



WQ XX-XXXX

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

Project Name:

23161 Mill Creek Development

P.M. 147, 43-47

Prepared for:

Toll Brothers

350 Commerce, Suite 200

Irvine, CA 92602

(714) 347-1375

Prepared by:

Wilson Mikami Corporation

9 Corporate Park, Suite 100

Irvine, CA 92606

(949) 679-0090

July 11, 2025

Priority Project Water Quality Management Plan (WQMP)
Mill Creek Road Development

Project Owner's Certification			
Planning Application No. (If applicable)	TBD	Grading Permit No.	TBD
Tract/Parcel Map and Lot(s) No.	P.M. 147-43-47	Building Permit No.	TBD
Address of Project Site and APN (If no address, specify Tract/Parcel Map and Lot Numbers)			23161 Mill Creek, Laguna Hills

This Water Quality Management Plan (WQMP) has been prepared for Toll Brothers 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.

Owner:			
Title	Kris Campbell, Vice President of Land Development		
Company	Toll Brothers		
Address	350 Commerce, Suite 200, Irvine, CA 92602		
Email	kcampbell@tollbrothers.com		
Telephone #	(714) 347-1375		
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)
Toll Brothers

Preparer (Engineer):			
Title	Scott Wilson, Principal	PE Registration #	49884
Company	Wilson Mikami Corporation		
Address	9 Corporate Park, Suite 100		
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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Attachment B	Rainfall Zones Map
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Attachment F	Preliminary Soils Report
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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).

Project Information	
Permit/ Application No. (If applicable)	TBD
Grading or Building Permit No. (If applicable)	TBD
Address of Project Site (or Tract Map and Lot Number if no address) and APN	23161 Mill Creek, Laguna Hills
Water Quality Conditions of Approval or Issuance	
Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.)	None
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

Provide a detailed project description including:

- Project areas;
- Land uses;
- Land cover;
- Design elements;
- A general description not broken down by drainage management areas (DMAs).

Include attributes relevant to determining applicable source controls. *Refer to Section 2.2 in the Technical Guidance Document (TGD) for information that must be included in the project description.*

Description of Proposed Project				
Development Category (From Model WQMP, Table 7.11-2; or -3):	Priority Project: 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 ²): 105,917	Number of Dwelling Units: 36		SIC Code: N/A	
Project Area	Pervious		Impervious	
	Area (acres or sq ft)	Percentage	Area (acres or sq ft)	Percentage
Pre-Project Conditions	0.53 ac	22%	1.87 ac	78%
Post-Project Conditions	0.62 ac	26%	1.78 ac	74%
Drainage Patterns/Connections	The drainage from the project is collected by a series of area drains and catch basins to collect street flow. The south half of the property drains out to Mill Creek through a proposed parkway culvert near the proposed driveway. The north half of the property drains out to Mill Creek Drive through a second proposed parkway culvert near the northeast corner of the site.			

<p>Narrative Project Description: (Use as much space as necessary.)</p>	<p>Re-development of an existing commercial property to a residential development including 36 duplex residential. No off-site drainage is anticipated.</p>
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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:		Attached Residential Development
	E=Expected to be of concern	N=Not Expected to be of concern	
Suspended-Solid/ Sediment	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Nutrients	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Heavy Metals	E <input type="checkbox"/>	N <input checked="" type="checkbox"/>	
Pathogens (Bacteria/Virus)	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Pesticides	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Oil and Grease	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Toxic Organic Compounds	E <input type="checkbox"/>	N <input checked="" type="checkbox"/>	
Trash and Debris	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	

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.*

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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 the pre development condition. Per Section 5.3-1 of the Technical Guidance, the following calculations are prepared:

1. $(V_{2 \text{ year, post}} / V_{2 \text{ year, pre}}) = \leq 1.05$
(776 cf / 833 cf) = 0.93 (7% decrease)
1. $Tc_{2 \text{ year, post}} / Tc_{2 \text{ year, pre}} = \leq 1.05$
(6.6 min / 7.1 min = 0.93 (7% decrease) *

* Reference calculations for time of concentration information for the 2 year storm event in Attachment D. 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 project is collected by a series of area drains and catch basins to collect street flow. The south half of the property drains out to Mill Creek through a proposed parkway culvert near the proposed driveway. The north half of the property drains out to Mill Creek Drive through a second proposed parkway culvert near the northeast corner of the site.

The flow continues down Mill Creek to an existing storm drain system tributary to San Diego Creek Channel. San Diego Creek channel drains to Upper Newport Bay.

II.5 Property Ownership/Management

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

On-site proposed drainage facilities will be privately owned and maintained.

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	23161 Mill Creek Drive
	Laguna Hills
General Plan Land Use Designation	MXU
Zoning	Mixed use, MXU
Acreage of Project Site	2.4 acres
Predominant Soil Type	Hydrological Soil Type "D"

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	0.80" (Refer to Figure XVI-1 of the TGD located in Attachment D)
Topography	Slopes on the existing and proposed developed portion of the site are relatively flat (<5%) with vegetative slopes at 2:1 (+30 feet) surrounding existing and proposed development

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Drainage Patterns/Connections	parkway culvert to Mill Creek. Ultimately tributary to San Diego Creek Reach 2, then Reach 1, then Upper Newport Bay
Soil Type, Geology, and Infiltration Properties	silty fine to coarse sands, clayey to fine sandy silts, silty clay, siltstone/claystone, and sandstone layers; relatively low infiltration rate. percolation test in process
Hydrogeologic (Groundwater) Conditions	Greater than 50 ft below ground surface
Geotechnical Conditions (relevant to infiltration)	relatively low infiltration (<0.5 in/hr) expected. Percolation test in process
Off-Site Drainage	Offsite drainage is not anticipated for this project.
Utility and Infrastructure Information	There is no existing storm drain system adjacent to the site. Stormwater will be collected by a series of PVC pipes discharging to a proposed bio-treatment BMP and then through a parkway culvert onto Mill Creek.

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	San Diego Creek Reach 1&2/Upper Newport Bay
303(d) Listed Impairments	category 5
Applicable TMDLs	5A-TMDL/5B-TMDL being addressed by USEPA approved TMDL
Pollutants of Concern for the Project	San Diego Creek Reach 2 -Indicator Bacteria, Nutrients, Sedimentation/Siltation, Unknown Toxicity San Diego Creek Reach 1 – Fecal Coliform, Nutrients, Pesticides, Sedimentation/Siltation, Selenium, Toxaphene Upper Newport Bay – Chlordane, Copper, DDT, Indicator Bacteria, Metals, Nutrients, PCB's, Pesticides, Sediment Toxicity, Sedimentation/Siltation

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Environmentally Sensitive and Special Biological Significant Areas	There are no Environment Sensitive Areas (ESA) or Areas of Special Biological Sign
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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 checked="" type="checkbox"/>	NO <input type="checkbox"/>
If yes, describe WIHMP feasibility criteria or regional/sub-regional LID opportunities.	Newport Bay has a WIHMP. This project will use LID Treatment BMPs to reduce the post development impacts including infiltration, harvest and use, evapotranspire, or biotreat/biofilter, the 85 th percentile of a 24 hour storm event. This project specifically proposes a LID Treatment BMP of impervious area dispersion. Biotreatment will be utilized for the remaining volume. Due to the limited available space, this project proposed the use of proprietary media biofiltration units.		

Project Performance Criteria	
<p>If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)</p>	<p>Per Section II-3 of this WQMP, HCOC's do not exist.</p>
<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 MQMP, if the LID performance criteria is not feasibly met by retention and/or biotreatment, then sizing of onsite treatment control BMPs are required. For this project, a LID BMP of impervious area dispersion (e.g. roof top disconnection) will be implemented. This does not</p>
<p>Calculate LID design storm capture volume for Project.</p>	<p>DMA A, VBMP = 1850 cf* DMA B, VBMP=2570 cf* *Refer to Worksheet A and C in Attachment E of this report.</p>

IV.2. Site Design and Drainage

Describe site design and drainage including

- A narrative of site design practices utilized or rationale for not using practices;
- A narrative of how site is designed to allow BMPs to be incorporated to the MEP
- A table of DMA characteristics and list of LID BMPs proposed in each DMA.
- Reference to the WQMP “BMP Exhibit.”
- Calculation of Design Capture Volume (DCV) for each drainage area.
- A listing of GIS coordinates for LID and Treatment Control BMPs.

Refer to Section 2.4.2 in the Technical Guidance Document (TGD).

DMA A includes the surface drainage, proposed inlets, and an underground piping system in the south half of the site. The piping discharges to a proposed BMP biofiltration basin with an underdrain. The underdrain connects to a parkway culvert discharging onto Mill Creek near the driveway entrance. DMA B includes the surface drainage, proposed inlets, and an underground piping system in the north half of the site. The piping discharges to a proposed BMP biofiltration basin with an underdrain. The underdrain connects to a proposed parkway culvert further down Mill Creek Drive. The limited surface area necessitates the use of a proprietary biofiltration system with engineered media to reduce the footprint. The use of proprietary biofiltration system will need to treat 150% of the design capture volume. Refer to BMP exhibit in Attachment C.

Drainage Area No. (DMA)	Area (ac)	Proposed BMPs	Northing	Easting	DCV (cf)	150% DCV (cf)
A	0.96	Bio-7 Proprietary Biofiltration	2174538	6109626	1,850	2775
B	1.22	Bio-7 Proprietary Biofiltration	2174693	6109566	2,570	3855

The sizing calculations and worksheets are in Attachment E.

IV.3 LID BMP Selection and Project Conformance Analysis

Each sub-section below documents that the proposed design features conform to the applicable project performance criteria via check boxes, tables, calculations, narratives, and/or references to worksheets. Refer to Section 2.4.2.3 in the Technical Guidance Document (TGD) for selecting LID BMPs and Section 2.4.3 in the Technical Guidance Document (TGD) for conducting conformance analysis with project performance criteria.

IV.3.1 Hydrologic Source Controls (HSCs)

If required HSCs are included, fill out applicable check box forms. If the retention criteria are otherwise met with other LID BMPs, include a statement indicating HSCs not required.

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"/>
Other:	<input type="checkbox"/>

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 B 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

Identify infiltration BMPs to be used in project. If design volume cannot be met, state why.

Name	Included?
Bioretention without underdrains	<input 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"/>

Not applicable because the natural soil has an infiltration rate that is too low to use bioretention without underdrains or other infiltration BMP's.

IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

If the full Design Storm Capture Volume cannot be met with infiltration BMPs, describe any evapotranspiration and/or rainwater harvesting BMPs included.

Name	Included?
All 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"/>

IV.3.4 Biotreatment BMPs

If the full Design Storm Capture Volume cannot be met with infiltration BMPs, and/or evapotranspiration and rainwater harvesting BMPs, describe biotreatment BMPs included. Include sections for selection, suitability, sizing, and infeasibility, as applicable.

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 checked="" type="checkbox"/>
Wet extended detention basin	<input type="checkbox"/>
Dry extended detention basins	<input type="checkbox"/>
Other:	<input type="checkbox"/>
Other:	<input type="checkbox"/>

Proprietary vegetated biotreatment systems will be used to treat 150% of the DCV. See calculations and sizing in Attachment E.

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

Describe regional/sub-regional LID BMPs in which the project will participate. *Refer to Section 7.II-2.4.3.2 of the Model WQMP.*

Regional/Sub-Regional LID BMPs
Not Applicable

IV.3.7 Treatment Control BMPs

Treatment control BMPs can only be considered if the project conformance analysis indicates that it is not feasible to retain the full design capture volume with LID BMPs. Describe treatment control BMPs including sections for selection, sizing, and infeasibility, as applicable.

Treatment Control BMPs	
BMP Name	BMP Description
DMA A - Filterra Model FTPD0809-HC-P	Filterra Bioretention planter (72 sq ft bed area) with 3" of mulch on top of a 18"high flow media layer (measured infiltration rate of 175 in/hr) over 6" of bridging stone on top of a 6" underdrain. Underdrain outlets to a proposed 18" RCP outlet pipe.
DMA B - Filterra Model FTPD08105-HC-P	Filterra Bioretention planter (84 sq ft bed area) with 3" of mulch on top of a 18"high flow media layer (measured infiltration rate of 175 in/hr) over 6" of bridging stone on top of a 6" underdrain. Underdrain outlets to a proposed 18" RCP outlet pipe.

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"/>	N/A Residential Development
N7	Spill Contingency Plan	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A Residential Development
N8	Underground Storage Tank Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A Residential Development
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"/>	
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"/>	N/A Residential Development

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 in common areas
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"/>	Not applicable
S7	Maintenance bays	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable
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"/>	Not applicable
S10	Equipment wash areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable
S11	Fueling areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable
S12	Hillside landscaping	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
S13	Wash water control for food preparation areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable
S14	Community car wash racks	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable

IV.4 Alternative Compliance Plan (If Applicable)

Describe an alternative compliance plan (if applicable). Include alternative compliance obligations (i.e., gallons, pounds) and describe proposed alternative compliance measures.

Not applicable

IV.4.1 Water Quality Credits

Determine if water quality credits are applicable for the project. *Refer to Section 3.1 of the Model WQMP for description of credits and Appendix VI of the Technical Guidance Document (TGD) for calculation methods for applying 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 BMP's Water quality credits will not be used.
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IV.4.2 Alternative Compliance Plan Information

Describe an alternative compliance plan (if applicable). Include alternative compliance obligations (i.e., gallons, pounds) and describe proposed alternative compliance measures. *Refer to Section 7.II 3.0 in the Model WQMP.*

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.

BMP Inspection/Maintenance			
BMP	Responsible Party(s)	Inspection/Maintenance Activities Required	Minimum Frequency of Activities
Education of Property Owners, Tenants, Occupants & Employees	Homeowner Maintenance Association	Information to be provided to property owners, tenants, occupants and employees	As needed
Activity restrictions	Homeowner Maintenance Association	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	Homeowner Maintenance Association	Hire professional landscape contractor to properly maintain common areas	Landscape maintenance required on a weekly basis or as needed
Uniform Fire Code Implementation	Homeowner Maintenance Association	Provide litter removal of site parking lot and landscape areas	Once per week

Priority Project Water Quality Management Plan (WQMP)
Mill Creek Development

<p>Parking Lot Street sweeping</p>	<p>Homeowner Maintenance Association</p>	<p>Hire a professional street sweeping service</p>	<p>Once per week</p>
<p>Efficient Irrigation and Landscape planting</p>	<p>Homeowner Maintenance Association</p>	<p>Hire professional landscape contractor to properly maintain landscape and control irrigation measures in common areas</p>	<p>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.</p>
<p>Filtterra Planter Boxes</p>	<p>Homeowner Maintenance Association</p>	<p>Hire professional contractor to properly maintain the biofiltration planter boxes</p>	<p>Regular maintenance prior to, during, and following the rainy season. Service a minimum of once per year and as necessary.</p>

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

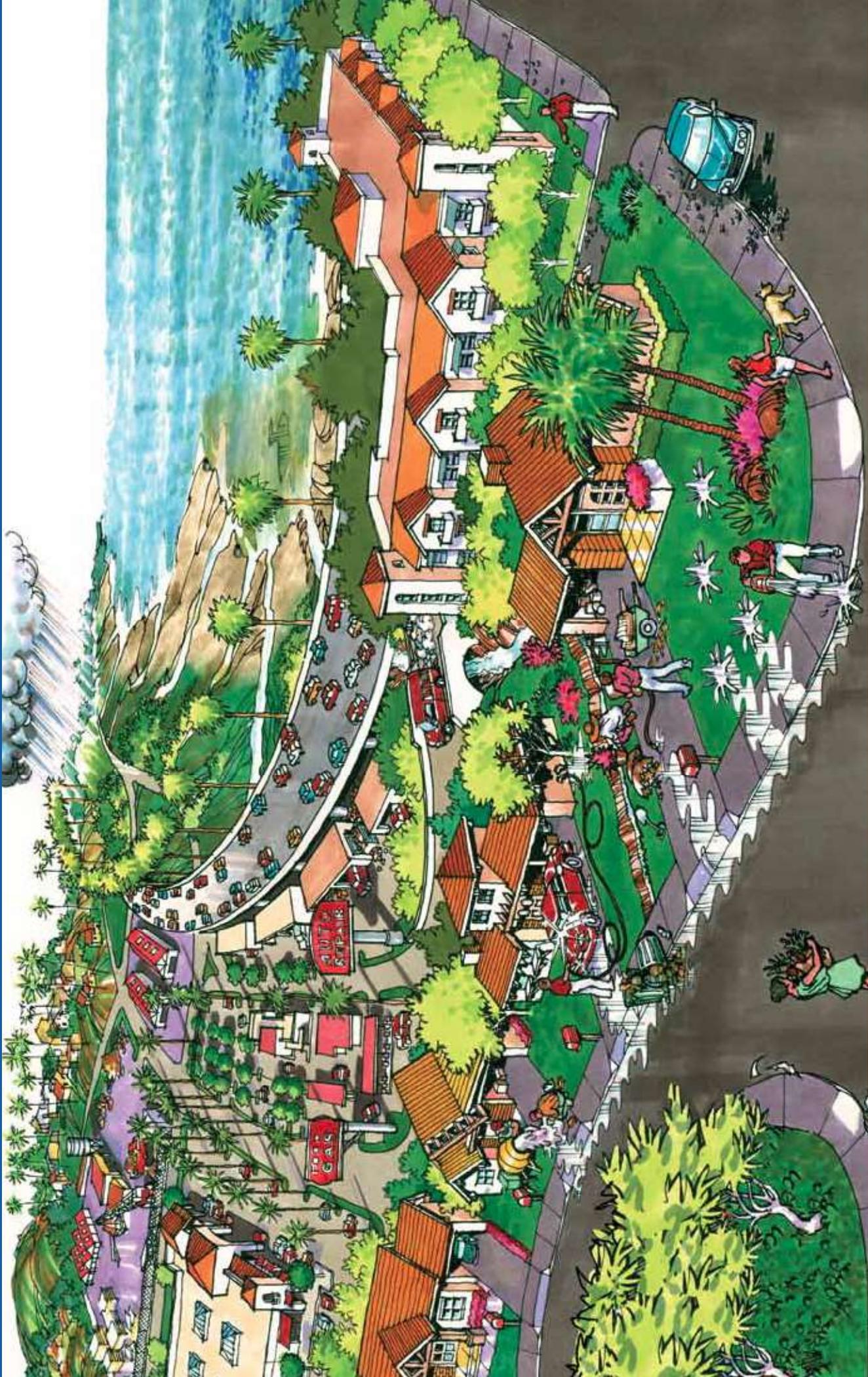
Refer to the Orange County Stormwater Program (ocwatersheds.com) for a library of materials available. Please only attach the educational materials specifically applicable to this project. Other materials specific to the project may be included as well and must be attached.

