stormwater pollution prevention BMPs a part of standard operating procedures and the employee training program. Provide employee education materials in the first language of employees.

### Applicability

The Food Service Facility fact sheet is applicable to new development and re-development of restaurants, food truck commissaries, grocery stores, bakeries, delicatessens, and any facility requiring a health department permit for food preparation.

Design considerations provided are applicable to new development and redevelopment as defined by various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.). These plans define “redevelopment” in terms of amounts of additional

### Design Objectives

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impervious area, increases in gross floor area and/or exterior construction, and land distributing activities with structural or impervious surfaces.

## **Design Considerations**

- Connect sinks and cleaning areas to a grease interceptor prior to discharge to the sanitary sewer system.
- Size sinks and other cleaning facilities appropriately to accommodate the largest possible items to be cleaned and allow for controlled drainage to a grease interceptor.
- Provide trash receptacles around loading docks to keep litter from accumulating.
- Install a spill cleanup kit near the dumpster and loading dock areas.
- Consider enclosing the dumpster in a roofed and bermed area to prevent exposure to rainwater, and draining the area to the sanitary sewer. Contact the local wastewater treatment plant or the county environmental health department for guidance.
- Design all other site components so that the discharge of fats, oils, and grease is controlled and minimized. Ensure that all discharges from cooling equipment go to the sanitary sewer and not the street, gutter, or storm drain.

## **Additional Information**

### ***Designing for Operation and Maintenance Considerations***

#### ***Equipment and Outdoor Cleaning***

If any cleaning will be done outside, provide an outside cleaning area that is connected to the sanitary sewer.

#### ***Grease Handling and Disposal***

Provide tallow bins or sealed containers with tamper-proof lids.

#### ***Landscaping and Grounds Maintenance***

Refer to fact sheet SD-40: Building and Grounds Maintenance for information on landscaping and grounds maintenance.

#### ***Dumpster and Loading Dock Areas***

For information on cleaning dumpster areas see the 2018 CASQA Industrial and Commercial Handbook business guide sheet BG-61: Mobile Cleaning – Food Service Related.

#### ***Pest Control***

Refer to 2018 CASQA Industrial and Commercial Handbook business guide sheet BG-30: Food Service Facilities for information on pest control.

#### ***Education and Training***

Post information about or labels for BMPs where employees and customers can see them.

## ***Spill Response and Prevention Procedures***

Refer to Fact Sheet SD-22: Spill Prevention, Control, and Cleanup for information on spill cleanup.

## **Other Resources**

Bay Area Stormwater Management Agencies Association, 2014. *BASMAA Post Construction Manual*.

Bay Area Pollution Prevention Group, 2010. *Gravity Grease Interceptor (GGI) Fact Sheet*. Available on-line at <http://bacwa.org/Portals/o/GGI%20Fact%20Sheet-Final.pdf>

Bay Area Pollution Prevention Group, 2010. *Hydromechanical Grease Interceptor (HGI) Fact Sheet*.

Bay Area Pollution Prevention Group, 2010. *Grease Removal Device (GRD) Fact Sheet*.

Bay Area Pollution Prevention Group, 2007. *Avoid Fines and Health Risks from Grease Overflows*.

City of Pleasanton. *BMPs for Restaurants*.

Contra Costa County Public Works Department. Municipal Stormwater NPDES Compliance. *Food Service Facilities*.

Food and Beverage Association of San Diego. *What's Cookin', Eating and Drinking Establishments Stormwater Best Management Practices*.

Orange County Public Works, OC Watersheds. Industrial/Commercial Business Activities Best Management Practices.

Sacramento Stormwater Management Program. *Waste Disposal Guidelines for Food-Handling Facilities*.

San Francisco Public Utilities Commission, 2016. *Technical Report Templates - Section 7: Source Control Checklist*.

San Mateo Countywide Stormwater Pollution Prevention Program. *Stormwater Best Management Practices for Restaurants and Food Facilities*.

Santa Cruz County Department of Public Works, Environmental Compliance Unit. Best Environmental Management Practices. *Restaurant Wastewater*.



## Description

The primary pollutants of concern in water from pools, spas, and decorative water features are disinfectant chemicals, such as chlorine, chloramine, or bromine (pools and spas) and algaecides (fountains and other water features). These chemicals, if discharged to the storm drain system, can be toxic to aquatic life. Following the procedures noted in this fact sheet will reduce exposure of waterways to the pollutants in discharge from pools, spas, and other water features.

## Approach

Never discharge water or wastewater from these activities to the driveway, street, gutter, or near a storm drain or where water might flow to a creek or seasonal stream. Follow local regulations for draining swimming pools.

## Applicability

This fact sheet is applicable to residential and commercial pools, spas, and decorative water features. Pools and spas located in sensitive areas or adjacent to shorelines should inquire with the appropriate authorities to determine if special code requirements apply.

Design considerations provided are applicable to new development and redevelopment as defined by various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.). These plans define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land distributing activities with structural or impervious surfaces.

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### Design Objectives

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---

### Targeted Constituents

---

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- Pesticides



## Design Considerations

- Design the layout of the pool area or water feature so that the cleanout is in a readily accessible area.
- If the municipality requires pools to be plumbed to sanitary sewer, design the connection according to local requirements and include a note on the plans referring to agency requirements.

### *Design Considerations based on Permitting Information*

Many of the regional and state permitting requirements state that swimming pool water, if identified as a source of pollution, is effectively prohibited from discharging into an MS4. Some permits allow discharge of pool water to an MS4 after chlorine, bromine, and algaecides, and other pollutants have been eliminated. See permits for full description of requirements.

## Additional Information

### *Designing for Operation and Maintenance Considerations*

#### *Draining Pools*

- Design so that discharge flows are kept at low levels typically possible through a garden hose. Higher flow rates may be prohibited by local ordinance.
- Design should prevent discharge to the street, storm drain, or where water might flow to a creek or seasonal stream.
- If a sanitary sewer cleanout is available, design so that facility can be discharged through that cleanout. If assistance is needed in locating the cleanout, call the local sanitary sewer agency.
- If discharge connects to the sewer line, design so that an “air gap” is maintained between the discharge line and the sewer line (do not seal the connection between the hose and sewer line).

### *Spill Response and Prevention Procedures*

Refer to Fact Sheet SD-22 Spill Prevention, Control, & Cleanup for information on spill response and prevention.

## Other Resources

CASQA Stormwater Best Management Practice Handbook Portal: Industrial and Commercial, 2014.

CASQA Stormwater Best Management Practice Handbook: Municipal, 2003.

Orange County Stormwater Program. Industrial/Commercial Business Activities Best Management Practices. Fact Sheet IC24 Disposal of Wastewater Generated by Mobile Businesses & Outdoor Activities. Available online at:

<http://ocwatersheds.com/civica3x/filebank/blobload.aspx?BlobID=10201>.

# Pools, Spas, & Decorative Water Features

SD-38

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Sacramento Stormwater Management Program. *Pool Water Brochure*. Available on-line at: <http://www.sacstormwater.org/StormwaterDocuments/StormwaterBrochures/PoolwaterBrochure.pdf>.

San Diego County Watershed Protection Program, 2009. *Pool and Fountain Maintenance Stormwater Best Management Practices (BMPs)*. Available on-line at: [http://www.sdcountry.ca.gov/dpw/watershedpdf/bmp\\_2009\\_pool+fountain\\_cleaning.pdf](http://www.sdcountry.ca.gov/dpw/watershedpdf/bmp_2009_pool+fountain_cleaning.pdf).

Santa Clara Valley Urban Runoff Pollution Prevention Program, 2004. *Draining Pools and Spas Brochure*. Available on-line at <http://bacwa.org/Portals/o/Committees/BAPPG/Archive/PoolsBrochure.pdf>

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Los Angeles County Stormwater Quality. Public Agency Activities Model Program. On-line: [http://ladpw.org/wmd/npdes/public\\_TC.cfm](http://ladpw.org/wmd/npdes/public_TC.cfm)

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program  
[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

Santa Clara Valley Urban Runoff Pollution Prevention Program. Maintenance Best Management Practices for the Construction Industry. Brochures: Landscaping, Gardening, and Pool; Roadwork and Paving; and Fresh Concrete and Mortar Application. June 2001.



Photo Credit: City of Vancouver, WA

### Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the potential for exposure of stormwater to pollutants from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, and keeping debris from entering the storm drains.

### Approach

Proper design of building and grounds maintenance facilities reduces the opportunity for pollutants to enter the stormwater conveyance system. Preventative measures including containment, source control pollution prevention, and effective employee training should be used to reduce the likelihood of contaminated discharge.

### Applicability

Appropriate applications include building and grounds maintenance areas for new development and redevelopment of residential, commercial, and industrial areas.

Design considerations provided are applicable to new development and redevelopment as defined by various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.). These plans define “redevelopment” in terms of amounts of additional

### Design Objectives

- Cover
- Contain
- Reduce/Minimize
- Prohibit Dumping
- Collect & Convey

### Targeted Constituents

- Sediment
- Nutrients
- Trash
- Metals
- Bacteria
- Oil & Grease
- Synthetic Organics
- Pesticides



impervious area, increases in gross floor area and/or exterior construction, and land distributing activities with structural or impervious surfaces.

## Design Considerations

### *Waste Management*

- Provide pet waste collection dispensers, where applicable.
- Provide trash receptacles in areas of high pedestrian traffic.

### *Landscape/Outdoor Pesticide Use*

See SD-10 Site Design and Landscaping.

## Additional Information

### *Designing for Operation and Maintenance Considerations*

#### *Landscaping Activities*

Provide an area for stockpiling materials temporarily that is located away from watercourses and drain inlets. Ideally, a permanently covered area would be provided although temporary covers can be used during operation.

#### *Building Repair, Remodeling, and Construction*

Provide containment devices for work areas to prevent dust, grit, wash water, or other pollutants entering catch basins which may include a storm drain cover, filter fabric, or similarly effective runoff control mechanism.

#### *Material Handling and Waste Management*

- Follow all federal, state, and local laws and regulations governing the design for use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

### *Spill Response and Prevention Procedures*

Refer to Fact Sheet SD-22 – Spill Prevention, Control, and Cleanup for information on spill cleanup.

### *Fire Sprinkler Line Flushing*

Site fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping,



Figure 1. Maintenance of bioretention facility.

# Attachment D

SUBJECT TO FURTHER REVISION

PROJECT SITE

**LEGEND**

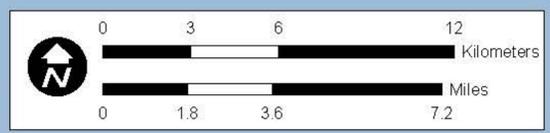
- Orange County Precipitation Stations
- 24 Hour, 85th Percentile Rainfall (Inches)
- - - 24 Hour, 85th Percentile Rainfall (Inches) - Extrapolated
- City Boundaries

**Rainfall Zones**

Design Capture Storm Depth (inches)

- 0.65"
- 0.7
- 0.75
- 0.80
- 0.85
- 0.90
- 0.95
- 1.00
- 1.10"

Note: Events defined as 24-hour periods (calendar days) with greater than 0.1 inches of rainfall.  
For areas outside of available data coverage, professional judgment shall be applied.



TITLE  
 ORANGE COUNTY  
 TECHNICAL GUIDANCE  
 DOCUMENT  
 JOB  
 SCALE 1" = 1.8 miles  
 DESIGNED TH  
 DRAWING TH  
 CHECKED BMP  
 DATE 04/22/10  
 JOB NO. 9926-E  
 ORANGE CO.  
 CA



FIGURE  
**XVI-1**

P:\9926E\GIS\Mxd\Reports\Infiltration\Fe osability\_20110215\9926E\_FigureXVI-1\_RainfallZones\_20110215.mxd

SUBJECT TO FURTHER REVISION

**LEGEND**

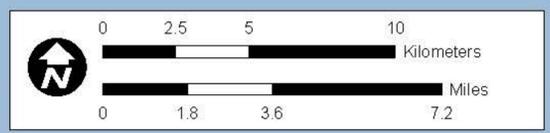
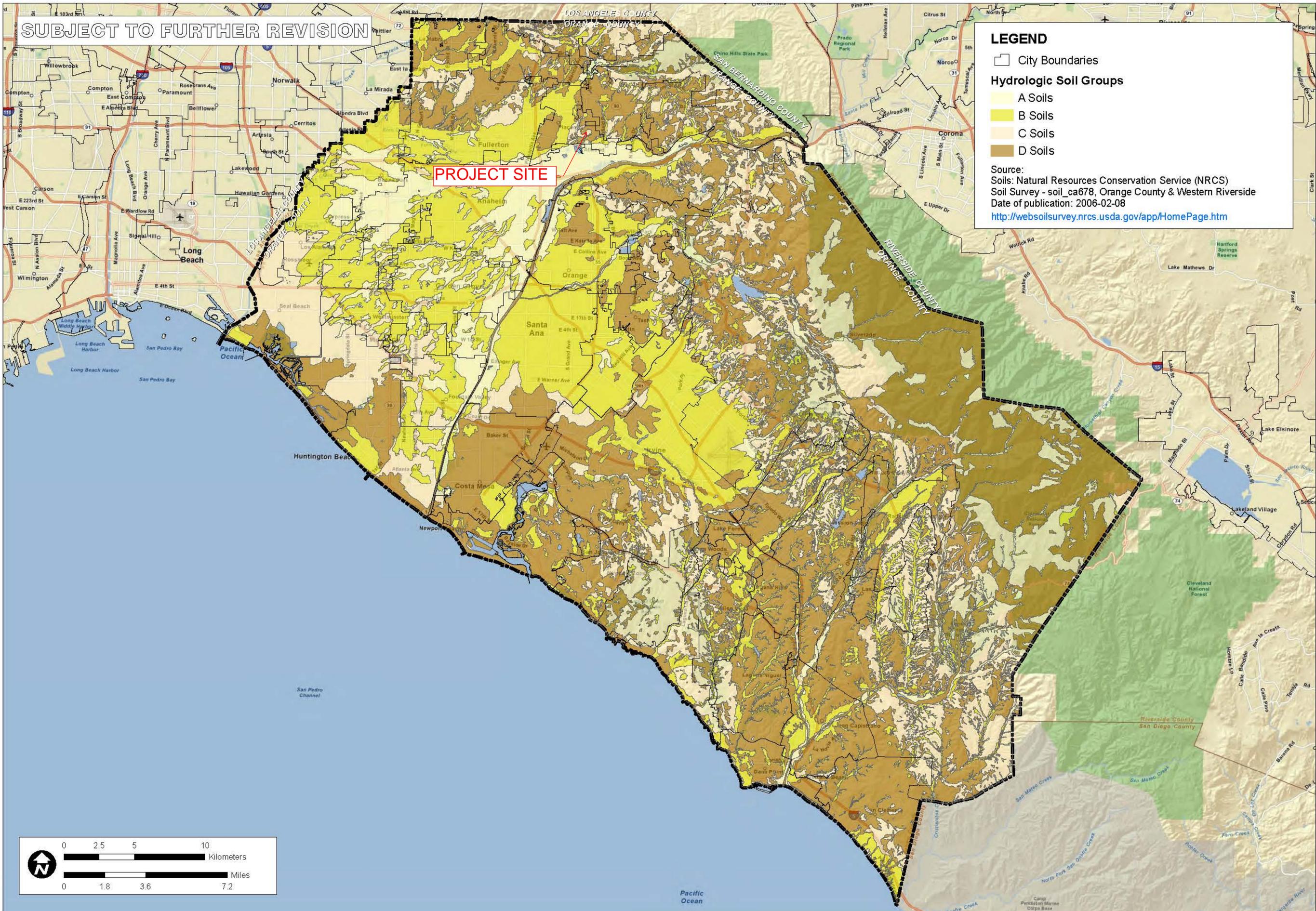
- City Boundaries

**Hydrologic Soil Groups**

- A Soils
- B Soils
- C Soils
- D Soils

Source:  
 Soils: Natural Resources Conservation Service (NRCS)  
 Soil Survey - soil\_ca678, Orange County & Western Riverside  
 Date of publication: 2006-02-08  
<http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>

PROJECT SITE



TITLE  
**ORANGE COUNTY INFLTRATION STUDY**  
 CA

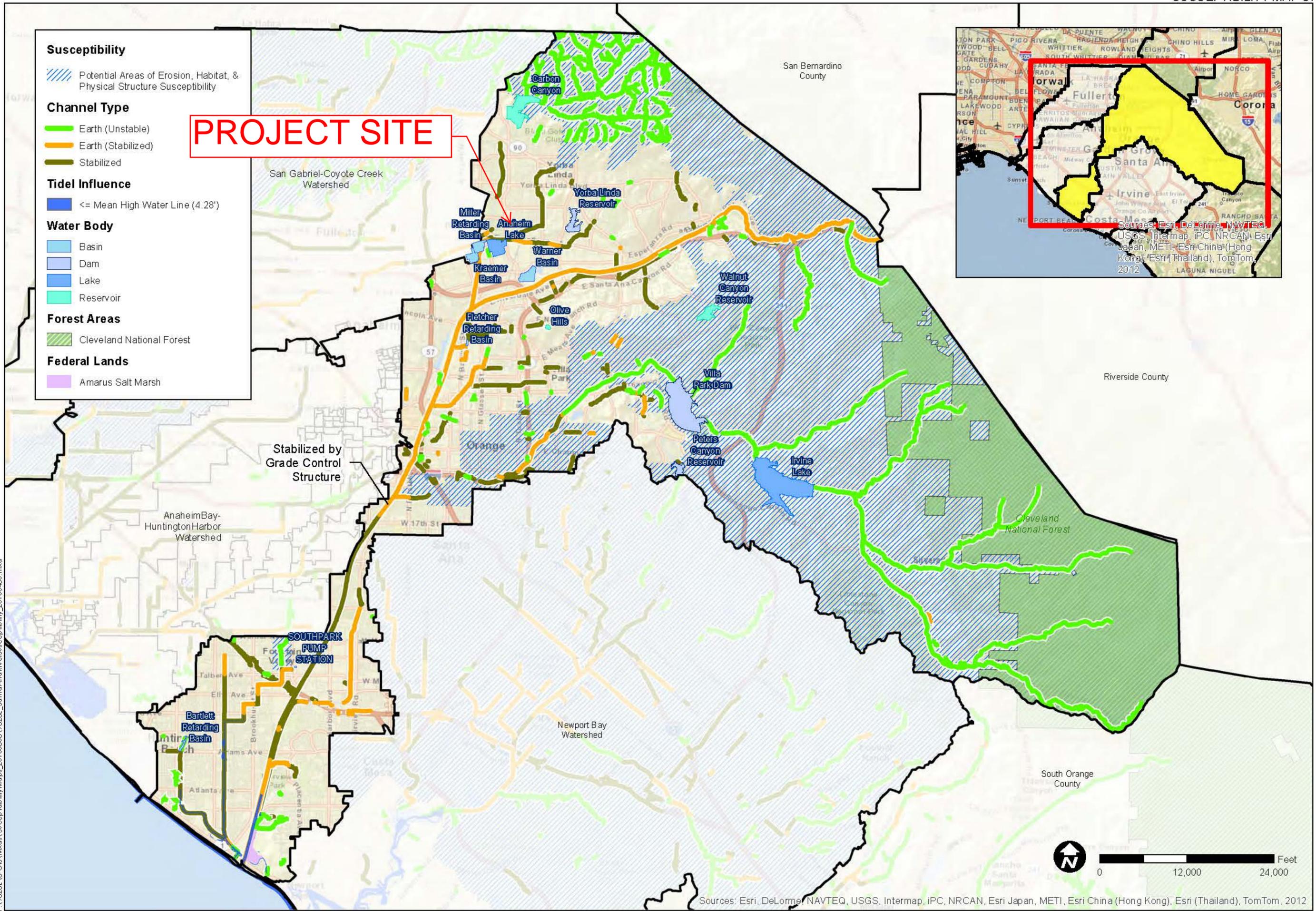
JOB  
 SCALE 1" = 1.8 miles  
 DESIGNED TH  
 DRAWING TH  
 CHECKED BMP  
 DATE 02/09/11  
 JOB NO. 9936-E