Education Materials			
Residential Material (http://www.ocwatersheds.com)	Check If Applicable	Business Material (http://www.ocwatersheds.com)	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"/>	Other Material	Check If Attached
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 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

Education Materials

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.
- 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.

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.

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.

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

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

Earth 911 - Community-Specific Environmental Information 1-800-cleanup or visit www.1800cleanup.org

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

(714) 433-6400 or visit www.ocbeachinfo.com

Integrated Waste Management Dept. of Orange County

(714) 834-6752 or visit 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

Stormwater Best Management Practice Handbook

Visit www.cabmphandbooks.com

UC Master Gardener Hotline

(714) 708-1646 or visit 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

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



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.



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

Solution: 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.



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 sheets 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.

6 Motor Oil/Vehicle Fluids

Solution: 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.

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?

A TEAM EFFORT

The Orange County Stormwater Program has teamed with the Municipal Water District of Orange County (MUDOC) 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/

www.mudoc.com

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.



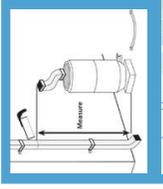
In Orange County, 60-70% of water used by residents and businesses goes to irrigation and other outdoor uses. Reusing rainwater to irrigate our lawn not only reduces the impact of water pollution from runoff, but it also is a great way to conserve our precious water resources and replenish our groundwater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



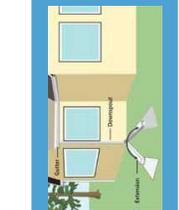
Downspout Disconnection/Redirection
 Disconnecting downspouts from pipes running to the gutter prevents runoff from transporting pollutants to the storm drain. Once disconnected, downspouts can be redirected to rain gardens or other vegetated areas, or be connected to a rain barrel.

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/mosquitoes.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/

OTHER WATER CONSERVATION AND POLLUTION PREVENTION TECHNIQUES

Native Vegetation and Maintenance
 "California Friendly" plants or native vegetation can significantly reduce water use. These plants often require far less fertilizers and pesticides, which are two significant pollutants found in Orange County waterways. Replacing water "thirsty" plants and grass types with water efficient natives is a great way to save water and reduce the need for potentially harmful pesticides and fertilizer. Please see the California Friendly Garden Guide produced by the Metropolitan Water District of Southern California and associated Southern California Water Agencies for a catalog of California friendly plants and other garden resources at www.bewaterwise.com/Gardensoft.



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

Soil Amendments
 Soil amendments such as green waste (e.g. grass clippings, compost, etc.) can be a significant source of nutrients and can help keep the soil near the roots of plants moist. However, they can cause algal 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 in the early morning. Within a few hours of being on the sprinklers, time your sprinklers, when the water begins to run off of your lawn, you can turn them off. Your timer can be set to water your lawn for this duration every time.

• **Water at Sunrise.** Watering early in the morning reduces water loss due to evaporation. Additionally, winds tend to be cooler 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 hoses is leaking, replace the nylon or rubber hose washer and ensure a tight connection. Fix broken sprinklers immediately.



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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

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.

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



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

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).

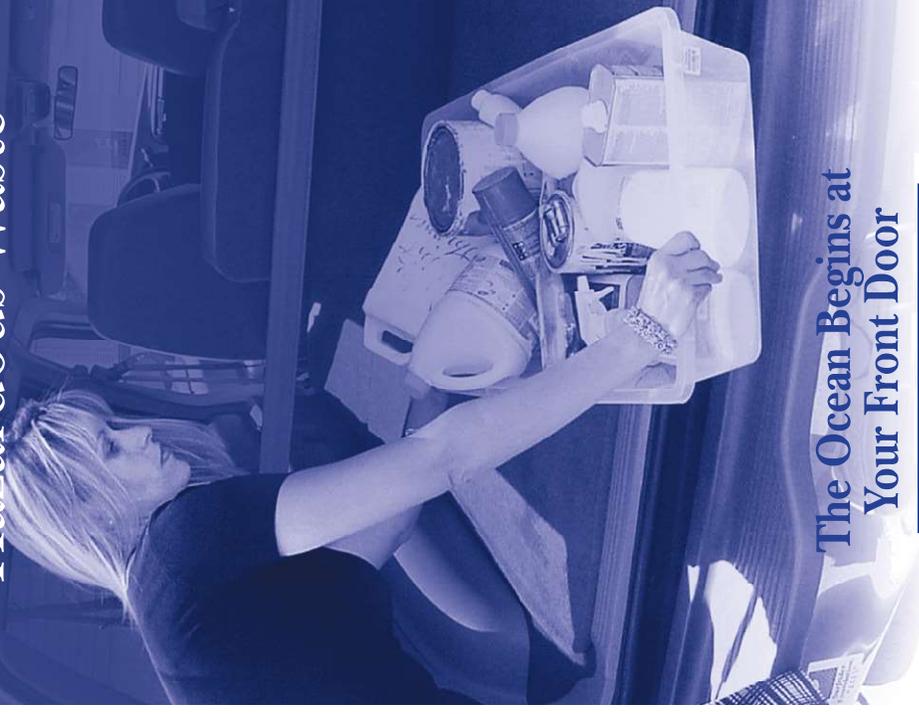
For emergencies, dial 911.



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Help Prevent Ocean Pollution:

Proper Disposal of Household Hazardous Waste



The Ocean Begins at Your Front Door



ORANGE COUNTY

Pollution Prevention

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

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

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

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

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

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

Common household hazardous wastes

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

- Television & monitors (CRTs, flatscreens)

Tips for household hazardous waste

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



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.

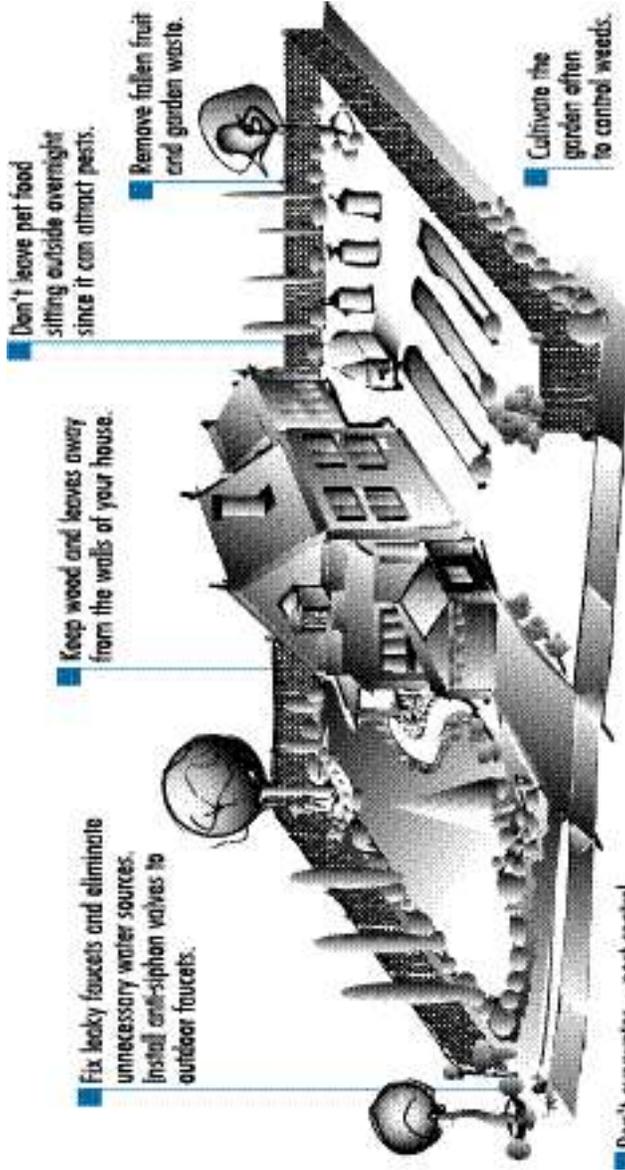
When You're Spraying

- 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.

Clean up debris that may harbor pests. Remove weak or dying plants.

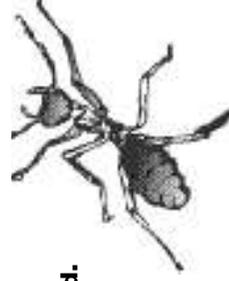
IPM... OUTSMARTING PESTS WHILE PROTECTING WATER

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 Brochures1-877-89-SPILL (1-877-897-7455)
 UC Masters & Coop Extension (714) 708-1646
 ucmastergardeners@yahoo.com

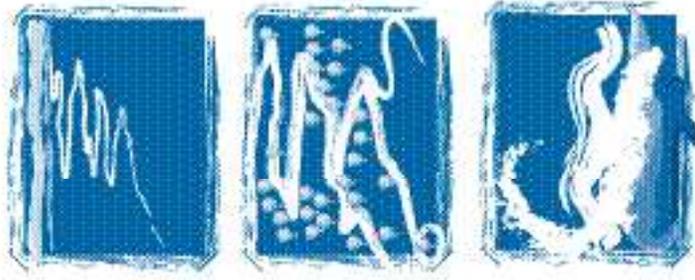
O.C. Household Hazardous Waste Information (714) 834-6752
 or www.oc.ca.gov/IWMD

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

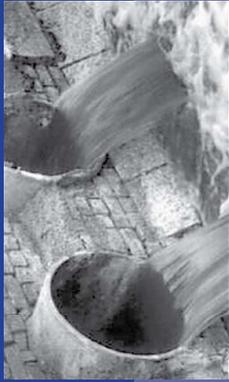
Original graphics developed with support from:
 Coalition For Urban/Rural Environmental Stewardship (CURES)
 Western Crop Protection Association (WCPA)
 Responsible Industry for a Sound Environment (RISE)



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



**HOMEOWNER TIPS
PROTECTING
WATER**



Clean 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

www.ipm.ucdavis.edu

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

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

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

For emergencies, dial 911.

Information From:

Cheryl Wilen, Area IPM Advisor; Darren Haver,

Watershed Management Advisor; Mary

Louise Flint, IPM Education and Publication

Director; Pamela M. Geisel, Environmental

Horticulture Advisor; Carolyn L. Unruh,

University of California Cooperative

Extension staff writer. Photos courtesy of

the UC Statewide IPM Program and

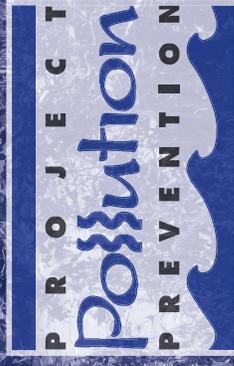
Darren Haver.

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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.

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

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

Step 4: Wear appropriate protective clothing.

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

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

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

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

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

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

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

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

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

Step 7: Properly store and dispose of unused pesticides.

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

Store unused chemicals in a locked cabinet.

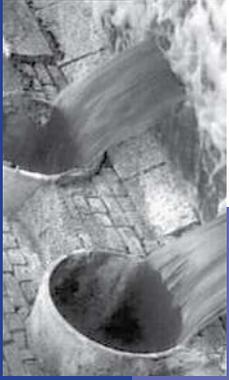
Unused pesticide chemicals may be disposed of at a Household Hazardous Waste Collection Center.

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





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

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

For more information, please call the

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

or visit

www.ocwatersheds.com

To report a spill, call the

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

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

For emergencies, dial 911.

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



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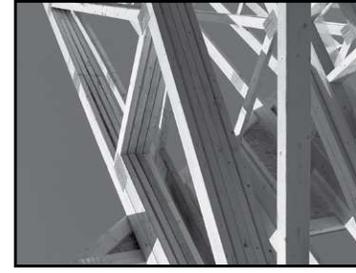
Help Prevent Ocean Pollution: Tips for Home Improvement Projects



Tips for Home Improvement Projects

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

General Construction



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

Building Materials

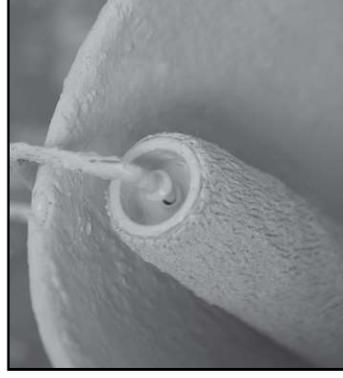
- Never hose materials into a street, gutter or storm drain.
- Exposed piles of construction material should not be stored on the street or sidewalk.
- Minimize waste by ordering only the amount of materials needed to complete the job.
- Do not mix more fresh concrete than is needed for each project.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

Paint

- Measure the room or object to be painted, then buy only the amount needed.
- Place the lid on firmly and store the paint can upside-down in a dry location away from the elements.
- Tools such as brushes, buckets and rags should never be washed where excess water can drain into the street, gutter or storm drain. All tools should be rinsed in a sink connected to the sanitary sewer.

- When disposing of paint, never put wet paint in the trash.

- Dispose of water-based paint by removing the lid and letting it dry in the can. Large amounts must be taken to a Household Hazardous Waste Collection Center (HHWCC).



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

- For HHWCC locations and hours, call (714) 834-6752 or visit www.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.

- Prevent erosion by planting fast-growing annual and perennial grasses. They will shield and bind the soil.

Recycle

- Use a construction and demolition recycling company to recycle lumber, paper, cardboard, metals, masonry (bricks, concrete, etc.), carpet, plastic, pipes (plastic, metal and clay), drywall, rocks, dirt and green waste.



- For a listing of construction and demolition recycling locations in your area, visit www.ciwmb.ca.gov/recycle.

Spills

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

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

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.

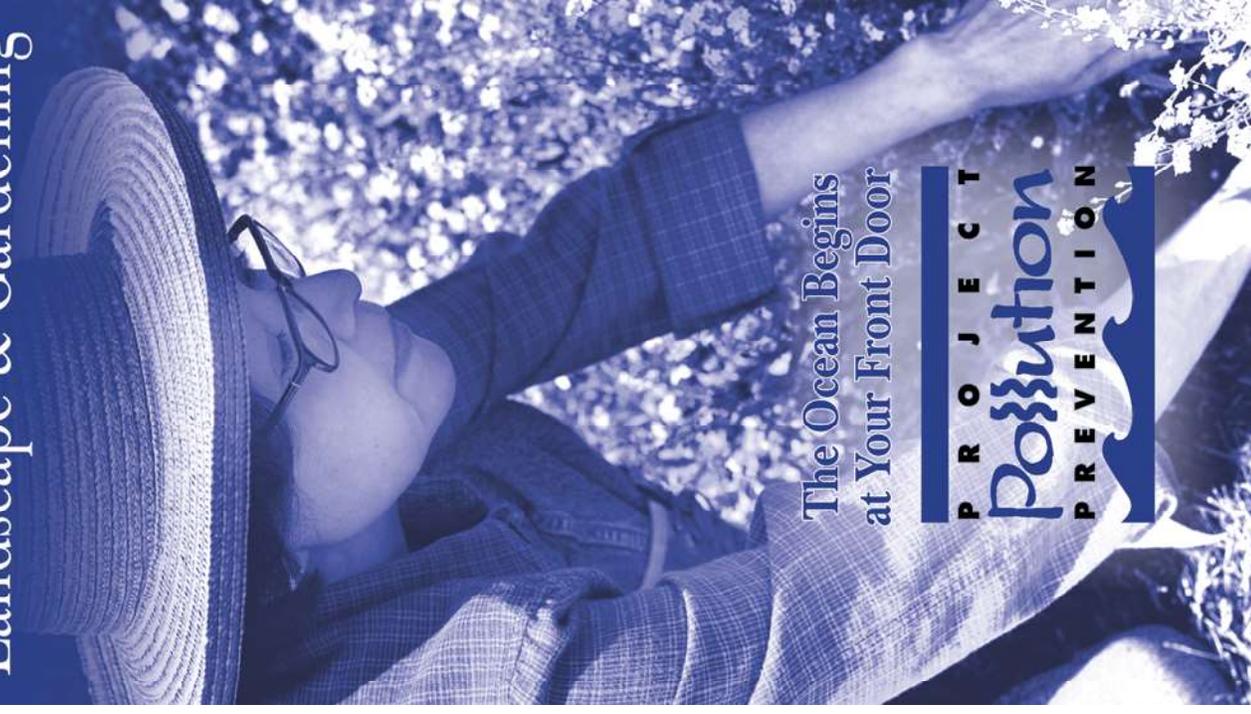
The tips contained in this brochure provide useful information to help prevent water pollution while landscaping or gardening. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.