ORANGE CO.

**PACE**  
 Advanced Water Engineering

FIGURE  
**XVI-2a**

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**Susceptibility**

- Potential Areas of Erosion, Habitat, & Physical Structure Susceptibility

**Channel Type**

- Earth (Unstable)
- Earth (Stabilized)
- Stabilized

**Tidel Influence**

- <= Mean High Water Line (4.28')

**Water Body**

- Basin
- Dam
- Lake
- Reservoir

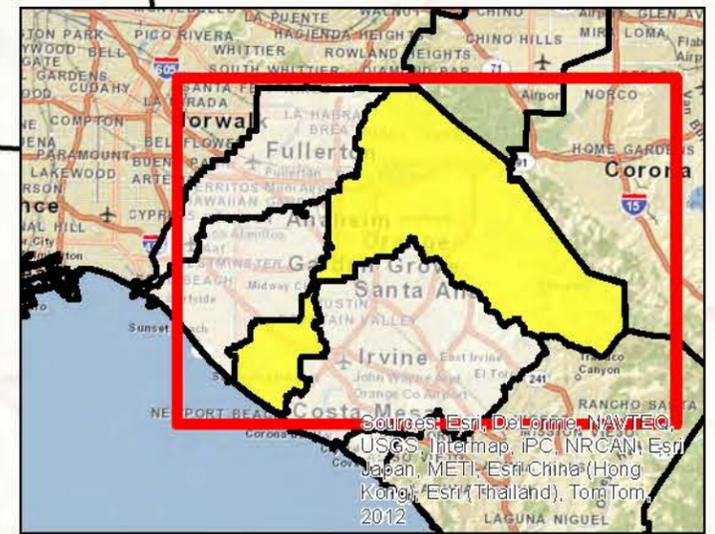
**Forest Areas**

- Cleveland National Forest

**Federal Lands**

- Amarus Salt Marsh

**PROJECT SITE**



SUSCEPTIBILITY ANALYSIS  
SANTA ANA RIVER

ORANGE COUNTY  
WATERSHED  
MASTER PLANNING

SCALE	1" = 12000'
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/30/10
JOB NO.	9535E



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, IPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012

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**Worksheet B: Simple Design Capture Volume Sizing Method: DMA A**

<b>Step 1: Determine the design capture storm depth used for calculating volume</b>			
1	Enter design capture storm depth from Figure III.1, d (inches)	d=	0.90 inches
2	Enter the effect of provided HSCs, d <sub>HSC</sub> (inches) (Worksheet A)	d <sub>HSC</sub> =	0.1165 inches
3	Calculate the remainder of the design capture storm depth, d <sub>remainder</sub> (inches) (Line 1 – Line 2)	d <sub>remainder</sub> =	0.78 inches
<b>Step 2: Calculate the DCV</b>			
1	Enter Project area tributary to BMP (s), A (acres)	A=	13.90 acres
2	Enter Project Imperviousness, imp (unitless)	imp=	0.54
3	Calculate runoff coefficient, C= (0.75 x imp) + 0.15	C=	0.5550
4	Calculate runoff volume, V <sub>design</sub> = (C x d <sub>remainder</sub> x A x 43560 x (1/12))	V <sub>design</sub> =	21,941 cu-ft
<b>Step 3: Design BMPs to ensure full retention of the DCV</b>			
<b>Step 3a: Determine design infiltration rate</b>			
1	Enter measured infiltration rate, K <sub>measured</sub> (in/hr) (Appendix VII)	K <sub>measured</sub> =	100 In/hr
2	Enter combined safety factor from Worksheet H, S <sub>final</sub> (unitless)	S <sub>final</sub> =	1.0
3	Calculate design infiltration rate, K <sub>design</sub> = K <sub>measured</sub> / S <sub>final</sub>	K <sub>design</sub> =	100.000 In/hr
<b>Step 3b: Determine minimum BMP footprint</b>			
4	Enter drawdown time, T (max 48 hours)	T=	0.25 Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), D <sub>max</sub> = K <sub>design</sub> x T x (1/12)	D <sub>max</sub> =	2.08 Feet
6	Calculate minimum area required for BMP (sq-ft), A <sub>min</sub> = V <sub>design</sub> / d <sub>max</sub>	A <sub>min</sub> =	10,532 sq-ft
<b>Calculate the Aggregate Reservoir Depth</b>			
Calculate the depth trench fill with porosity of aggregate reservoir = 0.35 D <sub>reservoir</sub> = D <sub>48</sub> / 0.35		D <sub>reservoir</sub>	Feet

# Attachment E

(Soils Report Pending)

# Attachment F

**Project:** Alta Vista 1.5 AC development in Placentia  
**JN** 10367.00.000

**Storm Event Volume Calculations**

**Storm Event:** 2 Year

**Existing Condition**

Volume(24 hour) =  $1/2 (dQ) * (dTime)$

	<u>Area A</u>	
Tc=	28.4	min
dTime = 2 x Tc	56.8	min
dQ =	7.4	cfs

Volume (24 hr)= **6,305** cf

**Proposed Condition**

Volume(24 hour) =  $1/2 (dQ) * (dTime)$

	<u>Area A</u>	
Tc=	11.0	min
dTime = 2 x Tc	22.0	min
dQ =	16.7	cfs

Volume (24 hr)= **5,511** cf

\*\*\*\*\*

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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Ver. 23.0 Release Date: 07/01/2016 License ID 1557

Analysis prepared by:

Wilson Mikami, Inc
9 CORPORATE PARK, SUITE 100
IRVINE, CA 92606
(949) 679-0090

\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*
\* PLACENTIA ALTA VISTA \*
\* EXISTING CONDITION \*
\* 2-YEAR HYDROLOGY \*
\*\*\*\*\*

FILE NAME: EX-AV.DAT
TIME/DATE OF STUDY: 08:02 08/15/2022

=====
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 = 0.95
\*DATA BANK RAINFALL USED\*
\*ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD\*

Table with 9 columns: NO., HALF-WIDTH (FT), CROWN TO CROSSFALL (FT), STREET-CROSSFALL IN- / OUT- / SIDE / SIDE / WAY, PARK- HEIGHT (FT), CURB GUTTER-GEOMETRIES: WIDTH (FT), LIP (FT), HIKE (FT), MANNING FACTOR (n). Row 1: 1, 30.0, 20.0, 0.018/0.018/0.020, 0.67, 2.00, 0.0313, 0.167, 0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

- 1. Relative Flow-Depth = 0.00 FEET as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)
\*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.\*
\*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

\*\*\*\*\*
FLOW PROCESS FROM NODE 10.00 TO NODE 11.00 IS CODE = 21
-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH (FEET) = 256.00
ELEVATION DATA: UPSTREAM (FEET) = 308.00 DOWNSTREAM (FEET) = 297.00

Tc = K\*[(LENGTH\*\* 3.00)/(ELEVATION CHANGE)]\*\*0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 9.054
\* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.610
SUBAREA Tc AND LOSS RATE DATA (AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)

NATURAL POOR COVER  
 "BARREN" D 1.00 0.20 1.000 83 9.05  
 NATURAL POOR COVER  
 "BARREN" C 0.92 0.25 1.000 80 9.05  
 SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p$ (INCH/HR) = 0.22  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION,  $A_p$  = 1.000  
 SUBAREA RUNOFF(CFS) = 2.39  
 TOTAL AREA(ACRES) = 1.92 PEAK FLOW RATE(CFS) = 2.39

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 11.00 TO NODE 12.00 IS CODE = 56  
 -----

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<  
 >>>>TRAVELTIME THRU SUBAREA<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 297.00 DOWNSTREAM(FEET) = 277.00  
 CHANNEL LENGTH THRU SUBAREA(FEET) = 1458.00 CHANNEL SLOPE = 0.0137  
 GIVEN CHANNEL BASE(FEET) = 10.00 CHANNEL FREEBOARD(FEET) = 1.0  
 "Z" FACTOR = 99.900 MANNING'S FACTOR = 0.030  
 \*ESTIMATED CHANNEL HEIGHT(FEET) = 1.22  
 \* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 0.835  
 SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	$F_p$ (INCH/HR)	$A_p$ (DECIMAL)	SCS CN
NATURAL POOR COVER "BARREN"	C	12.00	0.25	1.000	80

SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p$ (INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION,  $A_p$  = 1.000  
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 5.80  
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.26  
 AVERAGE FLOW DEPTH(FEET) = 0.17 TRAVEL TIME(MIN.) = 19.35  
 $T_c$ (MIN.) = 28.40  
 SUBAREA AREA(ACRES) = 12.00 SUBAREA RUNOFF(CFS) = 6.32  
 EFFECTIVE AREA(ACRES) = 13.92 AREA-AVERAGED  $F_m$ (INCH/HR) = 0.25  
 AREA-AVERAGED  $F_p$ (INCH/HR) = 0.25 AREA-AVERAGED  $A_p$  = 1.00  
 TOTAL AREA(ACRES) = 13.9 PEAK FLOW RATE(CFS) = 7.38  
 GIVEN CHANNEL BASE(FEET) = 10.00 CHANNEL FREEBOARD(FEET) = 1.0  
 "Z" FACTOR = 99.900 MANNING'S FACTOR = 0.030  
 \*ESTIMATED CHANNEL HEIGHT(FEET) = 1.19

END OF SUBAREA CHANNEL FLOW HYDRAULICS:  
 DEPTH(FEET) = 0.19 FLOW VELOCITY(FEET/SEC.) = 1.36  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 1714.00 FEET.

\*\*\*\*\*

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Analysis prepared by:

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9 CORPORATE PARK, SUITE 100  
IRVINE, CA 92606  
(949) 679-0090

\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*  
\* PLACENTIA ALTA VISTA \*  
\* 2-YEAR HYDROLOGY \*  
\* BY KAM 072722 \*  
\*\*\*\*\*

FILE NAME: ALTA.DAT  
TIME/DATE OF STUDY: 08:03 08/15/2022

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

--\*TIME-OF-CONCENTRATION MODEL\*--

USER SPECIFIED STORM EVENT (YEAR) = 2.00  
SPECIFIED MINIMUM PIPE SIZE (INCH) = 12.00  
SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.95  
\*DATA BANK RAINFALL USED\*  
\*ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD\*

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT-/ SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MANNING FACTOR (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 10.00 TO NODE 11.00 IS CODE = 21  
-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<  
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH (FEET) = 162.00  
ELEVATION DATA: UPSTREAM (FEET) = 304.00 DOWNSTREAM (FEET) = 300.40

Tc = K\*[(LENGTH\*\* 3.00)/(ELEVATION CHANGE)]\*\*0.20  
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 6.128  
\* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 2.014

SUBAREA Tc AND LOSS RATE DATA (AMC I):  
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc  
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)

RESIDENTIAL  
 "8-10 DWELLINGS/ACRE" D 0.34 0.20 0.400 57 6.13  
 SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p$ (INCH/HR) = 0.20  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION,  $A_p$  = 0.400  
 SUBAREA RUNOFF(CFS) = 0.59  
 TOTAL AREA(ACRES) = 0.34 PEAK FLOW RATE(CFS) = 0.59

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 11.00 TO NODE 12.00 IS CODE = 31

-----  
 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 294.40 DOWNSTREAM(FEET) = 291.70  
 FLOW LENGTH(FEET) = 110.00 MANNING'S N = 0.010  
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000  
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 2.3 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 5.48  
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 0.59  
 PIPE TRAVEL TIME(MIN.) = 0.33  $T_c$ (MIN.) = 6.46  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 272.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 12.00 TO NODE 12.00 IS CODE = 81

-----  
 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE  $T_c$ (MIN.) = 6.46  
 \* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.954  
 SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	$F_p$ (INCH/HR)	$A_p$ (DECIMAL)	SCS CN
RESIDENTIAL "8-10 DWELLINGS/ACRE"	D	0.46	0.20	0.400	57
SUBAREA AVERAGE PERVIOUS LOSS RATE, $F_p$ (INCH/HR) = 0.20					
SUBAREA AVERAGE PERVIOUS AREA FRACTION, $A_p$ = 0.400					
SUBAREA AREA(ACRES) = 0.46		SUBAREA RUNOFF(CFS) = 0.78			
EFFECTIVE AREA(ACRES) = 0.80		AREA-AVERAGED $F_m$ (INCH/HR) = 0.08			
AREA-AVERAGED $F_p$ (INCH/HR) = 0.20		AREA-AVERAGED $A_p$ = 0.40			
TOTAL AREA(ACRES) = 0.8		PEAK FLOW RATE(CFS) = 1.35			

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 12.00 TO NODE 13.00 IS CODE = 31

-----  
 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 291.70 DOWNSTREAM(FEET) = 290.80  
 FLOW LENGTH(FEET) = 90.00 MANNING'S N = 0.010  
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000  
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 4.5 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 5.02  
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 1.35  
 PIPE TRAVEL TIME(MIN.) = 0.30  $T_c$ (MIN.) = 6.76  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 13.00 = 362.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 13.00 TO NODE 13.00 IS CODE = 81

-----  
 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

MAINLINE Tc(MIN.) = 6.76  
 \* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.904  
 SUBAREA LOSS RATE DATA(AMC I ):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "8-10 DWELLINGS/ACRE"	C	0.23	0.25	0.400	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
 SUBAREA AREA(ACRES) = 0.23 SUBAREA RUNOFF(CFS) = 0.37  
 EFFECTIVE AREA(ACRES) = 1.03 AREA-AVERAGED Fm(INCH/HR) = 0.08  
 AREA-AVERAGED Fp(INCH/HR) = 0.21 AREA-AVERAGED Ap = 0.40  
 TOTAL AREA(ACRES) = 1.0 PEAK FLOW RATE(CFS) = 1.69

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 13.00 TO NODE 13.00 IS CODE = 81  
 -----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

MAINLINE Tc(MIN.) = 6.76  
 \* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.904  
 SUBAREA LOSS RATE DATA(AMC I ):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "8-10 DWELLINGS/ACRE"	C	0.26	0.25	0.400	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
 SUBAREA AREA(ACRES) = 0.26 SUBAREA RUNOFF(CFS) = 0.42  
 EFFECTIVE AREA(ACRES) = 1.29 AREA-AVERAGED Fm(INCH/HR) = 0.09  
 AREA-AVERAGED Fp(INCH/HR) = 0.22 AREA-AVERAGED Ap = 0.40  
 TOTAL AREA(ACRES) = 1.3 PEAK FLOW RATE(CFS) = 2.11

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 13.00 TO NODE 14.00 IS CODE = 31  
 -----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 290.80 DOWNSTREAM(FEET) = 289.70  
 FLOW LENGTH(FEET) = 116.00 MANNING'S N = 0.010  
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 5.9 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 5.53  
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 2.11  
 PIPE TRAVEL TIME(MIN.) = 0.35 Tc(MIN.) = 7.11  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 14.00 = 478.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 14.00 TO NODE 14.00 IS CODE = 81  
 -----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

MAINLINE Tc(MIN.) = 7.11  
 \* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.849  
 SUBAREA LOSS RATE DATA(AMC I ):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "8-10 DWELLINGS/ACRE"	C	0.23	0.25	0.400	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
 SUBAREA AREA(ACRES) = 0.23 SUBAREA RUNOFF(CFS) = 0.36

EFFECTIVE AREA(ACRES) = 1.52 AREA-AVERAGED Fm(INCH/HR) = 0.09  
 AREA-AVERAGED Fp(INCH/HR) = 0.22 AREA-AVERAGED Ap = 0.40  
 TOTAL AREA(ACRES) = 1.5 PEAK FLOW RATE(CFS) = 2.41

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 14.00 TO NODE 14.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) = 7.11  
 \* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.849  
 SUBAREA LOSS RATE DATA(AMC I):  
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
 RESIDENTIAL  
 "8-10 DWELLINGS/ACRE" C 0.24 0.25 0.400 50  
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
 SUBAREA AREA(ACRES) = 0.24 SUBAREA RUNOFF(CFS) = 0.38  
 EFFECTIVE AREA(ACRES) = 1.76 AREA-AVERAGED Fm(INCH/HR) = 0.09  
 AREA-AVERAGED Fp(INCH/HR) = 0.23 AREA-AVERAGED Ap = 0.40  
 TOTAL AREA(ACRES) = 1.8 PEAK FLOW RATE(CFS) = 2.79