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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



Tips for Landscape & Gardening

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

General Landscaping Tips

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

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

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

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

Garden & Lawn Maintenance

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

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

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

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

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

■ Rinse empty pesticide containers and re-use rinse water as you would use the



product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.

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

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

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

Household Hazardous Waste Collection Centers

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

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

Tips for Pet Care

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

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

For more information, please call the

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

or visit

www.ocwatersheds.com

To report a spill, call the

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

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

For emergencies, dial 911.

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



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**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**

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.



Printed on Recycled Paper

Help Prevent Ocean Pollution:

Tips for Residential Pool, Landscape and Hardscape Drains



The Ocean Begins
at Your Front Door

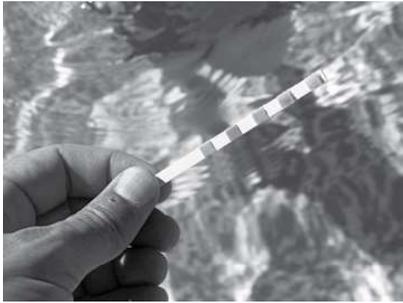


Tips for Residential Pool, Landscape and Hardscape Drains

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.
- Do not hose down your driveways, sidewalks or patios to your landscape or hardscape drain. Sweep up debris and dispose of it in the trash.
- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash.

- Do not store items such as cleaners, batteries, automotive fluids, paint products, TVs, or computer monitors uncovered outdoors. Take them to a HHWCC for disposal.

Yard Maintenance

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



Vehicle Maintenance

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



Tips for Projects Using Paint



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

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

For more information, please call the

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

or visit

www.ocwatersheds.com

To report a spill, call the

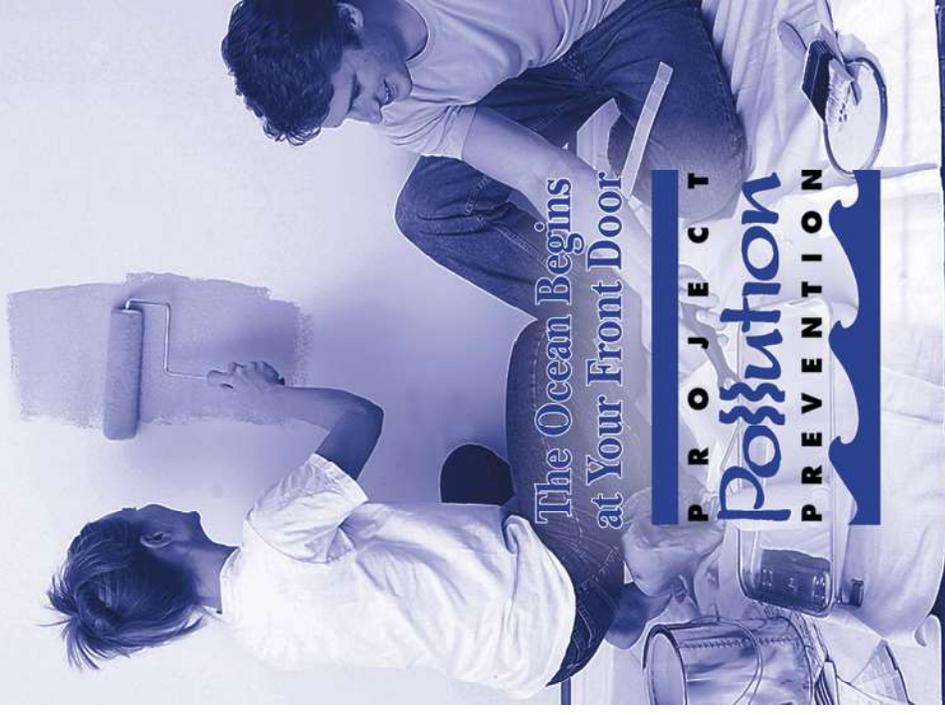
**Orange County 24-Hour
Water Pollution Problem
Reporting Hotline**
at 1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

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



Printed on Recycled Paper



The Ocean Begins
at Your Front Door

PROJECT
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.oclandfills.com.



Disposing of Paint

- Never put wet paint in the trash.
- **For water-based paint:**
If possible, brush the leftover paint on cardboard or newspaper. Otherwise, allow the paint to dry in the can with the lid off in a well-ventilated area protected from the elements, children and pets. Stirring the paint every few days will speed up the drying.
- Large quantities of extra paint should be taken to a HHWCC.
- Once dried, paint and painted surfaces may be disposed of in the trash. When setting a dried paint can out for trash collection, leave the lid off so the collector will see that the paint has dried.

For oil-based paint:

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

Aerosol paint:

- Dispose of aerosol paint cans at a HHWCC.

Spills

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



Clean 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

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



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

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 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

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.



RECYCLE
USED OIL



Printed on Recycled Paper

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.
- 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.
- Properly label materials. Familiarize employees with Material Safety Data Sheets.



Attachment B

Rainfall Zones Map

SUBJECT TO FURTHER REVISION

LEGEND

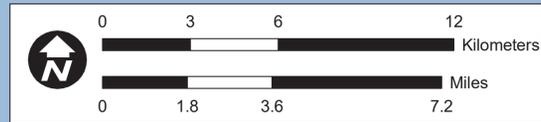
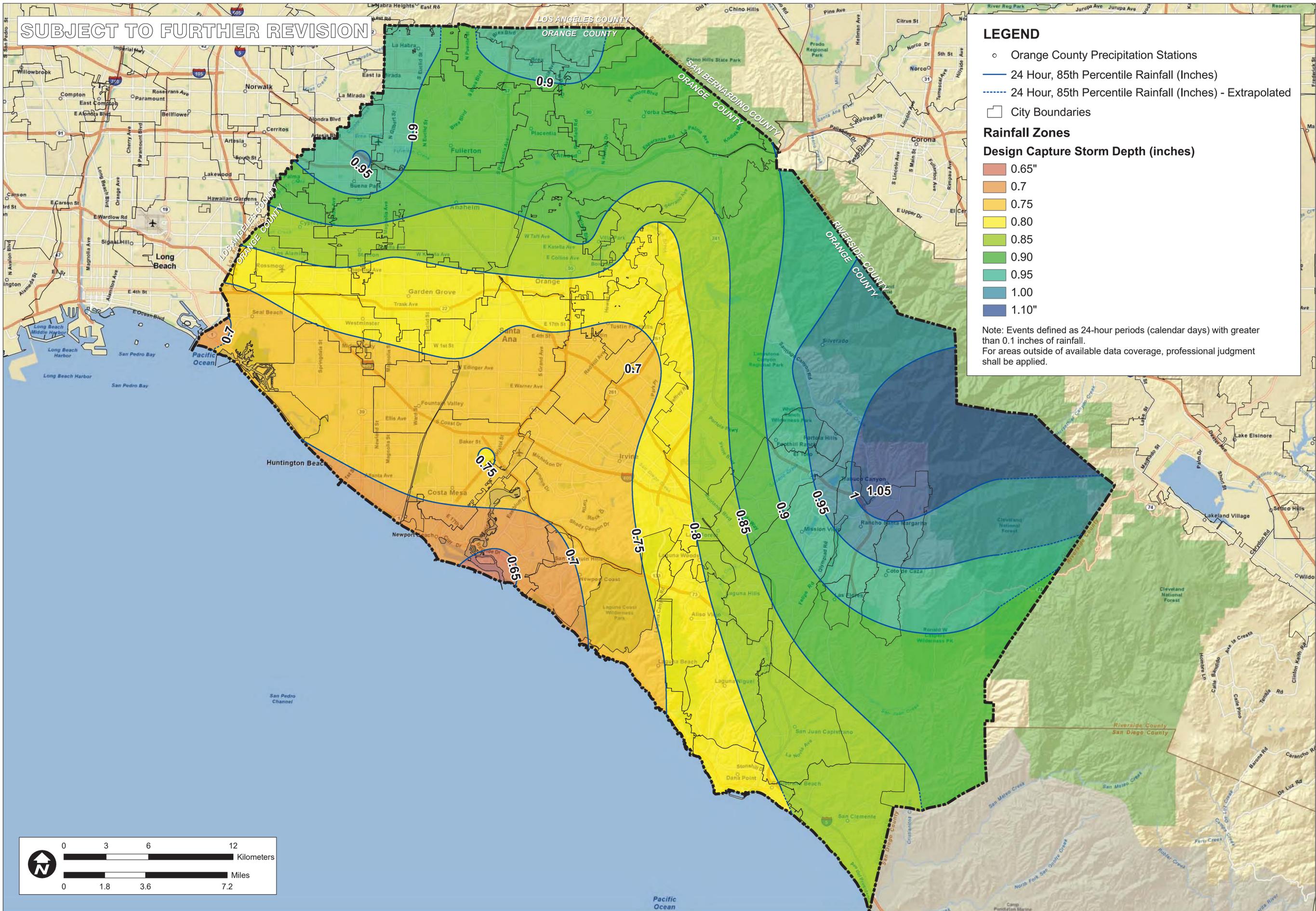
- Orange County Precipitation Stations
- 24 Hour, 85th Percentile Rainfall (Inches)
- - - 24 Hour, 85th Percentile Rainfall (Inches) - Extrapolated
- City Boundaries

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.



RAINFALL ZONES

CA

ORANGE COUNTY
TECHNICAL GUIDANCE
DOCUMENT

ORANGE CO.

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



FIGURE
XVI-1

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

Attachment C

WQMP Exhibit

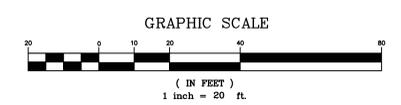


- LEGEND**
- A
100 DMA ID AREA (ACRES)
 - LANDSCAPE AREA GRASS/SHRUBS (PERVIOUS)
 - BUILDINGS (IMPERVIOUS) ROOFS HAVE DOWNSPOUTS SUBJECT TO IMPERVIOUS AREA DISPERSION REQUIREMENTS
 - PAVEMENT AND HARDSCAPE (IMPERVIOUS)
 - PROPERTY LINE
 - DMA AREAS
 - STORM DRAIN AND INLET
 - DRAINAGE PATH
 - STORM DRAIN, (PROPOSED OR EXISTING)
 - CB STORM DRAIN CATCH BASIN (PROPOSED) (SEE APPENDIX 6)
 - STRUCTURAL BMP – CATCH BASIN/GRATE INLET FILTER BASKET & CONNECTOR PIPE SCREEN
 - + STRUCTURAL BMP – BIOFILTRATION BMP (FILTRERA –SEE TABLE FOR SIZE AND MODEL) (SEE SHEET 2 FOR DETAIL)

- LIST OF SOURCE CONTROL BMPS**
- CATCH BASIN MARKINGS "ONLY RAIN DOWN THE STORM DRAIN"
 - MINIMIZING IRRIGATION AND RUN-OFF
 - FIRE SPRINKLER TEST WATER, DRAIN TO SEWER

ON-SITE DMA AREA	PERVIOUS AREA (SF)	IMPERVIOUS AREA (SF)	TOTAL AREA (AC)	TOTAL AREA (SF)	A _{imp} (%)	C RUNOFF COEFF	DCV ¹ VOLUME (CU-FT)	Q(BMP) ² (CFS)	DCV ³ REQUIRED (CU-FT)	Q(BMP) ³ REQUIRED (CFS)	FILTRERA REQUIRED SURFACE AREA (SF) ⁴	PROVIDED SURFACE AREA (SF)	PROPOSED BMP SIZING
A	8180	33638	0.96	41818	0.80	0.753	1850	0.159	2775	0.239	59	72	FTP0809-HC-P
B	5476	47667	1.22	53143	0.90	0.823	2570	0.221	3855	0.332	82	84	FTP08105-HC-P

1 SEE WORKSHEETS A AND B
 2 SEE WORKSHEETS A AND D
 3 TO USE A PROPRIETARY BIOFILTRATION UNIT, REQUIRED TO TREAT 150% OF THE DCV AND CORRESPONDING Q(BMP)
 4 THE FILTRERA UNIT SURFACE AREA REQUIRED IS BASED ON A 175 IN/HR MEDIA LOADING RATE (AREA REQ = Q(BMP) REQ/175 IN/HR)



NO.	DATE	REVISIONS

DESIGNED BY: ES
 DRAFTED BY: ES
 CHECKED BY: KM
 DATE: 9/24

WILSON MIKAMI CORPORATION
 9 CORPORATE PARK, SUITE 100
 IRVINE, CA 92606
 T: 949-679-0090

LAGUNA HILLS

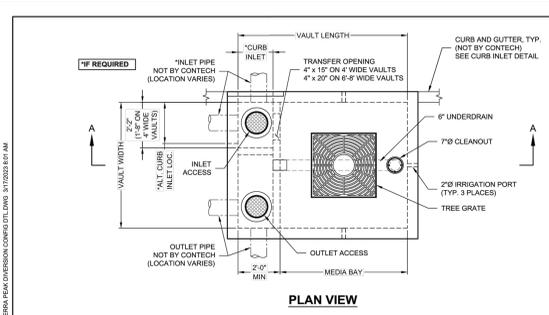
KHOSHBIN MILL CREEK PROPERTY

PROPOSED CONDITION HYDROLOGY MAP

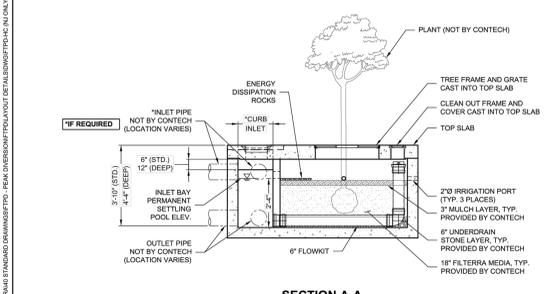
PROJECT NO.
10501.00

SHEET **1**
OF **2**

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PLAN VIEW

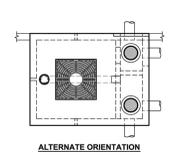


SECTION A-A (STANDARD DEPTH SHOWN)

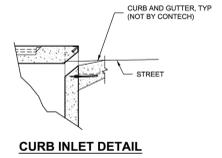
FTPD-HC CONFIGURATION
(OPTIONS: DEEP "D", THROAT INLET "T", PIPE INLET "P", PIPE AND THROAT INLET "PT")

MODEL NAME	PART NUMBER	AVAILABILITY	MEDIA AREA (SF)	MEDIA BAY SIZE	VAULT SIZE (W x L)	WEIR LENGTH/ MAX. CURB OPENING	*MAX BYPASS FLOW (CFS)	INLET/ OUTLET ACCESS DIA.	TREE GRATE QTY. AND SIZE
FTPD 64 HC (648 VAULT)	FTPD064HC	ALL	16	4 x 4	4 x 6	1'-0"	1.4 / 4.6	12"12"	(1) 3' x 3'
FTPD 66 HC (648 VAULT)	FTPD066HC	ALL (EXCEPT OR, WA, NV, HI)	24	4 x 6	4 x 8	1'-0"	1.4 / 4.6	12"12"	(1) 3' x 3'
FTPD 68 HC (648 VAULT)	FTPD068HC	ALL (EXCEPT CA, TN)	24	6 x 4	6 x 6	1'-0"	1.4 / 4.6	12"12"	(1) 3' x 3'
FTPD 64 HC (648 VAULT)	FTPD064HC	ALL (EXCEPT TN)	26	4.5 x 5.83	4.5 x 7.83	1'-0"	1.4 / 4.6	12"12"	(1) 3' x 3'
FTPD 66 HC (648 VAULT)	FTPD066HC	ALL (EXCEPT CA, TN)	36	6 x 6	6 x 8	1'-0"	1.4 / 4.6	12"12"	(1) 3' x 3'
FTPD 68 HC (648 VAULT)	FTPD068HC	ALL (EXCEPT CA, TN)	48	6 x 8	6 x 10	1'-0"	1.4 / 4.6	12"12"	(1) 4' x 4'
FTPD 87 HC (810 VAULT)	FTPD087HC	CA, TX ONLY	56	8 x 7	8 x 10	2'-0"	2.1 / 6.8	24"24"	(1) 4' x 4'
FTPD 810 HC (810 VAULT)	FTPD0810HC	ALL (EXCEPT TN)	60	6 x 10	6 x 12	1'-0"	1.4 / 4.6	12"12"	(1) 4' x 4'
FTPD 710 HC (713 VAULT)	FTPD0710HC	ALL (EXCEPT CA, TN)	70	7 x 10	7 x 13	2'-0"	2.1 / 6.8	24"24"	(1) 4' x 4'
FTPD 68 HC (810 VAULT)	FTPD068HC	CA, TX ONLY	72	8 x 9	8 x 12	2'-0"	2.1 / 6.8	24"24"	(1) 4' x 4'
FTPD 8x10.5 HC (814 VAULT)	FTPD08105HC	ALL (EXCEPT OR, WA)	84	8 x 10.5	8 x 14	3'-0"	2.5 / 8.2	24"24"	(1) 4' x 4'
FTPD 8x12.5 HC (818 VAULT)	FTPD08125HC	ALL (EXCEPT OR, WA)	100	8 x 12.5	8 x 16	3'-0"	2.5 / 8.2	24"24"	(2) 4' x 4'
FTPD 8x11.5 HC (815 VAULT)	FTPD08115HC	OR, WA ONLY	103	9 x 11.5	9 x 15	3'-0"	2.5 / 8.2	24"24"	(2) 4' x 4'

*MAX BYPASS FLOW IS INTERNAL WEIR FLOW. CAPACITIES SHOWN ARE FOR STANDARD DEPTH AND DEEP (D), RESPECTIVELY. SITE SPECIFIC ANALYSIS IS REQUIRED TO DETERMINE CURB INLET FLOW CAPACITY.