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 14.00 TO NODE 15.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 289.70 DOWNSTREAM(FEET) = 288.20  
 FLOW LENGTH(FEET) = 153.00 MANNING'S N = 0.010  
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.9 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 6.01  
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 2.79  
 PIPE TRAVEL TIME(MIN.) = 0.42 Tc(MIN.) = 7.54  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 15.00 = 631.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 15.00 TO NODE 15.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) = 7.54  
 \* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.789  
 SUBAREA LOSS RATE DATA(AMC I):  
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
 COMMERCIAL C 0.37 0.25 0.100 50  
 RESIDENTIAL  
 "8-10 DWELLINGS/ACRE" C 0.36 0.25 0.400 50  
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.248  
 SUBAREA AREA(ACRES) = 0.73 SUBAREA RUNOFF(CFS) = 1.13  
 EFFECTIVE AREA(ACRES) = 2.49 AREA-AVERAGED Fm(INCH/HR) = 0.08  
 AREA-AVERAGED Fp(INCH/HR) = 0.23 AREA-AVERAGED Ap = 0.36  
 TOTAL AREA(ACRES) = 2.5 PEAK FLOW RATE(CFS) = 3.82

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 15.00 TO NODE 15.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

MAINLINE Tc(MIN.) = 7.54  
 \* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.789  
 SUBAREA LOSS RATE DATA(AMC I):  
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
 COMMERCIAL C 0.32 0.25 0.100 50  
 RESIDENTIAL  
 "8-10 DWELLINGS/ACRE" C 0.37 0.25 0.400 50  
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.261  
 SUBAREA AREA(ACRES) = 0.69 SUBAREA RUNOFF(CFS) = 1.07  
 EFFECTIVE AREA(ACRES) = 3.18 AREA-AVERAGED Fm(INCH/HR) = 0.08  
 AREA-AVERAGED Fp(INCH/HR) = 0.23 AREA-AVERAGED Ap = 0.33  
 TOTAL AREA(ACRES) = 3.2 PEAK FLOW RATE(CFS) = 4.89

\*\*\*\*\*

FLOW PROCESS FROM NODE 15.00 TO NODE 16.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 288.20 DOWNSTREAM(FEET) = 287.60  
 FLOW LENGTH(FEET) = 107.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.4 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 4.60  
 ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 4.89  
 PIPE TRAVEL TIME(MIN.) = 0.39 Tc(MIN.) = 7.92  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 16.00 = 738.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 16.00 TO NODE 16.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

MAINLINE Tc(MIN.) = 7.92  
 \* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.738  
 SUBAREA LOSS RATE DATA(AMC I):  
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
 RESIDENTIAL  
 "8-10 DWELLINGS/ACRE" C 0.19 0.25 0.400 50  
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
 SUBAREA AREA(ACRES) = 0.19 SUBAREA RUNOFF(CFS) = 0.28  
 EFFECTIVE AREA(ACRES) = 3.37 AREA-AVERAGED Fm(INCH/HR) = 0.08  
 AREA-AVERAGED Fp(INCH/HR) = 0.24 AREA-AVERAGED Ap = 0.34  
 TOTAL AREA(ACRES) = 3.4 PEAK FLOW RATE(CFS) = 5.03

\*\*\*\*\*

FLOW PROCESS FROM NODE 16.00 TO NODE 17.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 287.60 DOWNSTREAM(FEET) = 286.80  
 FLOW LENGTH(FEET) = 126.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.2 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 4.85  
 ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 5.03  
 PIPE TRAVEL TIME(MIN.) = 0.43 Tc(MIN.) = 8.36  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 17.00 = 864.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 17.00 TO NODE 17.00 IS CODE = 81  
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) =	8.36				
* 2 YEAR RAINFALL INTENSITY(INCH/HR) =	1.686				
SUBAREA LOSS RATE DATA(AMC I):					
DEVELOPMENT TYPE/	SCS SOIL	AREA	Fp	Ap	SCS
LAND USE	GROUP	(ACRES)	(INCH/HR)	(DECIMAL)	CN

RESIDENTIAL  
"8-10 DWELLINGS/ACRE" C 0.19 0.25 0.400 50  
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25  
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
SUBAREA AREA(ACRES) = 0.19 SUBAREA RUNOFF(CFS) = 0.27  
EFFECTIVE AREA(ACRES) = 3.56 AREA-AVERAGED Fm(INCH/HR) = 0.08  
AREA-AVERAGED Fp(INCH/HR) = 0.24 AREA-AVERAGED Ap = 0.34  
TOTAL AREA(ACRES) = 3.6 PEAK FLOW RATE(CFS) = 5.14

\*\*\*\*\*  
FLOW PROCESS FROM NODE 17.00 TO NODE 50.00 IS CODE = 31  
-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) =	286.80	DOWNSTREAM(FEET) =	286.30
FLOW LENGTH(FEET) =	50.00	MANNING'S N =	0.013
DEPTH OF FLOW IN 15.0 INCH PIPE IS 10.3 INCHES			
PIPE-FLOW VELOCITY(FEET/SEC.) =	5.72		
ESTIMATED PIPE DIAMETER(INCH) =	15.00	NUMBER OF PIPES =	1
PIPE-FLOW(CFS) =	5.14		
PIPE TRAVEL TIME(MIN.) =	0.15	Tc(MIN.) =	8.50
LONGEST FLOWPATH FROM NODE	10.00 TO NODE	50.00 =	914.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 50.00 TO NODE 50.00 IS CODE = 81  
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) =	8.50				
* 2 YEAR RAINFALL INTENSITY(INCH/HR) =	1.669				
SUBAREA LOSS RATE DATA(AMC I):					
DEVELOPMENT TYPE/	SCS SOIL	AREA	Fp	Ap	SCS
LAND USE	GROUP	(ACRES)	(INCH/HR)	(DECIMAL)	CN

COMMERCIAL C 0.17 0.25 0.100 50  
RESIDENTIAL  
"5-7 DWELLINGS/ACRE" C 0.68 0.25 0.500 50  
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25  
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.420  
SUBAREA AREA(ACRES) = 0.85 SUBAREA RUNOFF(CFS) = 1.20  
EFFECTIVE AREA(ACRES) = 4.41 AREA-AVERAGED Fm(INCH/HR) = 0.09  
AREA-AVERAGED Fp(INCH/HR) = 0.24 AREA-AVERAGED Ap = 0.36  
TOTAL AREA(ACRES) = 4.4 PEAK FLOW RATE(CFS) = 6.28

\*\*\*\*\*  
FLOW PROCESS FROM NODE 50.00 TO NODE 18.00 IS CODE = 31  
-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) =	286.30	DOWNSTREAM(FEET) =	285.80
FLOW LENGTH(FEET) =	40.00	MANNING'S N =	0.013

DEPTH OF FLOW IN 15.0 INCH PIPE IS 11.0 INCHES  
 PIPE-FLOW VELOCITY (FEET/SEC.) = 6.49  
 ESTIMATED PIPE DIAMETER (INCH) = 15.00 NUMBER OF PIPES = 1  
 PIPE-FLOW (CFS) = 6.28  
 PIPE TRAVEL TIME (MIN.) = 0.10 Tc (MIN.) = 8.60  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 18.00 = 954.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 18.00 TO NODE 18.00 IS CODE = 81  
 -----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc (MIN.) = 8.60  
 \* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.658  
 SUBAREA LOSS RATE DATA (AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "8-10 DWELLINGS/ACRE"	C	0.19	0.25	0.400	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
 SUBAREA AREA (ACRES) = 0.19 SUBAREA RUNOFF (CFS) = 0.27  
 EFFECTIVE AREA (ACRES) = 4.60 AREA-AVERAGED Fm (INCH/HR) = 0.09  
 AREA-AVERAGED Fp (INCH/HR) = 0.24 AREA-AVERAGED Ap = 0.36  
 TOTAL AREA (ACRES) = 4.6 PEAK FLOW RATE (CFS) = 6.51

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 18.00 TO NODE 19.00 IS CODE = 31  
 -----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM (FEET) = 285.80 DOWNSTREAM (FEET) = 285.60  
 FLOW LENGTH (FEET) = 21.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.6 INCHES  
 PIPE-FLOW VELOCITY (FEET/SEC.) = 6.02  
 ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1  
 PIPE-FLOW (CFS) = 6.51  
 PIPE TRAVEL TIME (MIN.) = 0.06 Tc (MIN.) = 8.66  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 19.00 = 975.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 19.00 TO NODE 19.00 IS CODE = 81  
 -----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc (MIN.) = 8.66  
 \* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.651  
 SUBAREA LOSS RATE DATA (AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "8-10 DWELLINGS/ACRE"	C	0.21	0.25	0.400	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
 SUBAREA AREA (ACRES) = 0.21 SUBAREA RUNOFF (CFS) = 0.29  
 EFFECTIVE AREA (ACRES) = 4.81 AREA-AVERAGED Fm (INCH/HR) = 0.09  
 AREA-AVERAGED Fp (INCH/HR) = 0.24 AREA-AVERAGED Ap = 0.36  
 TOTAL AREA (ACRES) = 4.8 PEAK FLOW RATE (CFS) = 6.77

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 19.00 TO NODE 20.00 IS CODE = 31  
 -----

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>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 285.60 DOWNSTREAM(FEET) = 284.70
FLOW LENGTH(FEET) = 88.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.24
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 6.77
PIPE TRAVEL TIME(MIN.) = 0.23 Tc(MIN.) = 8.90
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 20.00 = 1063.00 FEET.