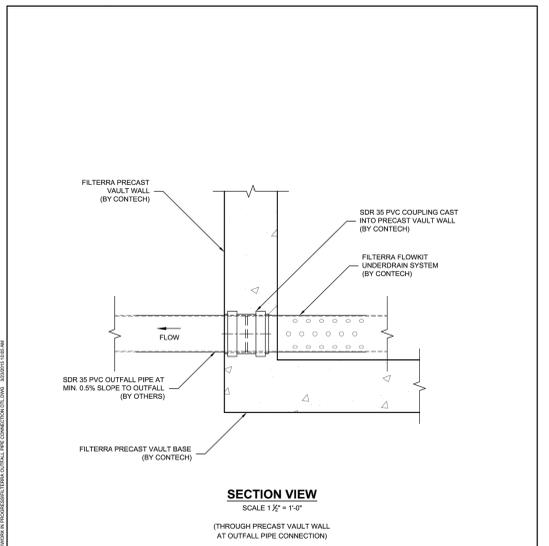
ALTERNATE ORIENTATION



CURB INLET DETAIL

CONTECH
ENGINEERED SOLUTIONS LLC
www.contechES.com
803 Center Pointe Dr., Suite 400, West Chester, OH 45380
937-338-1122 937-445-7000 937-445-7993 FAX

FILTERRA HC PEAK DIVERSION (FTPD-HC) CONFIGURATION DETAIL



SECTION VIEW
SCALE 1/2" = 1'-0"

(THROUGH PRECAST VAULT WALL AT OUTFALL PIPE CONNECTION)

CONTECH
ENGINEERED SOLUTIONS LLC
www.contechES.com
803 Center Pointe Dr., Suite 400, West Chester, OH 45380
937-338-1122 937-445-7000 937-445-7993 FAX

FILTERRA OUTFALL PIPE CONNECTION TO PRECAST VAULT WALL DETAIL

DATE: 03-23-15 FILE NAME: FILTERRA OUTFALL PIPE CONNECTION.DWG DRAWN: SDJ CHECKED: AXJ

NO.	DATE	REVISIONS

DESIGNED BY:	
DRAFTED BY:	
CHECKED BY:	
DATE:	

WILSON MIKAMI CORPORATION
9 CORPORATE PARK, SUITE 100
IRVINE, CA 92606
T: 949-679-0090

LAGUNA HILLS
KHOSHBIN MILL CREEK PROJECT
WATER QUALITY MANAGEMENT PLAN

PROJECT NO.
10501.00
SHEET 2
OF 2

S:\1\0501\100\dwg\PREX0006-WQMP.dwg 7/14/25

Attachment D

Hydrologic Conditions of Concern Calculations

Project: Proposed Mill Creek Development
JN 10501

Storm Event Volume Calculations

Storm Event: 2 Year

Existing Condition

$$\text{Volume(24 hour)} = 1/2 (dQ) * (dTime)$$

Tc=	7.12		min
dTime = 2 x Tc	14.24		min
dQ =	3.9		cfs

Volume (24 hr)= 833 cf

Proposed Condition

$$\text{Volume(24 hour)} = 1/2 (dQ) * (dTime)$$

Tc=	6.6	10.6	min
dTime = 2 x Tc	13.3	21.2	min
dQ =	3.9	3.0	cfs

Volume (24 hr)= 776 cf

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
(c) Copyright 1983-2016 Advanced Engineering Software (aes)
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 *****

* KHOSHBIN MILL CREEK PROPERTY *
* EXISTING CONDITION 2-YEAR HYDROLOGY *
* BY KAM 071425 *

FILE NAME: EX_MC2.DAT
TIME/DATE OF STUDY: 13:57 07/14/2025

=====

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

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

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT- / PARK- 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) = 203.00
ELEVATION DATA: UPSTREAM (FEET) = 316.50 DOWNSTREAM (FEET) = 304.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 5.000
* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 2.264

SUBAREA Tc AND LOSS RATE DATA (AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
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COMMERCIAL D 0.18 0.20 0.100 57 5.00
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 0.36
TOTAL AREA(ACRES) = 0.18 PEAK FLOW RATE(CFS) = 0.36

FLOW PROCESS FROM NODE 11.00 TO NODE 12.00 IS CODE = 61

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>(STANDARD CURB SECTION USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 304.00 DOWNSTREAM ELEVATION(FEET) = 299.70
STREET LENGTH(FEET) = 185.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 10.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 5.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

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

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.53
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

STREET FLOW DEPTH(FEET) = 0.19
HALFSTREET FLOOD WIDTH(FEET) = 3.19
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.42
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.46
STREET FLOW TRAVEL TIME(MIN.) = 1.28 Tc(MIN.) = 6.28
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.987

SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.19	0.20	0.100	57

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.19 SUBAREA RUNOFF(CFS) = 0.34
EFFECTIVE AREA(ACRES) = 0.37 AREA-AVERAGED Fm(INCH/HR) = 0.02
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 0.4 PEAK FLOW RATE(CFS) = 0.65

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.20 HALFSTREET FLOOD WIDTH(FEET) = 3.86
FLOW VELOCITY(FEET/SEC.) = 2.45 DEPTH*VELOCITY(FT*FT/SEC.) = 0.50
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 388.00 FEET.

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

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

=====

MAINLINE Tc(MIN.) = 6.28
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.987
SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.96	0.20	0.100	57

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.96 SUBAREA RUNOFF(CFS) = 1.70
EFFECTIVE AREA(ACRES) = 1.33 AREA-AVERAGED Fm(INCH/HR) = 0.02
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10

TOTAL AREA (ACRES) = 1.3 PEAK FLOW RATE (CFS) = 2.35

FLOW PROCESS FROM NODE 12.00 TO NODE 13.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM (FEET) =	299.70	DOWNSTREAM (FEET) =	296.00
CHANNEL LENGTH THRU SUBAREA (FEET) =	119.00	CHANNEL SLOPE =	0.0311
CHANNEL BASE (FEET) =	0.00	"Z" FACTOR =	7.500
MANNING'S FACTOR =	0.015	MAXIMUM DEPTH (FEET) =	1.00
* 2 YEAR RAINFALL INTENSITY (INCH/HR) =	1.913		

SUBAREA LOSS RATE DATA (AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.55	0.20	0.100	57

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 2.82
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY (FEET/SEC.) = 4.63
AVERAGE FLOW DEPTH (FEET) = 0.29 TRAVEL TIME (MIN.) = 0.43
Tc (MIN.) = 6.70
SUBAREA AREA (ACRES) = 0.55 SUBAREA RUNOFF (CFS) = 0.94
EFFECTIVE AREA (ACRES) = 1.88 AREA-AVERAGED Fm (INCH/HR) = 0.02
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
TOTAL AREA (ACRES) = 1.9 PEAK FLOW RATE (CFS) = 3.20

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH (FEET) = 0.29 FLOW VELOCITY (FEET/SEC.) = 4.92
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 13.00 = 507.00 FEET.

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

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

=====

MAINLINE Tc (MIN.) = 6.70
* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.913
SUBAREA LOSS RATE DATA (AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
NATURAL FAIR COVER "CHAPARRAL, BROADLEAF"	D	0.27	0.20	1.000	64

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA AREA (ACRES) = 0.27 SUBAREA RUNOFF (CFS) = 0.42
EFFECTIVE AREA (ACRES) = 2.15 AREA-AVERAGED Fm (INCH/HR) = 0.04
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.21
TOTAL AREA (ACRES) = 2.1 PEAK FLOW RATE (CFS) = 3.62

FLOW PROCESS FROM NODE 13.00 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) = 296.00 DOWNSTREAM (FEET) = 272.00
FLOW LENGTH (FEET) = 265.00 MANNING'S N = 0.015
ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000
DEPTH OF FLOW IN 18.0 INCH PIPE IS 4.5 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 10.56
ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 3.62
 PIPE TRAVEL TIME(MIN.) = 0.42 Tc(MIN.) = 7.12
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 21.00 = 772.00 FEET.

 FLOW PROCESS FROM NODE 21.00 TO NODE 21.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION(MIN.) = 7.12
 RAINFALL INTENSITY(INCH/HR) = 1.85
 AREA-AVERAGED Fm(INCH/HR) = 0.04
 AREA-AVERAGED Fp(INCH/HR) = 0.20
 AREA-AVERAGED Ap = 0.21
 EFFECTIVE STREAM AREA(ACRES) = 2.15
 TOTAL STREAM AREA(ACRES) = 2.15
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 3.62

 FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 21

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

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 70.00
 ELEVATION DATA: UPSTREAM(FEET) = 302.00 DOWNSTREAM(FEET) = 272.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.264
 SUBAREA Tc AND LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
NATURAL FAIR COVER "CHAPARRAL,BROADLEAF"	D	0.21	0.20	1.000	64	5.00

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
 SUBAREA RUNOFF(CFS) = 0.39
 TOTAL AREA(ACRES) = 0.21 PEAK FLOW RATE(CFS) = 0.39

 FLOW PROCESS FROM NODE 21.00 TO NODE 21.00 IS CODE = 1

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

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 5.00
 RAINFALL INTENSITY(INCH/HR) = 2.26
 AREA-AVERAGED Fm(INCH/HR) = 0.20
 AREA-AVERAGED Fp(INCH/HR) = 0.20
 AREA-AVERAGED Ap = 1.00
 EFFECTIVE STREAM AREA(ACRES) = 0.21
 TOTAL STREAM AREA(ACRES) = 0.21
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 0.39

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	3.62	7.12	1.848	0.20(0.04)	0.21	2.1	10.00

2 0.39 5.00 2.264 0.20(0.20) 1.00 0.2 20.00

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	3.52	5.00	2.264	0.20(0.06)	0.31	1.7	20.00
2	3.93	7.12	1.848	0.20(0.06)	0.28	2.4	10.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 3.93 Tc(MIN.) = 7.12
EFFECTIVE AREA(ACRES) = 2.36 AREA-AVERAGED Fm(INCH/HR) = 0.06
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.28
TOTAL AREA(ACRES) = 2.4
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 21.00 = 772.00 FEET.

=====
END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 2.4 TC(MIN.) = 7.12
EFFECTIVE AREA(ACRES) = 2.36 AREA-AVERAGED Fm(INCH/HR) = 0.06
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.283
PEAK FLOW RATE(CFS) = 3.93

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	3.52	5.00	2.264	0.20(0.06)	0.31	1.7	20.00
2	3.93	7.12	1.848	0.20(0.06)	0.28	2.4	10.00

=====
END OF RATIONAL METHOD ANALYSIS

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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Analysis prepared by:

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

***** DESCRIPTION OF STUDY *****
* KHOSHBIN MILL CREEK PROPOSED CONDITION HYDROLOGY *
* 2-YEAR HYDROLOGY *
* BY KAM 071425 *

FILE NAME: KOSH.DAT
TIME/DATE OF STUDY: 13:48 07/14/2025

=====
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

Table with 9 columns: NO., 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, 0.0312, 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) = 240.00
ELEVATION DATA: UPSTREAM (FEET) = 312.40 DOWNSTREAM (FEET) = 309.20

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 6.456
* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.955

SUBAREA Tc AND LOSS RATE DATA (AMC I):

Table with 7 columns: DEVELOPMENT TYPE / LAND USE, SCS SOIL GROUP, AREA (ACRES), Fp (INCH/HR), Ap (DECIMAL), SCS CN, Tc (MIN.)

COMMERCIAL D 0.10 0.20 0.100 57 6.46
SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
SUBAREA RUNOFF(CFS) = 0.17
TOTAL AREA(ACRES) = 0.10 PEAK FLOW RATE(CFS) = 0.17

FLOW PROCESS FROM NODE 11.00 TO NODE 11.00 IS CODE = 81

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

=====

MAINLINE T_c (MIN.) = 6.46
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.955
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 "11+ DWELLINGS/ACRE"	D	0.24	0.20	0.200	57

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.200
SUBAREA AREA(ACRES) = 0.24 SUBAREA RUNOFF(CFS) = 0.41
EFFECTIVE AREA(ACRES) = 0.34 AREA-AVERAGED F_m (INCH/HR) = 0.03
AREA-AVERAGED F_p (INCH/HR) = 0.20 AREA-AVERAGED A_p = 0.17
TOTAL AREA(ACRES) = 0.3 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) = 303.20 DOWNSTREAM(FEET) = 302.50
FLOW LENGTH(FEET) = 47.00 MANNING'S N = 0.010
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS 2.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.58
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 0.59
PIPE TRAVEL TIME(MIN.) = 0.17 T_c (MIN.) = 6.63
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 287.00 FEET.

FLOW PROCESS FROM NODE 12.00 TO NODE 12.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 6.63
RAINFALL INTENSITY(INCH/HR) = 1.93
AREA-AVERAGED F_m (INCH/HR) = 0.03
AREA-AVERAGED F_p (INCH/HR) = 0.20
AREA-AVERAGED A_p = 0.17
EFFECTIVE STREAM AREA(ACRES) = 0.34
TOTAL STREAM AREA(ACRES) = 0.34
PEAK FLOW RATE(CFS) AT CONFLUENCE = 0.59

FLOW PROCESS FROM NODE 10.00 TO NODE 13.00 IS CODE = 21

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

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 254.00
ELEVATION DATA: UPSTREAM(FEET) = 312.40 DOWNSTREAM(FEET) = 308.20

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 6.326
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.978
SUBAREA T_c AND LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS T_c
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL D 0.10 0.20 0.100 57 6.33
SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
SUBAREA RUNOFF(CFS) = 0.18
TOTAL AREA(ACRES) = 0.10 PEAK FLOW RATE(CFS) = 0.18

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

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

=====

MAINLINE T_c (MIN.) = 6.33
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.978
SUBAREA LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"11+ DWELLINGS/ACRE" D 0.26 0.20 0.200 57
SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.200
SUBAREA AREA(ACRES) = 0.26 SUBAREA RUNOFF(CFS) = 0.45
EFFECTIVE AREA(ACRES) = 0.36 AREA-AVERAGED F_m (INCH/HR) = 0.03
AREA-AVERAGED F_p (INCH/HR) = 0.20 AREA-AVERAGED A_p = 0.17
TOTAL AREA(ACRES) = 0.4 PEAK FLOW RATE(CFS) = 0.63

FLOW PROCESS FROM NODE 13.00 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) = 302.70 DOWNSTREAM(FEET) = 302.50
FLOW LENGTH(FEET) = 11.00 MANNING'S N = 0.010
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS 2.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.02
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 0.63
PIPE TRAVEL TIME(MIN.) = 0.04 T_c (MIN.) = 6.36
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 265.00 FEET.