*****
FLOW PROCESS FROM NODE 20.00 TO NODE 20.00 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
MAINLINE Tc(MIN.) = 8.90
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.626
SUBAREA LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"8-10 DWELLINGS/ACRE" C 0.12 0.25 0.400 50
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
SUBAREA AREA(ACRES) = 0.12 SUBAREA RUNOFF(CFS) = 0.16
EFFECTIVE AREA(ACRES) = 4.93 AREA-AVERAGED Fm(INCH/HR) = 0.09
AREA-AVERAGED Fp(INCH/HR) = 0.24 AREA-AVERAGED Ap = 0.36
TOTAL AREA(ACRES) = 4.9 PEAK FLOW RATE(CFS) = 6.83

*****
FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 284.70 DOWNSTREAM(FEET) = 284.30
FLOW LENGTH(FEET) = 40.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.20
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 6.83
PIPE TRAVEL TIME(MIN.) = 0.11 Tc(MIN.) = 9.01
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 21.00 = 1103.00 FEET.

*****
FLOW PROCESS FROM NODE 21.00 TO NODE 21.00 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
MAINLINE Tc(MIN.) = 9.01
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.615
SUBAREA LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"8-10 DWELLINGS/ACRE" C 0.18 0.25 0.400 50
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
SUBAREA AREA(ACRES) = 0.18 SUBAREA RUNOFF(CFS) = 0.25
EFFECTIVE AREA(ACRES) = 5.11 AREA-AVERAGED Fm(INCH/HR) = 0.09
AREA-AVERAGED Fp(INCH/HR) = 0.24 AREA-AVERAGED Ap = 0.36

```

TOTAL AREA (ACRES) = 5.1 PEAK FLOW RATE (CFS) = 7.02

\*\*\*\*\*  
FLOW PROCESS FROM NODE 21.00 TO NODE 22.00 IS CODE = 31  
-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM (FEET) = 284.30 DOWNSTREAM (FEET) = 283.30  
FLOW LENGTH (FEET) = 100.00 MANNING'S N = 0.013  
DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.9 INCHES  
PIPE-FLOW VELOCITY (FEET/SEC.) = 6.24  
ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1  
PIPE-FLOW (CFS) = 7.02  
PIPE TRAVEL TIME (MIN.) = 0.27 Tc (MIN.) = 9.27  
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 22.00 = 1203.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 81  
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc (MIN.) = 9.27  
\* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.588  
SUBAREA LOSS RATE DATA (AMC I):  
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
COMMERCIAL C 0.35 0.25 0.100 50  
RESIDENTIAL  
"8-10 DWELLINGS/ACRE" C 0.32 0.25 0.400 50  
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.25  
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.243  
SUBAREA AREA (ACRES) = 0.67 SUBAREA RUNOFF (CFS) = 0.92  
EFFECTIVE AREA (ACRES) = 5.78 AREA-AVERAGED Fm (INCH/HR) = 0.08  
AREA-AVERAGED Fp (INCH/HR) = 0.24 AREA-AVERAGED Ap = 0.35  
TOTAL AREA (ACRES) = 5.8 PEAK FLOW RATE (CFS) = 7.82

\*\*\*\*\*  
FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 81  
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc (MIN.) = 9.27  
\* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.588  
SUBAREA LOSS RATE DATA (AMC I):  
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
RESIDENTIAL  
"8-10 DWELLINGS/ACRE" C 0.29 0.25 0.400 50  
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.25  
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
SUBAREA AREA (ACRES) = 0.29 SUBAREA RUNOFF (CFS) = 0.39  
EFFECTIVE AREA (ACRES) = 6.07 AREA-AVERAGED Fm (INCH/HR) = 0.09  
AREA-AVERAGED Fp (INCH/HR) = 0.24 AREA-AVERAGED Ap = 0.35  
TOTAL AREA (ACRES) = 6.1 PEAK FLOW RATE (CFS) = 8.21

\*\*\*\*\*  
FLOW PROCESS FROM NODE 22.00 TO NODE 23.00 IS CODE = 31  
-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM (FEET) = 283.30 DOWNSTREAM (FEET) = 282.80

FLOW LENGTH(FEET) = 50.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 12.2 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 6.44  
 ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 8.21  
 PIPE TRAVEL TIME(MIN.) = 0.13 Tc(MIN.) = 9.40  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 23.00 = 1253.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 23.00 TO NODE 23.00 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.) = 9.40  
 RAINFALL INTENSITY(INCH/HR) = 1.58  
 AREA-AVERAGED Fm(INCH/HR) = 0.09  
 AREA-AVERAGED Fp(INCH/HR) = 0.24  
 AREA-AVERAGED Ap = 0.35  
 EFFECTIVE STREAM AREA(ACRES) = 6.07  
 TOTAL STREAM AREA(ACRES) = 6.07  
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 8.21

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 30.00 TO NODE 31.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<  
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====  
 INITIAL SUBAREA FLOW-LENGTH(FEET) = 161.00  
 ELEVATION DATA: UPSTREAM(FEET) = 298.10 DOWNSTREAM(FEET) = 296.40

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$   
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 7.094  
 \* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.852  
 SUBAREA Tc AND LOSS RATE DATA(AMC I):  

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
RESIDENTIAL "8-10 DWELLINGS/ACRE"	C	0.19	0.25	0.400	50	7.09

 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
 SUBAREA RUNOFF(CFS) = 0.30  
 TOTAL AREA(ACRES) = 0.19 PEAK FLOW RATE(CFS) = 0.30

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 31.00 TO NODE 32.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====  
 ELEVATION DATA: UPSTREAM(FEET) = 290.40 DOWNSTREAM(FEET) = 287.80  
 FLOW LENGTH(FEET) = 61.00 MANNING'S N = 0.010  
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000  
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 1.5 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 5.42  
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 0.30  
 PIPE TRAVEL TIME(MIN.) = 0.19 Tc(MIN.) = 7.28  
 LONGEST FLOWPATH FROM NODE 30.00 TO NODE 32.00 = 222.00 FEET.

\*\*\*\*\*

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FLOW PROCESS FROM NODE      32.00 TO NODE      32.00 IS CODE =  81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
MAINLINE Tc(MIN.) =      7.28
* 2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.824
SUBAREA LOSS RATE DATA(AMC I ):
DEVELOPMENT TYPE/      SCS SOIL  AREA      Fp      Ap      SCS
LAND USE              GROUP  (ACRES)  (INCH/HR)  (DECIMAL)  CN
RESIDENTIAL
"8-10 DWELLINGS/ACRE"  C      0.43      0.25      0.400      50
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.400
SUBAREA AREA(ACRES) =  0.43      SUBAREA RUNOFF(CFS) =  0.67
EFFECTIVE AREA(ACRES) =  0.62      AREA-AVERAGED Fm(INCH/HR) =  0.10
AREA-AVERAGED Fp(INCH/HR) =  0.25      AREA-AVERAGED Ap =  0.40
TOTAL AREA(ACRES) =  0.6      PEAK FLOW RATE(CFS) =  0.96

*****
FLOW PROCESS FROM NODE      32.00 TO NODE      33.00 IS CODE =  31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) =  287.80  DOWNSTREAM(FEET) =  286.00
FLOW LENGTH(FEET) =  181.00  MANNING'S N =  0.010
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS  3.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  4.56
ESTIMATED PIPE DIAMETER(INCH) = 12.00      NUMBER OF PIPES =  1
PIPE-FLOW(CFS) =  0.96
PIPE TRAVEL TIME(MIN.) =  0.66      Tc(MIN.) =  7.94
LONGEST FLOWPATH FROM NODE      30.00 TO NODE      33.00 =  403.00 FEET.

*****
FLOW PROCESS FROM NODE      33.00 TO NODE      33.00 IS CODE =  81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
MAINLINE Tc(MIN.) =      7.94
* 2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.736
SUBAREA LOSS RATE DATA(AMC I ):
DEVELOPMENT TYPE/      SCS SOIL  AREA      Fp      Ap      SCS
LAND USE              GROUP  (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL
RESIDENTIAL
"8-10 DWELLINGS/ACRE"  C      0.44      0.25      0.400      50
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.306
SUBAREA AREA(ACRES) =  0.64      SUBAREA RUNOFF(CFS) =  0.96
EFFECTIVE AREA(ACRES) =  1.26      AREA-AVERAGED Fm(INCH/HR) =  0.09
AREA-AVERAGED Fp(INCH/HR) =  0.25      AREA-AVERAGED Ap =  0.35
TOTAL AREA(ACRES) =  1.3      PEAK FLOW RATE(CFS) =  1.87

*****
FLOW PROCESS FROM NODE      33.00 TO NODE      34.00 IS CODE =  31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) =  286.00  DOWNSTREAM(FEET) =  285.60
FLOW LENGTH(FEET) =  34.00  MANNING'S N =  0.013
DEPTH OF FLOW IN 12.0 INCH PIPE IS  6.0 INCHES

```

PIPE-FLOW VELOCITY (FEET/SEC.) = 4.79  
 ESTIMATED PIPE DIAMETER (INCH) = 12.00 NUMBER OF PIPES = 1  
 PIPE-FLOW (CFS) = 1.87  
 PIPE TRAVEL TIME (MIN.) = 0.12 Tc (MIN.) = 8.06  
 LONGEST FLOWPATH FROM NODE 30.00 TO NODE 34.00 = 437.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 34.00 TO NODE 34.00 IS CODE = 81  
 -----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc (MIN.) = 8.06  
 \* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.721  
 SUBAREA LOSS RATE DATA (AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "8-10 DWELLINGS/ACRE"	C	0.27	0.25	0.400	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
 SUBAREA AREA (ACRES) = 0.27 SUBAREA RUNOFF (CFS) = 0.39  
 EFFECTIVE AREA (ACRES) = 1.53 AREA-AVERAGED Fm (INCH/HR) = 0.09  
 AREA-AVERAGED Fp (INCH/HR) = 0.25 AREA-AVERAGED Ap = 0.36  
 TOTAL AREA (ACRES) = 1.5 PEAK FLOW RATE (CFS) = 2.25

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 34.00 TO NODE 35.00 IS CODE = 31  
 -----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM (FEET) = 285.60 DOWNSTREAM (FEET) = 285.20  
 FLOW LENGTH (FEET) = 44.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 7.2 INCHES  
 PIPE-FLOW VELOCITY (FEET/SEC.) = 4.53  
 ESTIMATED PIPE DIAMETER (INCH) = 12.00 NUMBER OF PIPES = 1  
 PIPE-FLOW (CFS) = 2.25  
 PIPE TRAVEL TIME (MIN.) = 0.16 Tc (MIN.) = 8.22  
 LONGEST FLOWPATH FROM NODE 30.00 TO NODE 35.00 = 481.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 35.00 TO NODE 35.00 IS CODE = 81  
 -----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc (MIN.) = 8.22  
 \* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.701  
 SUBAREA LOSS RATE DATA (AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	C	0.24	0.25	0.100	50
RESIDENTIAL "8-10 DWELLINGS/ACRE"	C	0.45	0.25	0.400	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.296  
 SUBAREA AREA (ACRES) = 0.69 SUBAREA RUNOFF (CFS) = 1.01  
 EFFECTIVE AREA (ACRES) = 2.22 AREA-AVERAGED Fm (INCH/HR) = 0.09  
 AREA-AVERAGED Fp (INCH/HR) = 0.25 AREA-AVERAGED Ap = 0.34  
 TOTAL AREA (ACRES) = 2.2 PEAK FLOW RATE (CFS) = 3.23

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 35.00 TO NODE 36.00 IS CODE = 31  
 -----

```

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 285.20 DOWNSTREAM(FEET) = 284.60
FLOW LENGTH(FEET) = 58.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 12.0 INCH PIPE IS 9.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.10
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 3.23
PIPE TRAVEL TIME(MIN.) = 0.19 Tc(MIN.) = 8.41
LONGEST FLOWPATH FROM NODE 30.00 TO NODE 36.00 = 539.00 FEET.

*****
FLOW PROCESS FROM NODE 36.00 TO NODE 36.00 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
MAINLINE Tc(MIN.) = 8.41
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.679
SUBAREA LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"5-7 DWELLINGS/ACRE" C 0.33 0.25 0.500 50
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.500
SUBAREA AREA(ACRES) = 0.33 SUBAREA RUNOFF(CFS) = 0.46
EFFECTIVE AREA(ACRES) = 2.55 AREA-AVERAGED Fm(INCH/HR) = 0.09
AREA-AVERAGED Fp(INCH/HR) = 0.25 AREA-AVERAGED Ap = 0.36
TOTAL AREA(ACRES) = 2.5 PEAK FLOW RATE(CFS) = 3.65

*****
FLOW PROCESS FROM NODE 36.00 TO NODE 37.00 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 284.60 DOWNSTREAM(FEET) = 283.70
FLOW LENGTH(FEET) = 178.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 15.0 INCH PIPE IS 10.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.07
ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 3.65
PIPE TRAVEL TIME(MIN.) = 0.73 Tc(MIN.) = 9.14
LONGEST FLOWPATH FROM NODE 30.00 TO NODE 37.00 = 717.00 FEET.

*****
FLOW PROCESS FROM NODE 37.00 TO NODE 37.00 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
MAINLINE Tc(MIN.) = 9.14
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.601
SUBAREA LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"8-10 DWELLINGS/ACRE" C 0.22 0.25 0.400 50
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
SUBAREA AREA(ACRES) = 0.22 SUBAREA RUNOFF(CFS) = 0.30
EFFECTIVE AREA(ACRES) = 2.77 AREA-AVERAGED Fm(INCH/HR) = 0.09
AREA-AVERAGED Fp(INCH/HR) = 0.25 AREA-AVERAGED Ap = 0.36