FLOW PROCESS FROM NODE 12.00 TO NODE 12.00 IS CODE = 1

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

=====

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 6.36
RAINFALL INTENSITY(INCH/HR) = 1.97
AREA-AVERAGED F_m (INCH/HR) = 0.03
AREA-AVERAGED F_p (INCH/HR) = 0.20
AREA-AVERAGED A_p = 0.17

EFFECTIVE STREAM AREA (ACRES) = 0.36
 TOTAL STREAM AREA (ACRES) = 0.36
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 0.63

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	0.59	6.63	1.926	0.20 (0.03)	0.17	0.3	10.00
2	0.63	6.36	1.971	0.20 (0.03)	0.17	0.4	10.00

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	1.21	6.36	1.971	0.20 (0.03)	0.17	0.7	10.00
2	1.20	6.63	1.926	0.20 (0.03)	0.17	0.7	10.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 1.21 Tc (MIN.) = 6.36
 EFFECTIVE AREA (ACRES) = 0.69 AREA-AVERAGED Fm (INCH/HR) = 0.03
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.17
 TOTAL AREA (ACRES) = 0.7
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 287.00 FEET.

 FLOW PROCESS FROM NODE 12.00 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) = 302.50 DOWNSTREAM (FEET) = 296.20
 FLOW LENGTH (FEET) = 103.00 MANNING'S N = 0.010
 ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 12.000
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 2.7 INCHES
 PIPE-FLOW VELOCITY (FEET/SEC.) = 9.29
 ESTIMATED PIPE DIAMETER (INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW (CFS) = 1.21
 PIPE TRAVEL TIME (MIN.) = 0.18 Tc (MIN.) = 6.55
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 14.00 = 390.00 FEET.

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

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

=====

MAINLINE Tc (MIN.) = 6.55
 * 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.939
 SUBAREA LOSS RATE DATA (AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.14	0.20	0.100	57

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA AREA (ACRES) = 0.14 SUBAREA RUNOFF (CFS) = 0.24
 EFFECTIVE AREA (ACRES) = 0.83 AREA-AVERAGED Fm (INCH/HR) = 0.03
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.16
 TOTAL AREA (ACRES) = 0.8 PEAK FLOW RATE (CFS) = 1.42

 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) = 296.20 DOWNSTREAM(FEET) = 294.30
FLOW LENGTH(FEET) = 45.00 MANNING'S N = 0.010
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS 3.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 8.56
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 1.42
PIPE TRAVEL TIME(MIN.) = 0.09 Tc(MIN.) = 6.63
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 15.00 = 435.00 FEET.

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

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

=====

MAINLINE Tc(MIN.) = 6.63
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.924
SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.10	0.20	0.100	57

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.10 SUBAREA RUNOFF(CFS) = 0.17
EFFECTIVE AREA(ACRES) = 0.93 AREA-AVERAGED Fm(INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.15
TOTAL AREA(ACRES) = 0.9 PEAK FLOW RATE(CFS) = 1.58

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) = 294.30 DOWNSTREAM(FEET) = 292.30
FLOW LENGTH(FEET) = 50.00 MANNING'S N = 0.010
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS 3.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 8.66
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 1.58
PIPE TRAVEL TIME(MIN.) = 0.10 Tc(MIN.) = 6.73
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 16.00 = 485.00 FEET.

FLOW PROCESS FROM NODE 16.00 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) = 292.30 DOWNSTREAM(FEET) = 272.30
FLOW LENGTH(FEET) = 206.00 MANNING'S N = 0.015
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS 3.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 8.87
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 1.58
PIPE TRAVEL TIME(MIN.) = 0.39 Tc(MIN.) = 7.12
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 26.00 = 691.00 FEET.

FLOW PROCESS FROM NODE 26.00 TO NODE 26.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) = 7.12
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.848
SUBAREA LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
NATURAL FAIR COVER
"CHAPARRAL,NARROWLEAF" D 0.28 0.20 1.000 72
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA AREA(ACRES) = 0.28 SUBAREA RUNOFF(CFS) = 0.42
EFFECTIVE AREA(ACRES) = 1.21 AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.35
TOTAL AREA(ACRES) = 1.2 PEAK FLOW RATE(CFS) = 1.93

FLOW PROCESS FROM NODE 26.00 TO NODE 26.00 IS CODE = 10

>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<

FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 21

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

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 262.00
ELEVATION DATA: UPSTREAM(FEET) = 306.00 DOWNSTREAM(FEET) = 301.70

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 6.414
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.962
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.)
COMMERCIAL D 0.13 0.20 0.100 57 6.41
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 0.23
TOTAL AREA(ACRES) = 0.13 PEAK FLOW RATE(CFS) = 0.23

FLOW PROCESS FROM NODE 21.00 TO NODE 21.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) = 6.41
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.962
SUBAREA LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
COMMERCIAL D 0.06 0.20 0.100 57
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.06 SUBAREA RUNOFF(CFS) = 0.10
EFFECTIVE AREA(ACRES) = 0.19 AREA-AVERAGED Fm(INCH/HR) = 0.02
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 0.2 PEAK FLOW RATE(CFS) = 0.33

FLOW PROCESS FROM NODE 21.00 TO NODE 21.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) =	6.41				
* 2 YEAR RAINFALL INTENSITY(INCH/HR) =	1.962				
SUBAREA LOSS RATE DATA(AMC I):					
DEVELOPMENT TYPE/	SCS SOIL	AREA	Fp	Ap	SCS
LAND USE	GROUP	(ACRES)	(INCH/HR)	(DECIMAL)	CN
RESIDENTIAL					
"11+ DWELLINGS/ACRE"	D	0.26	0.20	0.200	57
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20					
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200					
SUBAREA AREA(ACRES) =		0.26	SUBAREA RUNOFF(CFS) =		0.45
EFFECTIVE AREA(ACRES) =		0.45	AREA-AVERAGED Fm(INCH/HR) =		0.03
AREA-AVERAGED Fp(INCH/HR) =		0.20	AREA-AVERAGED Ap =		0.16
TOTAL AREA(ACRES) =		0.4	PEAK FLOW RATE(CFS) =		0.78

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) =	296.70	DOWNSTREAM(FEET) =	296.50	
FLOW LENGTH(FEET) =	21.00	MANNING'S N =	0.010	
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000				
DEPTH OF FLOW IN 12.0 INCH PIPE IS 3.4 INCHES				
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.22				
ESTIMATED PIPE DIAMETER(INCH) =		12.00	NUMBER OF PIPES =	1
PIPE-FLOW(CFS) = 0.78				
PIPE TRAVEL TIME(MIN.) =		0.08	Tc(MIN.) =	6.50
LONGEST FLOWPATH FROM NODE		20.00 TO NODE	22.00 =	283.00 FEET.

FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) =	6.50				
* 2 YEAR RAINFALL INTENSITY(INCH/HR) =	1.948				
SUBAREA LOSS RATE DATA(AMC I):					
DEVELOPMENT TYPE/	SCS SOIL	AREA	Fp	Ap	SCS
LAND USE	GROUP	(ACRES)	(INCH/HR)	(DECIMAL)	CN
COMMERCIAL	D	0.14	0.20	0.100	57
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20					
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100					
SUBAREA AREA(ACRES) =		0.14	SUBAREA RUNOFF(CFS) =		0.24
EFFECTIVE AREA(ACRES) =		0.59	AREA-AVERAGED Fm(INCH/HR) =		0.03
AREA-AVERAGED Fp(INCH/HR) =		0.20	AREA-AVERAGED Ap =		0.14
TOTAL AREA(ACRES) =		0.6	PEAK FLOW RATE(CFS) =		1.02

FLOW PROCESS FROM NODE 22.00 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) =	296.50	DOWNSTREAM(FEET) =	296.30
FLOW LENGTH(FEET) =	22.00	MANNING'S N =	0.010
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000			

DEPTH OF FLOW IN 12.0 INCH PIPE IS 4.0 INCHES
 PIPE-FLOW VELOCITY (FEET/SEC.) = 4.50
 ESTIMATED PIPE DIAMETER (INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW (CFS) = 1.02
 PIPE TRAVEL TIME (MIN.) = 0.08 Tc (MIN.) = 6.58
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 25.00 = 305.00 FEET.

 FLOW PROCESS FROM NODE 25.00 TO NODE 25.00 IS CODE = 1

 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 =====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION (MIN.) = 6.58
 RAINFALL INTENSITY (INCH/HR) = 1.93
 AREA-AVERAGED Fm (INCH/HR) = 0.03
 AREA-AVERAGED Fp (INCH/HR) = 0.20
 AREA-AVERAGED Ap = 0.14
 EFFECTIVE STREAM AREA (ACRES) = 0.59
 TOTAL STREAM AREA (ACRES) = 0.59
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 1.02

 FLOW PROCESS FROM NODE 20.00 TO NODE 23.00 IS CODE = 21

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

INITIAL SUBAREA FLOW-LENGTH (FEET) = 173.00
 ELEVATION DATA: UPSTREAM (FEET) = 306.00 DOWNSTREAM (FEET) = 300.80

Tc = K * [(LENGTH** 3.00) / (ELEVATION CHANGE)] ** 0.20
 SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 5.000
 * 2 YEAR RAINFALL INTENSITY (INCH/HR) = 2.264
 SUBAREA Tc AND LOSS RATE DATA (AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	D	0.07	0.20	0.100	57	5.00

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF (CFS) = 0.14
 TOTAL AREA (ACRES) = 0.07 PEAK FLOW RATE (CFS) = 0.14

 FLOW PROCESS FROM NODE 23.00 TO NODE 23.00 IS CODE = 81

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

MAINLINE Tc (MIN.) = 5.00
 * 2 YEAR RAINFALL INTENSITY (INCH/HR) = 2.264
 SUBAREA LOSS RATE DATA (AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "11+ DWELLINGS/ACRE"	D	0.18	0.20	0.200	57

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
 SUBAREA AREA (ACRES) = 0.18 SUBAREA RUNOFF (CFS) = 0.36
 EFFECTIVE AREA (ACRES) = 0.25 AREA-AVERAGED Fm (INCH/HR) = 0.03
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.17
 TOTAL AREA (ACRES) = 0.2 PEAK FLOW RATE (CFS) = 0.50

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) =	297.80	DOWNSTREAM(FEET) =	297.60
FLOW LENGTH(FEET) =	21.00	MANNING'S N =	0.010
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000			
DEPTH OF FLOW IN 12.0 INCH PIPE IS 2.7 INCHES			
PIPE-FLOW VELOCITY(FEET/SEC.) =	3.73		
ESTIMATED PIPE DIAMETER(INCH) =	12.00	NUMBER OF PIPES =	1
PIPE-FLOW(CFS) =	0.50		
PIPE TRAVEL TIME(MIN.) =	0.09	Tc(MIN.) =	5.09
LONGEST FLOWPATH FROM NODE	20.00 TO NODE	24.00 =	194.00 FEET.

FLOW PROCESS FROM NODE 24.00 TO NODE 24.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) =	5.09				
* 2 YEAR RAINFALL INTENSITY(INCH/HR) =	2.240				
SUBAREA LOSS RATE DATA(AMC I):					
DEVELOPMENT TYPE/	SCS SOIL	AREA	Fp	Ap	SCS
LAND USE	GROUP	(ACRES)	(INCH/HR)	(DECIMAL)	CN
COMMERCIAL	D	0.03	0.20	0.100	57
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20					
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100					
SUBAREA AREA(ACRES) =		0.03	SUBAREA RUNOFF(CFS) =		0.06
EFFECTIVE AREA(ACRES) =		0.28	AREA-AVERAGED Fm(INCH/HR) =		0.03
AREA-AVERAGED Fp(INCH/HR) =		0.20	AREA-AVERAGED Ap =		0.16
TOTAL AREA(ACRES) =		0.3	PEAK FLOW RATE(CFS) =		0.56

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) =	297.60	DOWNSTREAM(FEET) =	296.30
FLOW LENGTH(FEET) =	245.00	MANNING'S N =	0.010
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000			
DEPTH OF FLOW IN 12.0 INCH PIPE IS 3.3 INCHES			
PIPE-FLOW VELOCITY(FEET/SEC.) =	3.12		
ESTIMATED PIPE DIAMETER(INCH) =	12.00	NUMBER OF PIPES =	1
PIPE-FLOW(CFS) =	0.56		
PIPE TRAVEL TIME(MIN.) =	1.31	Tc(MIN.) =	6.40
LONGEST FLOWPATH FROM NODE	20.00 TO NODE	25.00 =	439.00 FEET.

FLOW PROCESS FROM NODE 25.00 TO NODE 25.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) =	6.40				
* 2 YEAR RAINFALL INTENSITY(INCH/HR) =	1.965				
SUBAREA LOSS RATE DATA(AMC I):					
DEVELOPMENT TYPE/	SCS SOIL	AREA	Fp	Ap	SCS
LAND USE	GROUP	(ACRES)	(INCH/HR)	(DECIMAL)	CN
RESIDENTIAL					
"11+ DWELLINGS/ACRE"	D	0.20	0.20	0.200	57
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20					

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
 SUBAREA AREA (ACRES) = 0.20 SUBAREA RUNOFF (CFS) = 0.35
 EFFECTIVE AREA (ACRES) = 0.48 AREA-AVERAGED Fm (INCH/HR) = 0.04
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.18
 TOTAL AREA (ACRES) = 0.5 PEAK FLOW RATE (CFS) = 0.83

 FLOW PROCESS FROM NODE 25.00 TO NODE 25.00 IS CODE = 1

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

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION (MIN.) = 6.40
 RAINFALL INTENSITY (INCH/HR) = 1.96
 AREA-AVERAGED Fm (INCH/HR) = 0.04
 AREA-AVERAGED Fp (INCH/HR) = 0.20
 AREA-AVERAGED Ap = 0.18
 EFFECTIVE STREAM AREA (ACRES) = 0.48
 TOTAL STREAM AREA (ACRES) = 0.48
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 0.83

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	1.02	6.58	1.934	0.20 (0.03)	0.14	0.6	20.00
2	0.83	6.40	1.965	0.20 (0.04)	0.18	0.5	20.00

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	1.84	6.40	1.965	0.20 (0.03)	0.16	1.1	20.00
2	1.84	6.58	1.934	0.20 (0.03)	0.16	1.1	20.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 1.84 Tc (MIN.) = 6.40
 EFFECTIVE AREA (ACRES) = 1.05 AREA-AVERAGED Fm (INCH/HR) = 0.03
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.16
 TOTAL AREA (ACRES) = 1.1
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 25.00 = 439.00 FEET.

 FLOW PROCESS FROM NODE 25.00 TO NODE 25.00 IS CODE = 81

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

=====

MAINLINE Tc (MIN.) = 6.40
 * 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.965
 SUBAREA LOSS RATE DATA (AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "11+ DWELLINGS/ACRE"	D	0.12	0.20	0.200	57

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
 SUBAREA AREA (ACRES) = 0.12 SUBAREA RUNOFF (CFS) = 0.21
 EFFECTIVE AREA (ACRES) = 1.17 AREA-AVERAGED Fm (INCH/HR) = 0.03
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.16
 TOTAL AREA (ACRES) = 1.2 PEAK FLOW RATE (CFS) = 2.04

 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) = 296.30 DOWNSTREAM(FEET) = 274.00
 FLOW LENGTH(FEET) = 60.00 MANNING'S N = 0.010
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 2.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 20.50
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 2.04
 PIPE TRAVEL TIME(MIN.) = 0.05 Tc(MIN.) = 6.45
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 26.00 = 499.00 FEET.

 FLOW PROCESS FROM NODE 26.00 TO NODE 26.00 IS CODE = 11

>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<

** MAIN STREAM CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	2.04	6.45	1.956	0.20(0.03)	0.16	1.2	20.00
2	2.04	6.63	1.926	0.20(0.03)	0.16	1.2	20.00

LONGEST FLOWPATH FROM NODE 20.00 TO NODE 26.00 = 499.00 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	1.93	7.12	1.848	0.20(0.07)	0.35	1.2	10.00
2	1.91	7.38	1.810	0.20(0.07)	0.35	1.2	10.00

LONGEST FLOWPATH FROM NODE 10.00 TO NODE 26.00 = 691.00 FEET.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	3.90	6.45	1.956	0.20(0.05)	0.25	2.3	20.00
2	3.91	6.63	1.926	0.20(0.05)	0.25	2.3	20.00
3	3.88	7.12	1.848	0.20(0.05)	0.26	2.4	10.00
4	3.82	7.38	1.810	0.20(0.05)	0.26	2.4	10.00

TOTAL AREA(ACRES) = 2.4

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 3.91 Tc(MIN.) = 6.628
 EFFECTIVE AREA(ACRES) = 2.31 AREA-AVERAGED Fm(INCH/HR) = 0.05
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.25
 TOTAL AREA(ACRES) = 2.4
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 26.00 = 691.00 FEET.

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 2.4 TC(MIN.) = 6.63
 EFFECTIVE AREA(ACRES) = 2.31 AREA-AVERAGED Fm(INCH/HR) = 0.05
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.254
 PEAK FLOW RATE(CFS) = 3.91

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	3.90	6.45	1.956	0.20(0.05)	0.25	2.3	20.00

2	3.91	6.63	1.926	0.20 (0.05)	0.25	2.3	20.00
3	3.88	7.12	1.848	0.20 (0.05)	0.26	2.4	10.00
4	3.82	7.38	1.810	0.20 (0.05)	0.26	2.4	10.00

=====
=====
END OF RATIONAL METHOD ANALYSIS

Attachment E

BMP Sizing Calculations and Worksheets

Worksheet A: Hydrologic Source Control Calculation Form

Drainage area ID <u>DMA A</u>				
Total drainage area <u>0.96</u> acres				
Total drainage area Impervious Area (IA_{total}) <u>0.77</u> acres				
HSC ID	HSC Type/ Description/ Reference BMP Fact Sheet	Effect of individual HSC _i per criteria in BMP Fact Sheets (XIV.1) $(d_{HSCi})^1$	Impervious Area Tributary to HSC _i (IA_i)	$d_i \times IA_i$
A	HSC-2 IMPERVIOUS AREA	0.25	0.29 Ac	0.073
A	Bio-7 DISPERSION	0	0.96 Ac	0
Box 1:		$\sum d_i \times IA_i =$		0.073
Box 2:		$IA_{total} =$		0.77
[Box 1]/[Box 2]:		$d_{HSC total} =$		0.095
		<i>Percent Capture Provided by HSCs</i> (Table III.1)		20%

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

Worksheet B: Simple Design Capture Volume Sizing Method

DMA A

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, d (inches)	$d=$	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	$d_{HSC}=$	0.095	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 - Line 2)	$d_{remainder}=$	0.705	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), A (acres)	$A=$	0.96	acres
2	Enter Project Imperviousness, imp (unitless)	$imp=$	0.80	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	$C=$	0.753	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	$V_{design}=$	2,100 1,850	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{observed}$ ¹ (in/hr) (Appendix VII)	$K_{observed}=$		In/hr
2	Enter combined safety factor from Worksheet H, S_{total} (unitless)	$S_{total}=$		
3	Calculate design infiltration rate, $K_{design} = K_{observed} / S_{total}$	$K_{design}=$		In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, T (max 48 hours)	$T=$		Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	$D_{max}=$		feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	$A_{min}=$		sq-ft

¹ $K_{observed}$ is the vertical infiltration measured in the field, before applying a factor of safety. If field testing measures a rate that is different than the vertical infiltration rate (for example, three-dimensional borehole percolation rate), then this rate must be adjusted by an acceptable method (for example, Porchet method) to yield the field estimate of vertical infiltration rate, $K_{observed}$. See Appendix VII.

Worksheet D: Capture Efficiency Method for Flow-Based BMPs **DMA A**

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter the time of concentration, T_c (min) (See Appendix IV.2)	$T_c =$	6.6	
2	Using Figure III.4 , determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	$I_1 =$	0.25	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	$d_{HSC} =$	0.095	inches
4	Enter capture efficiency corresponding to d_{HSC} , Y_2 (Worksheet A)	$Y_2 =$	20	%
5	Using Figure III.4 , determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency (Y_2), I_2	$I_2 =$	0.03	
6	Determine the design intensity that must be provided by BMP, $I_{design} = I_1 - I_2$	$I_{design} =$	0.22	
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), A (acres)	$A =$	0.96	acres
2	Enter Project Imperviousness, imp (unitless)	$imp =$	0.80	
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	$C =$	0.753	
4	Calculate design flowrate, $Q_{design} = (C \times I_{design} \times A)$	$Q_{design} =$	0.159	cfs
Supporting Calculations				
Describe system:				
Provide time of concentration assumptions: SEE RATIONAL METHOD OUTPUT, PROPOSED CONDITION HYDROLOGY MHP				

Worksheet A: Hydrologic Source Control Calculation Form

Drainage area ID <u>DMA B</u>				
Total drainage area <u>1.22</u> acres				
Total drainage area Impervious Area (IA_{total}) <u>1.09</u> acres				
HSC ID	HSC Type/ Description/ Reference BMP Fact Sheet	Effect of individual HSC _i per criteria in BMP Fact Sheets (XIV.1) (d_{HSCi}) ¹	Impervious Area Tributary to HSC _i (IA_i)	$d_i \times IA_i$
B	HSC-2 <u>IMPERVIOUS AREA DISPERSION</u>	0.25	0.45 Ac	0.1125
B	B10-7	0	1.22 Ac	0
Box 1:			$\sum d_i \times IA_i =$	0.1125
Box 2:			$IA_{total} =$	1.09
[Box 1]/[Box 2]:			$d_{HSC total} =$	0.103
			<i>Percent Capture Provided by HSCs (Table III.1)</i>	20%

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

Worksheet B: Simple Design Capture Volume Sizing Method

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, d (inches)	$d=$	0.80	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	$d_{HSC}=$	0.095	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 - Line 2)	$d_{remainder}=$	0.705	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), A (acres)	$A=$	1.22	acres
2	Enter Project Imperviousness, imp (unitless)	$imp=$	0.90	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	$C=$	0.803	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	$V_{design}=$	2,570	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{observed}$ ¹ (in/hr) (Appendix VII)	$K_{observed}=$		In/hr
2	Enter combined safety factor from Worksheet H, S_{total} (unitless)	$S_{total}=$		
3	Calculate design infiltration rate, $K_{design} = K_{observed} / S_{total}$	$K_{design}=$		In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, T (max 48 hours)	$T=$		Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	$D_{max}=$		feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	$A_{min}=$		sq-ft

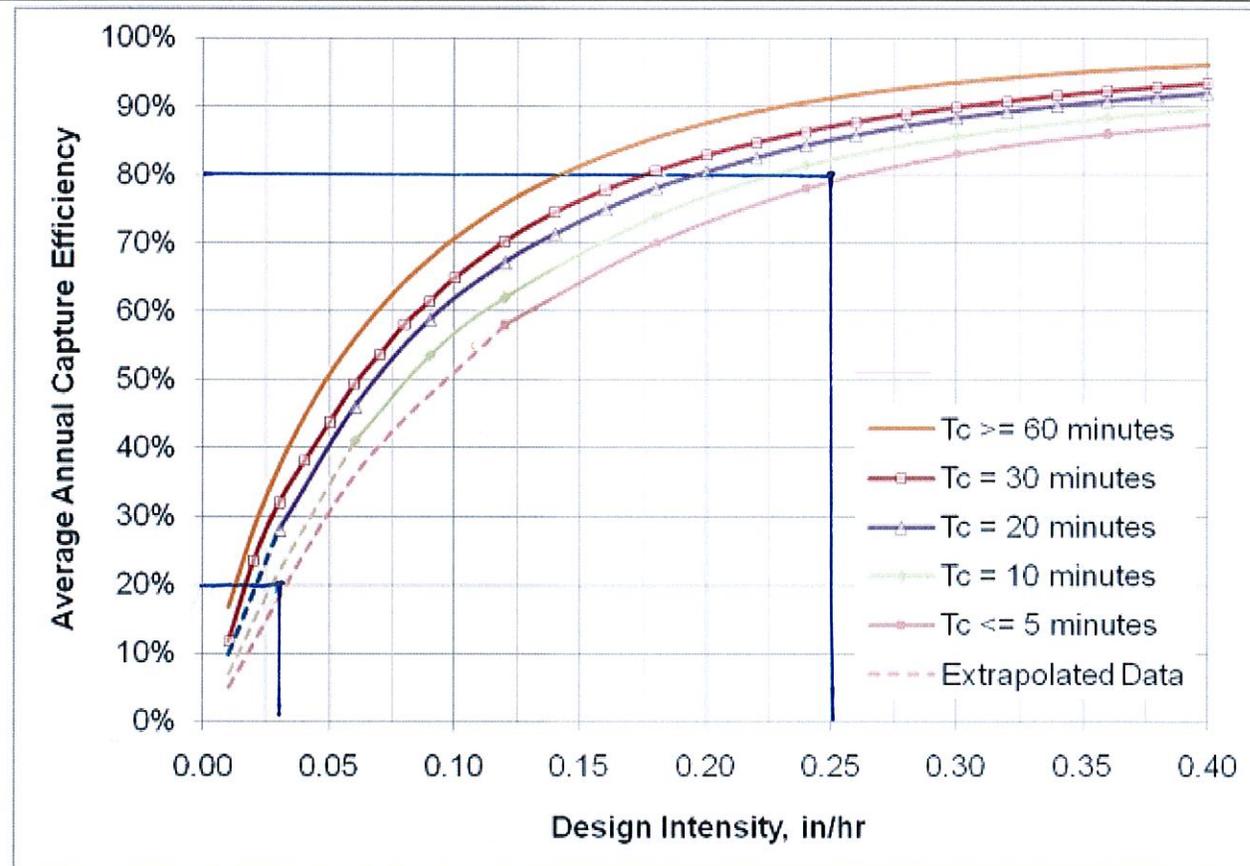
¹ $K_{observed}$ is the vertical infiltration measured in the field, before applying a factor of safety. If field testing measures a rate that is different than the vertical infiltration rate (for example, three-dimensional borehole percolation rate), then this rate must be adjusted by an acceptable method (for example, Porchet method) to yield the field estimate of vertical infiltration rate, $K_{observed}$. See Appendix VII.

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter the time of concentration, T_c (min) (See Appendix IV.2)	$T_c =$	6.	
2	Using Figure III.4 , determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	$I_1 =$	0.25	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	$d_{HSC} =$	0.103	inches
4	Enter capture efficiency corresponding to d_{HSC} , Y_2 (Worksheet A)	$Y_2 =$	20	%
5	Using Figure III.4 , determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency (Y_2), I_2	$I_2 =$	0.03	
6	Determine the design intensity that must be provided by BMP, $I_{design} = I_1 - I_2$	$I_{design} =$	0.22	
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), A (acres)	$A =$	1.22	acres
2	Enter Project Imperviousness, imp (unitless)	$imp =$	0.90	
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	$C =$	0.823	
4	Calculate design flowrate, $Q_{design} = (C \times I_{design} \times A)$	$Q_{design} =$	0.221	cfs
Supporting Calculations				
Describe system:				
Provide time of concentration assumptions: SEE RATIONAL METHOD OUTPUT, PROPOSED CONDITION HYDROLOGY MAP				

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

Graphical Operations



Provide supporting graphical operations. See Example III.7.

ON-SITE DMA AREA	PERVIOUS AREA (SF)	IMPERVIOUS AREA (SF)	TOTAL AREA (AC)	TOTAL AREA (SF)	Aimp (%)	C RUNOFF COEFF	DCV ¹ VOLUME (CU-FT)	Q(BMP) ² (CFS)	DCV ³ REQUIRED (CU-FT)	Q(BMP) ³ REQUIRED (CFS)	FILTERRA REQUIRED SURFACE AREA (SF) ⁴	PROVIDED SURFACE AREA (SF)	PROPOSED BMP SIZING
A	8180	33638	0.96	41818	0.80	0.753	1850	0.159	2775	0.239	59	72	FTPD0809-HC-P
B	5476	47667	1.22	53143	0.90	0.823	2570	0.221	3855	0.332	82	84	FTPD08105-HC-P

¹ SEE WORKSHEETS A AND B

² SEE WORKSHEETS A AND D

³ APPLY A 1.5x FACTOR TO 85TH PERCENTILE DESIGN CAPTURE DEPTH

⁴ ASSUMING A 175 IN/HR LOAD RATE, REQUIRED SURFACE AREA = Q(BMP)/175 IN/HR

Attachment F

Preliminary Soils Report



LGC Valley, Inc.

Geotechnical Consulting

***PRELIMINARY GEOTECHNICAL INVESTIGATION,
PROPOSED RESIDENTIAL DEVELOPMENT,
23161 MILL CREEK DRIVE,
LAGUNA HILLS, CALIFORNIA***

Dated: August 15, 2024

Project No. 244006-01

Prepared For:

***Toll Brothers
350 Commerce, Suite 200
Irvine, California 92602***



LGC Valley, Inc.

Geotechnical Consulting

August 15, 2024

Project No. 244006-01

Ms. Aylene Chu
Toll Brothers
350 Commerce, Suite 200
Irvine, California 92602

Subject: Preliminary Geotechnical Investigation, Proposed Residential Development, 23161 Mill Creek Drive, Laguna Hills, California

In accordance with your request, LGC Valley, Inc. (LGC) has performed a preliminary geotechnical investigation for the proposed multi-family residential development located at 23161 Mill Creek Drive (Assessor Parcel Number [APN] 588-142-07) in the City of Laguna Hills, California. The purpose of our geotechnical investigation was to evaluate the existing on-site geotechnical conditions relative to the proposed multi-family residential development of the site and to provide geotechnical recommendations applicable to the grading operations and future site construction for the project.

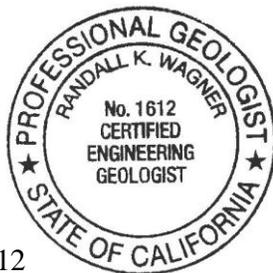
Our geotechnical study included: 1) review of the available geotechnical as-graded documents of the site and adjacent properties, and pertinent geotechnical and geologic reports and maps relative to the general vicinity; 2) a site reconnaissance, geologic mapping, and field exploration consisting of the excavation of six small-diameter borings; 3) laboratory testing of representative on-site soil samples; 4) geotechnical analysis of the collected data; and 5) preparation of this report that includes our findings, conclusions, opinions, and recommendations relative to the grading and development of the site.

Based on the results of our preliminary geotechnical investigation, it is our professional opinion that the proposed site development is feasible from a geotechnical standpoint provided the recommendations included in this report are incorporated into the project plans and specifications and followed during site grading and construction. If you have any questions regarding our report, please contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

LGC VALLEY, INC.


Randall K. Wagner, CEG 1612
Senior Project Geologist




Basil Hattar, GE 2734
Principal Engineer



Distribution: (1) Addressee (via e-mail)

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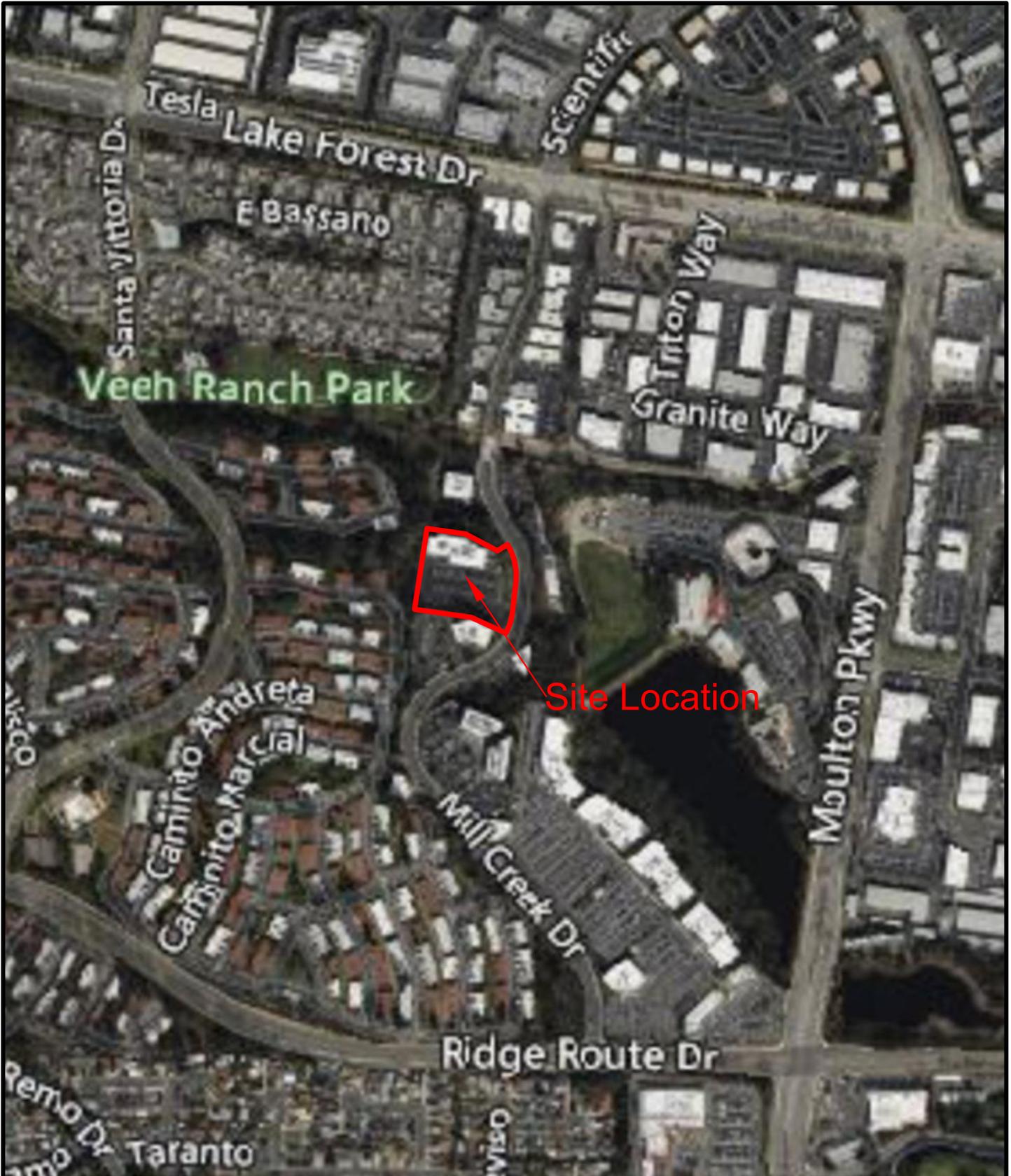
1.0 INTRODUCTION

1.1 Purpose and Scope of Services

The purpose of this preliminary geotechnical investigation was to identify and evaluate the existing geologic and geotechnical conditions at the subject site (Figure 1) and to provide preliminary geotechnical design criteria relative to the proposed multi-family development of the site. Recommendations for site grading, construction, preliminary foundation design for the proposed structures, and other relevant aspects of the proposed development are included herein to address the identified site geotechnical conditions.