```

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TOTAL AREA (ACRES) =          2.8          PEAK FLOW RATE (CFS) =          3.76
*****
FLOW PROCESS FROM NODE      37.00 TO NODE      38.00 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM (FEET) = 283.70 DOWNSTREAM (FEET) = 283.20
FLOW LENGTH (FEET) = 51.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 15.0 INCH PIPE IS 8.4 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 5.32
ESTIMATED PIPE DIAMETER (INCH) = 15.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 3.76
PIPE TRAVEL TIME (MIN.) = 0.16 Tc (MIN.) = 9.30
LONGEST FLOWPATH FROM NODE 30.00 TO NODE 38.00 = 768.00 FEET.
*****
FLOW PROCESS FROM NODE      38.00 TO NODE      38.00 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 I ):
DEVELOPMENT TYPE/      SCS SOIL  AREA      Fp      Ap      SCS
LAND USE              GROUP  (ACRES)  (INCH/HR) (DECIMAL) CN
COMMERCIAL            C      0.24      0.25      0.100    50
RESIDENTIAL
"8-10 DWELLINGS/ACRE" C      0.61      0.25      0.400    50
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.315
SUBAREA AREA (ACRES) = 0.85 SUBAREA RUNOFF (CFS) = 1.15
EFFECTIVE AREA (ACRES) = 3.62 AREA-AVERAGED Fm (INCH/HR) = 0.09
AREA-AVERAGED Fp (INCH/HR) = 0.25 AREA-AVERAGED Ap = 0.35
TOTAL AREA (ACRES) = 3.6 PEAK FLOW RATE (CFS) = 4.88
*****
FLOW PROCESS FROM NODE      38.00 TO NODE      38.00 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 I ):
DEVELOPMENT TYPE/      SCS SOIL  AREA      Fp      Ap      SCS
LAND USE              GROUP  (ACRES)  (INCH/HR) (DECIMAL) CN
COMMERCIAL            C      0.18      0.25      0.100    50
RESIDENTIAL
"5-7 DWELLINGS/ACRE" C      0.21      0.25      0.500    50
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.315
SUBAREA AREA (ACRES) = 0.39 SUBAREA RUNOFF (CFS) = 0.53
EFFECTIVE AREA (ACRES) = 4.01 AREA-AVERAGED Fm (INCH/HR) = 0.09
AREA-AVERAGED Fp (INCH/HR) = 0.25 AREA-AVERAGED Ap = 0.35
TOTAL AREA (ACRES) = 4.0 PEAK FLOW RATE (CFS) = 5.41
*****
FLOW PROCESS FROM NODE      38.00 TO NODE      23.00 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====

```

ELEVATION DATA: UPSTREAM(FEET) = 283.20 DOWNSTREAM(FEET) = 282.80  
 FLOW LENGTH(FEET) = 58.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.4 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 5.10  
 ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 5.41  
 PIPE TRAVEL TIME(MIN.) = 0.19 Tc(MIN.) = 9.49  
 LONGEST FLOWPATH FROM NODE 30.00 TO NODE 23.00 = 826.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 23.00 TO NODE 23.00 IS CODE = 1  
 -----

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<  
 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

=====

TOTAL NUMBER OF STREAMS = 2  
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:  
 TIME OF CONCENTRATION(MIN.) = 9.49  
 RAINFALL INTENSITY(INCH/HR) = 1.57  
 AREA-AVERAGED Fm(INCH/HR) = 0.09  
 AREA-AVERAGED Fp(INCH/HR) = 0.25  
 AREA-AVERAGED Ap = 0.35  
 EFFECTIVE STREAM AREA(ACRES) = 4.01  
 TOTAL STREAM AREA(ACRES) = 4.01  
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 5.41

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	8.21	9.40	1.575	0.24( 0.09)	0.35	6.1	10.00
2	5.41	9.49	1.567	0.25( 0.09)	0.35	4.0	30.00

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

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	13.60	9.40	1.575	0.25( 0.09)	0.35	10.0	10.00
2	13.57	9.49	1.567	0.25( 0.09)	0.35	10.1	30.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 13.60 Tc(MIN.) = 9.40  
 EFFECTIVE AREA(ACRES) = 10.04 AREA-AVERAGED Fm(INCH/HR) = 0.09  
 AREA-AVERAGED Fp(INCH/HR) = 0.25 AREA-AVERAGED Ap = 0.35  
 TOTAL AREA(ACRES) = 10.1  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 23.00 = 1253.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 23.00 TO NODE 23.00 IS CODE = 81  
 -----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) = 9.40  
 \* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.575  
 SUBAREA LOSS RATE DATA(AMC I ):  
 DEVELOPMENT TYPE/ SC5 SOIL AREA Fp Ap SCS  
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
 COMMERCIAL C 0.23 0.25 0.100 50  
 RESIDENTIAL  
 "8-10 DWELLINGS/ACRE" C 0.45 0.25 0.400 50  
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.299

SUBAREA AREA (ACRES) = 0.68      SUBAREA RUNOFF (CFS) = 0.92  
 EFFECTIVE AREA (ACRES) = 10.72    AREA-AVERAGED Fm (INCH/HR) = 0.09  
 AREA-AVERAGED Fp (INCH/HR) = 0.25    AREA-AVERAGED Ap = 0.35  
 TOTAL AREA (ACRES) = 10.8      PEAK FLOW RATE (CFS) = 14.38

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 23.00 TO NODE 24.00 IS CODE = 31  
 -----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM (FEET) = 282.80    DOWNSTREAM (FEET) = 282.40  
 FLOW LENGTH (FEET) = 43.00    MANNING'S N = 0.013  
 DEPTH OF FLOW IN 21.0 INCH PIPE IS 16.6 INCHES  
 PIPE-FLOW VELOCITY (FEET/SEC.) = 7.06  
 ESTIMATED PIPE DIAMETER (INCH) = 21.00    NUMBER OF PIPES = 1  
 PIPE-FLOW (CFS) = 14.38  
 PIPE TRAVEL TIME (MIN.) = 0.10    Tc (MIN.) = 9.50  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 24.00 = 1296.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 24.00 TO NODE 24.00 IS CODE = 81  
 -----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc (MIN.) = 9.50  
 \* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.566  
 SUBAREA LOSS RATE DATA (AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	C	0.17	0.25	0.100	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100  
 SUBAREA AREA (ACRES) = 0.17      SUBAREA RUNOFF (CFS) = 0.24  
 EFFECTIVE AREA (ACRES) = 10.89    AREA-AVERAGED Fm (INCH/HR) = 0.08  
 AREA-AVERAGED Fp (INCH/HR) = 0.25    AREA-AVERAGED Ap = 0.34  
 TOTAL AREA (ACRES) = 10.9      PEAK FLOW RATE (CFS) = 14.52

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 24.00 TO NODE 24.00 IS CODE = 81  
 -----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc (MIN.) = 9.50  
 \* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.566  
 SUBAREA LOSS RATE DATA (AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	C	0.28	0.25	0.100	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100  
 SUBAREA AREA (ACRES) = 0.28      SUBAREA RUNOFF (CFS) = 0.39  
 EFFECTIVE AREA (ACRES) = 11.17    AREA-AVERAGED Fm (INCH/HR) = 0.08  
 AREA-AVERAGED Fp (INCH/HR) = 0.25    AREA-AVERAGED Ap = 0.34  
 TOTAL AREA (ACRES) = 11.2      PEAK FLOW RATE (CFS) = 14.91

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 24.00 TO NODE 25.00 IS CODE = 31  
 -----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM (FEET) = 282.40    DOWNSTREAM (FEET) = 281.60

FLOW LENGTH(FEET) = 84.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 21.0 INCH PIPE IS 17.0 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 7.14  
 ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 14.91  
 PIPE TRAVEL TIME(MIN.) = 0.20 Tc(MIN.) = 9.70  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 25.00 = 1380.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 25.00 TO NODE 25.00 IS CODE = 81  
 -----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) = 9.70  
 \* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.548  
 SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "8-10 DWELLINGS/ACRE"	C	0.21	0.25	0.400	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
 SUBAREA AREA(ACRES) = 0.21 SUBAREA RUNOFF(CFS) = 0.27  
 EFFECTIVE AREA(ACRES) = 11.38 AREA-AVERAGED Fm(INCH/HR) = 0.08  
 AREA-AVERAGED Fp(INCH/HR) = 0.25 AREA-AVERAGED Ap = 0.34  
 TOTAL AREA(ACRES) = 11.4 PEAK FLOW RATE(CFS) = 15.00

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 25.00 TO NODE 26.00 IS CODE = 31  
 -----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 281.60 DOWNSTREAM(FEET) = 280.50  
 FLOW LENGTH(FEET) = 107.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 21.0 INCH PIPE IS 16.5 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 7.41  
 ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 15.00  
 PIPE TRAVEL TIME(MIN.) = 0.24 Tc(MIN.) = 9.94  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 26.00 = 1487.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 26.00 TO NODE 26.00 IS CODE = 81  
 -----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) = 9.94  
 \* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.526  
 SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "8-10 DWELLINGS/ACRE"	C	0.20	0.25	0.400	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
 SUBAREA AREA(ACRES) = 0.20 SUBAREA RUNOFF(CFS) = 0.26  
 EFFECTIVE AREA(ACRES) = 11.58 AREA-AVERAGED Fm(INCH/HR) = 0.08  
 AREA-AVERAGED Fp(INCH/HR) = 0.25 AREA-AVERAGED Ap = 0.34  
 TOTAL AREA(ACRES) = 11.6 PEAK FLOW RATE(CFS) = 15.04

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 26.00 TO NODE 27.00 IS CODE = 31

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-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 280.50 DOWNSTREAM(FEET) = 279.90
FLOW LENGTH(FEET) = 119.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 24.0 INCH PIPE IS 18.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.67
ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 15.04
PIPE TRAVEL TIME(MIN.) = 0.35 Tc(MIN.) = 10.29
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 27.00 = 1606.00 FEET.

*****
FLOW PROCESS FROM NODE 27.00 TO NODE 27.00 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
MAINLINE Tc(MIN.) = 10.29
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.496
SUBAREA LOSS RATE DATA(AMC I ):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"8-10 DWELLINGS/ACRE" C 0.17 0.25 0.400 50
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
SUBAREA AREA(ACRES) = 0.17 SUBAREA RUNOFF(CFS) = 0.21
EFFECTIVE AREA(ACRES) = 11.75 AREA-AVERAGED Fm(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.25 AREA-AVERAGED Ap = 0.34
TOTAL AREA(ACRES) = 11.8 PEAK FLOW RATE(CFS) = 15.04
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

*****
FLOW PROCESS FROM NODE 27.00 TO NODE 28.00 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 279.90 DOWNSTREAM(FEET) = 279.10
FLOW LENGTH(FEET) = 76.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 21.0 INCH PIPE IS 16.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 7.50
ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 15.04
PIPE TRAVEL TIME(MIN.) = 0.17 Tc(MIN.) = 10.46
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 28.00 = 1682.00 FEET.

*****
FLOW PROCESS FROM NODE 28.00 TO NODE 28.00 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
MAINLINE Tc(MIN.) = 10.46
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.482
SUBAREA LOSS RATE DATA(AMC I ):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
COMMERCIAL
C 0.32 0.25 0.100 50
RESIDENTIAL
"8-10 DWELLINGS/ACRE" C 0.75 0.25 0.400 50
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.25
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.310

```

SUBAREA AREA (ACRES) = 1.07      SUBAREA RUNOFF (CFS) = 1.35  
 EFFECTIVE AREA (ACRES) = 12.82      AREA-AVERAGED Fm (INCH/HR) = 0.08  
 AREA-AVERAGED Fp (INCH/HR) = 0.25      AREA-AVERAGED Ap = 0.34  
 TOTAL AREA (ACRES) = 12.9      PEAK FLOW RATE (CFS) = 16.14

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 28.00 TO NODE 29.00 IS CODE = 31  
 -----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

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ELEVATION DATA: UPSTREAM (FEET) = 279.10      DOWNSTREAM (FEET) = 273.00  
 FLOW LENGTH (FEET) = 305.00      MANNING'S N = 0.013  
 DEPTH OF FLOW IN 21.0 INCH PIPE IS 13.4 INCHES  
 PIPE-FLOW VELOCITY (FEET/SEC.) = 9.94  
 ESTIMATED PIPE DIAMETER (INCH) = 21.00      NUMBER OF PIPES = 1  
 PIPE-FLOW (CFS) = 16.14  
 PIPE TRAVEL TIME (MIN.) = 0.51      Tc (MIN.) = 10.97  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 29.00 = 1987.00 FEET.

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 FLOW PROCESS FROM NODE 29.00 TO NODE 29.00 IS CODE = 81  
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>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

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MAINLINE Tc (MIN.) = 10.97  
 \* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.442  
 SUBAREA LOSS RATE DATA (AMC I):  
 DEVELOPMENT TYPE/      SCS SOIL      AREA      Fp      Ap      SCS  
   LAND USE            GROUP      (ACRES)      (INCH/HR)      (DECIMAL)      CN  
 PUBLIC PARK            C            0.93      0.25      0.850      50  
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.25  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.850  
 SUBAREA AREA (ACRES) = 0.93      SUBAREA RUNOFF (CFS) = 1.03  
 EFFECTIVE AREA (ACRES) = 13.75      AREA-AVERAGED Fm (INCH/HR) = 0.09  
 AREA-AVERAGED Fp (INCH/HR) = 0.25      AREA-AVERAGED Ap = 0.37  
 TOTAL AREA (ACRES) = 13.8      PEAK FLOW RATE (CFS) = 16.71

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END OF STUDY SUMMARY:  
 TOTAL AREA (ACRES) = 13.8      TC (MIN.) = 10.97  
 EFFECTIVE AREA (ACRES) = 13.75      AREA-AVERAGED Fm (INCH/HR) = 0.09  
 AREA-AVERAGED Fp (INCH/HR) = 0.25      AREA-AVERAGED Ap = 0.372  
 PEAK FLOW RATE (CFS) = 16.71

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	16.71	10.97	1.442	0.25 (0.09)	0.37	13.8	10.00
2	16.67	11.06	1.435	0.25 (0.09)	0.37	13.8	30.00

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END OF RATIONAL METHOD ANALYSIS