Our scope-of-services for preparation of this document included:

- Review of available reports including prior geotechnical investigations, as-graded geotechnical documents, and other geotechnical related documents of the site and adjacent properties; and pertinent published geologic, geotechnical, and seismic reports and maps relative to the general vicinity (Appendix A).
- A site reconnaissance and geologic mapping of the site.
- A subsurface investigation consisting of the excavation, sampling, and logging of six small-diameter hollow-stem borings. The locations of the borings are shown on the Geotechnical Map (Figure 2). The logs of the borings are presented in Appendix B. The test borings were sampled and logged under the supervision of a licensed engineering geologist from our firm. The excavations were performed to evaluate the general characteristics of the subsurface conditions of the site including the classification of site soils and the determination of the depth to competent soil.
- Laboratory testing of representative soil samples obtained during our investigation (Appendix C).
- Review of boring logs from the geotechnical studies previously performed on the site and/or adjacent sites. The applicable boring logs are presented in Appendix D.
- Determination of seismic design parameters based on current building code requirements.
- Geotechnical analyses and evaluation of the data obtained during this study.
- Preparation of this report presenting our findings, conclusions, opinions, and recommendations including the General Earthwork and Grading Specifications for Rough Grading (Appendix E) with respect to the evaluated geotechnical conditions at the site and the proposed development.



Basemap: ESRI World Imagery Basemap, Accessed August 13, 2024



Figure 1
Site Location Map
 23161 Mill Creek Drive
 Laguna Hills, California

Project Name	Toll/23161 Mill Creek
Project No.	244006-01
Eng. / Geol.	BIH/RKW
Scale	Not-to-Scale
Date	August 15, 2024

1.2 Site and Project Description

The approximately 2.44-acre site is located on the west side of Mill Creek Drive southwest of the intersection of Mill Creek Drive and Lake Forest Drive in the northwestern portion of the City of Laguna Hills, California (Figure 1). The site is bounded by Mill Creek Drive on the east, existing business developments on the north (23091 Mill Creek Drive) and south (23201 Mill Creek Drive), and a residential development on the west. The site currently consists of one three-story commercial building in the northern portion of the site and a large, paved parking lot in the central and southern portions of the site. Additional improvements include underground utility lines, retaining walls along the south and west sides of the parking lot, landscaping, and associated improvements. A north- to east-facing slope up to approximately 40 to 45 feet in height is present on the north and east sides of the property that descends to the parking lot of 23091 Mill Creek Drive on the north and Mill Creek Drive on the east. An approximately 10 to 15-foot-tall north-facing slope is present along the south side of the property.

Review of available aerial photographs, historical Google Earth images, old topography maps, and geotechnical reports of adjacent properties (Appendix A) indicate that the site (and general vicinity) was rough graded in the late 1970's/early 1980's and the site was precise graded in 1985/1986. The as-graded geotechnical reports and grading plans specific to 23161 Mill Creek were not available at the City of Laguna Hills; and consequently, were not reviewed by us for the purposes of this study.

Prior to the grading of the site, the property was located along the north side of a northwest-southeast trending ridgeline. Mill Creek Drive along the east side of the property was the location of a small tributary canyon that was partially in-filled during the grading of the area. Based on Google Earth images, elevations of the relatively flat portion of the property range from approximately 297 to 301 feet along the north side of the property to 300 to 316 feet along the south side. Based on the original topography, current site grades, and our limited subsurface investigation, we anticipate that the prior grading of the site consisted of a cut-fill condition with shallow fills located across the site (existing parking lot area) and deeper fills along the northern side of the property (and beneath the existing building) with backfill soils behind the on-site retaining walls.

1.3 Proposed Development

We understand that the proposed development will consist of a multi-family townhome residential development consisting of nine 3- to 6-unit structures (totaling 43 units). Preliminary plans show perimeter retaining walls are being considered around the perimeter of the site consisting of a combination of block walls, pile walls, and segmental (MSE) walls ranging in height from 4 to 17 feet. Anticipated associated improvements will include asphalt concrete (AC) streets and parking areas, a gated entrance, Portland cement concrete (PCC) sidewalks, open-space areas/landscaping, underground utility lines, a storm water biofiltration system, and associated improvements.

1.4 Subsurface Investigation and Laboratory Testing

Our subsurface investigation was performed on May 8, 2024, and consisted of the excavation, sampling, and logging of six small diameter hollow-stem borings (designated Borings LGC-B-1 through LGC-B-6) excavated to depths ranging from approximately 10.5 to 20.5 feet. All of the borings were extended into competent formational material. The logs of the borings are presented in Appendix B while the approximate locations of the borings are shown on the Geotechnical Map (Figure 1). At least three days prior to the start of our subsurface investigation, the proposed boring excavation locations were staked, Underground Service Alert (USA) notified, and the applicable information provided to them. The USA Dig Alert Number for this project is A241230333.

During the subsurface investigation, representative bulk samples and relatively undisturbed samples were collected for laboratory testing, and were forwarded to EGLAB, Inc. (EGL) and to LGC Valley, Inc. for classification testing. Laboratory testing was performed on representative soil samples and included moisture/density, Atterberg Limit, sieve analysis, consolidation, expansion index, direct shear, remolded direct shear, maximum density, sulfate content, chloride content, pH, and minimum resistivity testing. A summary of the test procedures and printouts of the laboratory test results are presented in Appendix C. The moisture and density test results were presented on the boring logs included in Appendix B.

1.5 Existing As-Graded Geotechnical Conditions

Based on our review of available PDF copies of public records obtained from the City of Laguna Hills (see References - Appendix A); a number of different preliminary geotechnical investigations and as-grade reports have been prepared for adjacent properties. However, the preliminary geotechnical investigations and as-grade reports for the subject property (23161 Mill Creek Drive) and the property to the south (23201 Mill Creek Drive) were not available for our review. The findings and conclusions of the available geotechnical reports relative to 23091 Mill Creek Drive (located to the north of the subject site) are discussed below.

2.0 GEOTECHNICAL CONDITIONS

2.1 Site Geology

Based on our subsurface exploration and review of the available previous geotechnical reports for the property and pertinent geologic literature and maps (Appendix A), the bedrock unit at the site is the Tertiary-aged Sespe Formation. The bedrock is overlain by older artificial fills placed during previous development of the site. The approximate extent of the mapped geologic units present on the site is depicted on the Geotechnical Map (Figure 2). A brief description of the geologic units encountered on the site is presented below.

2.1.1 Artificial Older Fill (Afo)

Based on our review of the available geotechnical reports of the site and the general vicinity, it is our understanding that the on-site existing artificial fills (up to approximately 25+ feet in thickness) were placed and documented by Irvine Soils Engineering, Inc. (1980) and G.A. Nicoll and Associates, Inc. (1986); however, these reports were not available for our review.

Existing artificial fills were encountered in our recent geotechnical borings within the existing parking areas across the site and were found to consist of silty to clayey sands that were slightly moist and medium dense. The depths of the encountered fills ranged from approximately 1 to 5 feet in thickness. Based on the available data, the deeper existing fills are located underlying the existing structure and slope located along the northern portion of the site. Due to the existing site improvements and access issues, this deeper fill was not investigated as a part of this study.

Based on our understanding of the placement/documentation of the existing older fills and our observations and testing of the encountered fills on-site, it is our preliminary conclusion that the existing fills are considered suitable for support of the proposed structures, provided remedial removals are performed of any fills disturbed during site demolition. For confirmation purposes, an additional evaluation of the fill soils (after the existing building is demolished and removed) should be performed. This additional evaluation will need to include surface excavation (drilling), sampling, and laboratory testing to determine the competency of the existing fill soils, and suitability for support of the proposed structures. Additional remedial removal or foundation recommendations will be provided at that time, as necessary.

2.1.2 Tertiary-Aged Sespe Formation (Ts)

Based on our review of geologic maps of the site and general vicinity, the site is underlain by massive to thickly bedded non-marine gray to red pebbly sandstones and silty to clayey sandstones with interbedded siltstones and claystones of the Tertiary-aged Sespe Formation (Morton, Hauser, and Ruppert, 1999; and Morton and Miller,

2006). The results of our subsurface investigation indicated that the Sespe Formation soils encountered consisted of fine to coarse sandstone, silty and clayey fine to medium sandstone, and sandy to clayey siltstone with little to no pebbles.

2.2 Geologic Structure

Based on our review of geotechnical documents relative to the property directly north of the site, it appears that a large-diameter boring was excavated in the northern portion of the 23161 Mill Creek Drive property in 1986 by G. A. Nicoll and Associates Inc. (Lawmaster & Co, Inc., 1989). The location of the boring (Boring N-B-2) and the bedding attitudes obtained in the boring are shown on Figure 2. This information was obtained from a geotechnical investigation map of 23091 Mill Creek Drive (Lawmaster, 1989). As indicated, the bedding observed in the Sespe Formation ranges from N68W to N65E dipping 5 to 33 degrees to the south. As a result, bedding is dipping into-the-slope and is considered favorable in regard to slope stability. It should be noted that the geotechnical investigation report by G.A. Nicoll and Associates in 1986 that includes the boring log and the description of the subsurface investigation was not available for our review.

2.3 Landslides

Based on our review of aerial photographs and available geotechnical reports for the site, (Appendix A), no evidence of landsliding or other slope instability conditions were observed on-site or noted in the literature. Consequently, the potential for the existence of landslides is considered insignificant.

2.4 Groundwater

Review of available groundwater related internet web sites (Appendix A) indicates that groundwater is likely greater than 50 feet below the ground surface at the site. Groundwater is relatively shallow (generally less than 20 feet below the ground surface) in the large alluvial valley north and northeast of the site. As a result, groundwater is not expected to have a significant impact to the proposed development (provided the recommendations of this report are implemented during the design, grading, and construction of the proposed site improvements).

2.5 Surface Water and Flooding

Based on our review of the existing site grading plans and topography map of the site, sheet flow across the site is to the southeast. Surface water runoff relative to project design is the purview of the project civil engineer and should be directed away from planned structures. Due to the elevation of the site relative to drainages, flooding at the site is considered insignificant.

2.6 **Faulting**

The southern California region has long been recognized as being seismically active. The seismic activity results from several active faults that cross the region, all of which are related to the San Andreas transform system, a broad zone of right lateral faults that extend from Baja California to Cape Mendocino. The numerous faults in Southern California include Holocene active, pre-Holocene active, and age-undetermined faults. The definitions of fault activity terms used here are based on those developed for the Alquist-Priolo Special Studies Zone/Earthquake Zone Act of 1972 (CGS, 2018).

Holocene active faults are those faults that have had surface displacement within Holocene time (approximately the last 11,700 years) and have been included within an Alquist-Priolo Earthquake Zone. Pre-Holocene faults have not moved in the last 11,700 years but may be considered potentially active. Age-undetermined faults are faults where the recency of fault movement has not been determined and may likely be considered inactive faults.

The site is not within the currently established Alquist-Priolo Earthquake Fault Zone for fault rupture hazard (formerly Special Studies Zones for fault rupture hazard). Based on a review of geologic literature, no active faults are known to occur beneath or in the general vicinity of the project site. Accordingly, it appears that there is little probability of surface rupture due to faulting beneath the site. There are, however, several faults located in sufficiently close proximity that movement associated with them could cause significant ground motion at the site.

Regional active faults that occur within the Laguna Hills and southern California area include the Newport-Inglewood fault zone to the west and the San Joaquin Hills blind thrust fault, Whittier-Elsinore, San Jacinto, and San Andreas faults to the east. The closest known active faults to the site are the San Joaquin blind thrust Hills fault located approximately 1 mile (1.7 kilometers) to the northeast, the Newport-Inglewood fault zone located approximately 7 miles (11.5 kilometers) to the southwest, and the Elsinore fault zone located approximately 16.5 miles (26.5 kilometers) to the northeast.

The main seismic parameters to be considered when discussing the potential for earthquake-induced damage are the distances to the causative faults, earthquake magnitudes, and expected ground accelerations. Secondary effects of seismic shaking resulting from large earthquakes on the major faults in the southern California region include soil liquefaction and dynamic settlement. Other secondary seismic effects include shallow ground rupture, seiches and tsunamis. In general, these secondary effects of seismic shaking are a possibility throughout the Southern California region and are dependent on the distance between the site and the causative fault and the on-site geology.

2.7 **Seismicity and Related Effects**

We have performed site-specific analysis based on these seismic parameters for the site and the on-site geologic conditions. The results of our analysis are discussed in terms of the potential seismic events that could be produced by the maximum probable earthquakes. A

maximum probable earthquake is the maximum earthquake likely to occur given the known tectonic framework.

2.7.1 Seismic Design Criteria

Based on the 2022 California Building Code (CBC) the site seismic characteristics for the project were evaluated per the guidelines set forth in Chapter 16, Section 1613 of the 2022 CBC. Representative site coordinates for the project site of Latitude 33.625942° N and Longitude -117.735614° W were utilized in our analyses. The maximum considered earthquake (MCE) spectral response accelerations (SMS and SM1) and adjusted design spectral response acceleration parameters (SDS and SD1) for Site Class C are provided in the following table.

Table 1	
California Building Code Seismic Design Parameters	
Selected Parameters from 2022 CBC, Section 1613 - Earthquake Loads	Seismic Design Values
Site Class (per Chapter 20 of ASCE 7)	C
Risk-Targeted Spectral Acceleration for Short Periods (S_S)	1.223g
Risk-Targeted Spectral Accelerations for 1-Second Periods (S_1)	0.439g
Site Coefficient F_a [per CBC Table 1613.2.3(1)]	1.2
Site Coefficient F_v [per CBC Table 1613.2.3(2)]	1.5
Site Modified Spectral Acceleration for Short Periods (S_{MS}) [Note: $S_{MS} = F_a S_S$]	1.467g
Site Modified Spectral Acceleration for 1-Second Periods (S_{M1}) [Note: $S_{M1} = F_v S_1$]	0.659g
Design Spectral Acceleration for Short Periods (S_{DS}) [Note: $S_{DS} = (2/3) S_{MS}$]	0.978g
Design Spectral Acceleration for 1-Second Periods (S_{D1}) [Note: $S_{D1} = (2/3) S_{M1}$]	0.439g
Seismic Design Category (per CBC Section 1613.2.5)	D

Section 1803.5.12 of the 2022 CBC (per Section 11.8.3 of ASCE 7) states that the maximum considered earthquake ground motions, Peak Ground Acceleration (PGA) should be used for the geotechnical evaluations. The PGA_M for the site is equal to 0.617g (USGS Seismic Design Maps based on ASCE/SEI 7-16 and ASCE/SEI 7-16 Table 1.5-2).

A deaggregation of the PGA based on a 2,475-year average return period indicates that an earthquake magnitude of 6.89 at approximately 3.33 km (2.07 mi) from the site would contribute the most to this ground motion (USGS, 2014).

2.7.2 Lurching and Shallow Ground Rupture

Soil lurching refers to the rolling motion on the ground surface by the passage of seismic surface waves. Effects of this nature are not likely to be significant where the thickness of soft sediments do not vary appreciably under structures. Although there are several nearby active and potentially active faults, the native soils are dense, and no active faults are known or interpreted to cross the site. Based on this data, it is our opinion that the potential for lurching or shallow rupture at the site is very low to nil.

2.7.3 Liquefaction and Dynamic Settlement

Liquefaction is a seismic phenomenon in which loose, saturated, granular soils behave similarly to a fluid when subject to high-intensity ground shaking. Liquefaction occurs when three general conditions exist: 1) shallow groundwater; 2) low density non-cohesive (granular) soils; and 3) high-intensity ground motion. Liquefaction is typified by a buildup of pore-water pressure in the affected soil layer to a point where a total loss of shear strength occurs, causing the soil to behave as a liquid. Studies indicate that saturated, loose to medium dense, near surface cohesionless soils exhibit the highest liquefaction potential, while dry, dense, cohesionless soils and cohesive soils exhibit low to negligible liquefaction potential. Effects of liquefaction on level ground include settlement, sand boils, and bearing capacity failures below structures.

Based on the anticipated relative density of the on-site soils and the depth to the static groundwater in the area of the proposed development; it is our opinion that the potential for liquefaction impacting the site is nil, and seismically induced settlements are considered to be negligible.

During a strong seismic event, seismically induced settlement can occur within loose to moderately dense, dry, or saturated granular soil. Settlement caused by ground shaking is often non-uniformly distributed, which can result in differential settlement. Based on in-situ densities, and soil types, dry sand settlement and induced surface manifestations are not considered an issue at the site.

2.7.4 Tsunamis and Seiches

Due to the elevation of the proposed development at the site with respect to sea level and its distance from large open bodies of water, the potential of seiches and/or tsunami is considered to be very low.

2.8 Slope Stability

Based on the massive to thickly bedded Sespe Formation on the site, favorable (into-the-slope) geologic bedding conditions, and the construction of the proposed segmental geogrid retaining walls along the north and east sides of the property and the block and pile retaining walls along the west and south sides of the property, slope stability is not considered an issue with respect to site development. However, as part of our geotechnical review of the proposed segmental geogrid retaining walls and pile walls, a global slope stability analysis will be performed once the segmental wall designs are completed. The results will be presented in a future retaining wall plan review letter.

2.9 Expansion Potential

Expansion potential testing of representative on-site soil samples indicates that the on-site soils have a very low to low expansion potential (Appendix C). Although some of the near surface soils (Sespe Formation claystone layers) may have a medium to high expansion potential, we would anticipate the mixture and redistribution of site soils will result in a low expansion potential for the site. The as-graded soil conditions of the proposed building pads should be verified with confirmatory observation, sampling, and testing after site grading is completed and prior to the construction of the structures.

2.10 Soluble Sulfate and Corrosivity of the On-Site Soils

Laboratory testing of representative on-site soils indicated the on-site soils tested had soluble sulfate contents that ranged from 0.005 to 0.007 percent (Appendix C). As a result, the on-site soils should be considered to have a negligible degree of corrosivity to concrete and have an Exposure Class of S0 in accordance with ACI 318R-14 Table 19.3.1.1. The as-graded sulfate content of the finish grade soils on the building pads should be verified upon completion of grading.

Minimum resistivity, pH, and chloride content tests were also performed on two representative soil samples obtained during our subsurface investigation. These corrosion tests resulted in a minimum resistivity of 1,300 to 1,700 ohm-centimeters, a pH of 7.82 to 8.15, and a chloride content of 125 to 140 ppm (Appendix C). Based on these results, the on-site soils should be considered moderately corrosive to buried metals in contact with the on-site soils.

2.11 Excavation Characteristics

The site is underlain by near surface soils consisting of silty fine to coarse sands, clayey to fine sandy silts, silty clay, siltstone/claystone, and sandstone layers. It is anticipated that the on-site materials can be excavated with conventional heavy-duty construction equipment and that difficult excavation and/or blasting is not anticipated. In addition, the anticipated site excavation and the proposed construction will not have an adverse impact on the adjacent properties.

2.12 Earthwork Shrinkage and Bulking

The volume change of excavated on-site materials upon recompaction as fill is expected to vary with materials and location. Typically, the surficial soils and bedrock materials vary significantly in natural and compacted density, and therefore, accurate earthwork shrinkage/bulking estimate cannot be determined. However, the following factors (based on the results of our subsurface investigation and previous investigations of the site, laboratory testing, geotechnical analysis, and professional experience on nearby sites) are provided in Table 2 as guideline estimates. If possible, we suggest an area where site grades can be adjusted be provided as a balance area.

Table 2	
Earthwork Shrinkage and Bulking Estimates	
Geologic Unit	Estimated Shrinkage/Bulking
Artificial Fill and upper 1 to 2 feet of the site	3 to 7 percent shrinkage
Sespe Formation	0 to 5 percent bulking

2.12 Stormwater Infiltration/Percolation

Based on our understanding of site development, on-site storm water will flow into proprietary underground biofiltration BMP structures that will treat the storm water and then discharge it into the on-site storm drain system that is connected to the storm drain system in Mill Creek Drive. We also understand that site infiltration is not currently proposed. However, a future percolation/infiltration study may be required to determine the feasibility of storm water subsurface infiltration for the site.

Our limited subsurface investigation of the site that was performed on May 8, 2024 and consisted of the excavation, sampling, and logging of six small diameter hollow-stem borings excavated to depths ranging from approximately 10.5 to 20.5 feet, indicated the near surface soils consist of fill soils and Tertiary-Aged Sespe Formation. As encountered, the Sespe Formation soils consisted of fine to coarse sandstone, silty and clayey fine to medium sandstone, and sandy to clayey siltstone with little to no pebbles. Based on our professional experience with similar soils, infiltration of these sandy soils are likely feasible; however, the results will likely have a relatively low infiltration rate (slightly above the typical minimum required rate of 0.5 inches per hour). Infiltration into the fill soils and along the north, northeast, and east sides of the site are not recommended due to the presence of descending slopes, large retaining walls, and fill soils that will have a reduced factor-of-safety as the result of subsurface groundwater.

Once the final storm water infiltration design is determined for the site, a percolation/infiltration study (in accordance with the City of Laguna Hills/County of Orange requirements) should be performed to determine the actual percolation/infiltration rate(s) at the proposed storm water infiltration locations and appropriate factor-of-safeties.

3.0 CONCLUSIONS

Based on the results of our geotechnical investigation, evaluation, and review; it is our professional opinion that the proposed site development is feasible from a geotechnical standpoint, provided the recommendations included in this report are incorporated into the project plans and specifications, and followed during site grading and construction. Our geotechnical conclusions are as follows:

- Review of available aerial photographs, historical Google Earth images, old topography maps, and geotechnical reports of adjacent properties (Appendix A) indicate that the site (and general vicinity) was rough graded in the early 1980's and the site was precise graded in 1986. The as-graded geotechnical reports and grading plans specific to 23161 Mill Creek were not available at the City of Laguna Hills; and consequently were not reviewed by us.
- Based on our subsurface exploration and review of the available previous geotechnical reports for the property and pertinent geologic literature and maps, the bedrock unit at the site is the Tertiary-aged Sespe Formation that is overlain by artificial older fills. The fill soils are a mixture of silty to clayey sands, silty fine to coarse sands, clayey to fine sandy silts, and silty clay. The Sespe Formation generally consisted of massive to thickly bedded fine to coarse sandstone, silty and clayey fine to medium sandstone, and sandy to clayey siltstone with little to no pebbles. The fill soil layers encountered in our current geotechnical investigation were found to be competent and suitable for support of proposed structures, provided the recommendations of this report are followed during site grading and construction.
- After the removal of the existing buried underground utilities has been made, the trench locations should be surveyed, and the excavations should be replaced with fill soils compacted to a minimum 90 percent relative compaction (based on ASTM D1557). Where these trenches are located within the limits of the proposed multi-family building foundation footprints, special consideration should be made as the majority of the site is cut and the trenches will create cut/fill transition conditions. Mitigation measures may include overexcavation of the upper 5 feet of the pad and replacement with compacted fill or backfilling the trenches with a 2-sack sand/cement slurry.
- The existing on-site soils appear to be suitable material for use as fill provided, they are relatively free of rocks (larger than 8 inches in maximum dimension), organic material, and debris.
- The on-site formational material is anticipated to be massive to thickly bedded. The bedding observed in the Sespe Formation ranges from N68W to N65E dipping 5 to 33 degrees to the south (Lawmaster & Co, Inc., 1989). As a result, bedding is dipping into-the-slope and is considered favorable in regard to slope stability.
- There are no known landslides or other slope instability issues impacting the site.
- Review of available groundwater related internet web sites (Appendix A) indicates that groundwater is likely greater than 50 feet below the ground surface at the site. Groundwater was not encountered during our recent subsurface investigation. Consequently, groundwater is not expected to have an impact on the proposed development.

- Based on the topography of the site, surface water is anticipated to flow across the sheet-graded pad from the west to southeast.
- Due to the elevation of the site relative to existing drainages, flooding at the site is not considered an issue for the site.
- Active or potentially active faults are not known to exist on the site.
- The site is not located within the Alquist-Priolo Earthquake Fault Zone (CGS, 2018). The closest known Holocene active faults to the site are the San Joaquin blind thrust Hills fault located approximately 1 mile (1.7 kilometers) to the northeast, the Newport-Inglewood fault zone located approximately 7 miles (11.5 kilometers) to the southwest, and the Elsinore fault zone located approximately 16.5 miles (26.5 kilometers) to the northeast.
- The main seismic hazard that may affect the site is ground shaking from one of the active regional faults.
- Based on the relatively dense nature of the proposed compacted fill soils and existing formational material and lack of a permanent shallow groundwater condition, liquefaction and/or dynamic settlement at the site is considered very low to nil.
- Due to the elevation of the proposed development at the site with respect to sea level and its distance from large open bodies of water, the potential of seiches and/or tsunami is considered to be nil.
- Based on the massive to thickly bedded Sespe Formation on the site, generally favorable geologic bedding conditions, and the construction of the proposed segmental geogrid retaining walls along the north and west sides of the property, slope stability is not considered an issue with respect to site development. However, as part of our geotechnical review of the proposed geogrid retaining walls and pile walls, a global slope stability analysis will be performed once the wall designs are completed. The results will be presented in a future retaining wall plan review letter.
- Expansion potential testing of representative samples of the on-site soils indicate those soils have a very low to low expansion potential (Appendix C). Although some of the near surface soils may have a medium to high expansion potential, most of the soils on the site have a low expansion potential. The as-graded soil conditions of the proposed building pads should be verified with confirmatory observation, sampling, and testing after site grading is completed and prior to the construction of the structures.
- Laboratory testing of representative on-site soils indicated the on-site soils should be considered to have a negligible degree of corrosivity to concrete and have an Exposure Class of S0 in accordance with ACI 318R-14 Table 19.3.1.1.
- Minimum resistivity, pH, and chloride content tests were also performed on the two representative soil samples obtained during our subsurface investigation and these results indicate the on-site soils should be considered moderately corrosive to buried metals in contact with the on-site soils.

- It is anticipated that the on-site materials can be excavated with conventional heavy-duty construction equipment and that difficult excavation and/or blasting is not anticipated.
- The anticipated site excavation and the proposed construction will not have an adverse impact on the adjacent properties.
- The multi-family residential structures may be designed to be supported by post-tension or mat foundation systems.
- In order to reduce the potential for differential settlement in areas of cut/fill transitions, we recommend the upper 5 feet of the building pad be overexcavated and replaced with properly compacted fill to mitigate the transition condition beneath the proposed structure. This condition is likely along the north and west sides of the property, where existing buried utility lines that are abandoned and the trenches replaced with compacted fill, and possibly in the eastern portion of the site along the property boundary.
- Based on our professional experience with similar soils, infiltration of the on-site sandy formational soils are likely feasible; however, a percolation/infiltration study (in accordance with the City of Laguna Hills/County of Orange requirements) should be performed to determine the actual percolation/infiltration rate(s) at the proposed storm water infiltration locations and appropriate factor-of-safeties.

4.0 RECOMMENDATIONS

4.1 Site Earthwork

We anticipate that earthwork at the site will consist of site preparation and remedial grading and construction of site perimeter retaining walls followed by construction of the proposed slab-on-grade type foundations and associated improvements. We recommend that earthwork on-site be performed in accordance with the recommendations herein, the City of Laguna Hills grading requirements, and the General Earthwork and Grading Specifications for Rough Grading included in Appendix E. In case of conflict, the recommendations in the following sections shall supersede those included as part of Appendix E.

4.1.1 Site Preparation

Prior to grading of the area to receive structural fill or engineered structures, the ground surface should be cleared of obstructions, debris, potentially compressible material (such as undocumented fill soils, dry, disturbed, or desiccated documented fill and formational material and stripped of vegetation). Vegetation and debris should be removed and properly disposed of offsite. Holes resulting from the removal of buried obstructions or utilities, which extend below finished site grades, should be replaced with suitable compacted fill material. Areas to receive fill and/or other surface improvements should be scarified to a minimum depth of 6 inches, brought to a near-optimum moisture condition, and recompacted to at least 90 percent relative compaction (based on American Standard of Testing and Materials [ASTM] Test Method D1557).

4.1.2 Removal and Recomaction

The upper portion of the site is underlain by potentially compressible/collapsible or unsuitable soils (i.e., desiccated existing fills, and formational material) which may settle under the addition of water, under the surcharge of fill, and/or foundation loads. Compressible materials not removed by the planned grading should be excavated to competent material (as determined by the geotechnical consultant) and replaced with compacted fill soils. From a geotechnical perspective, soil that is removed may be placed as fill provided the material is relatively free from rocks (greater than 8-inches in maximum dimension), organic material and construction debris; is moisture-conditioned or dried (as needed) to obtain above-optimum moisture content; and then recompacted prior to additional fill placement or construction.

All disturbed or desiccated fills underlying or within the influence of the proposed development should be removed to competent soils. The actual depth and extent of the required removals should be determined during grading operations by the geotechnical consultant; however, the estimated remedial removals are as follows: we anticipate removals of up to 3 feet below existing grades; however, localized, deeper removals should be anticipated where deemed necessary by the geotechnical consultant based on observations during grading.

4.1.3 Cut/Fill Transition Condition

In order to reduce the potential for differential settlement of proposed buildings located across cut/fill transitions, we recommend the entire cut portion of the transition building pads be overexcavated to a minimum depth of 5 feet and replaced with properly compacted fill to mitigate the transition condition beneath the proposed structure; or the building foundations deepened so that all foundation footings are founded on formational material. Where existing buried utility lines that will be abandoned are located within the limits of the proposed building foundation footprint, special consideration should be made as the majority of the site is likely cut and the trenches will create cut/fill transition conditions. Mitigation measures may include overexcavation of the upper 5 feet of the pad and replacement with compacted fill or backfilling the trenches with a 2-sack sand/cement slurry.

4.1.4 Shrinkage/Bulking

Based on the encountered site soils; the existing fills and upper 1 to 2 feet of the site is anticipated to shrink while the formational materials are anticipated to bulk. The preliminary estimated shrinkage and bulking factors are presented in Table 2 (in Section 2.12 of this report). The value ranges are preliminary rough estimates which will vary with depth of removal, stripping losses, field conditions at the time of grading, etc. In addition, handling losses is not included in the estimates. If possible, we suggest an area where site grades can be adjusted be provided as a balance area.

4.1.5 Temporary Excavation Stability

In general, all excavations should be performed in accordance with project plans, specifications, and all Occupational Safety and Health Administration (OSHA) requirements. Excavations should be laid back or shored in accordance with OSHA requirements before personnel or equipment are allowed to enter. Soil conditions should be mapped and frequently checked by a representative of LGC to verify conditions are as anticipated. The contractor shall be responsible for providing the “competent person” required by OSHA standards to evaluate soil conditions. Close coordination with the geotechnical engineer should be maintained to facilitate construction while providing safe excavations. Excavation safety is the responsibility of the contractor.

Temporary excavations may be cut vertically up to five feet. Excavations over five feet should be slot-cut, shored, or cut no steeper than 1:1 (horizontal to vertical) slope gradient. If a block wall along the western property line adjacent to the existing off-site building is planned, shoring of the western property line will need to be provided to for support of the wall backcut and to maintain lateral support for the off-site structure. Surface water should be diverted away from any exposed cut, and not be allowed to pond on top of the excavations. Temporary cuts should not be left open for an extended period of time. Planned temporary conditions should be reviewed by the geotechnical consultant of record in order to reduce the potential for sidewall failure. The geotechnical consultant may provide recommendations for controlling the length of sidewall exposed.

4.1.6 Temporary Shoring

The following preliminary geotechnical parameters may be utilized by the shoring consultant for design of the temporary shoring system along the southern property boundary, as necessary. Temporary shoring is generally considered to have a service life of two years or less. The geotechnical conditions outside of the perimeter of the proposed site have not been investigated as part of this report. The recommendations provided herein with regard to shoring of the proposed excavation are based on assumed conditions, extrapolated from the data gathered from our review of the subject site and adjacent sites. The shoring designer should independently evaluate the parameters provided and conduct an additional investigation if they consider necessary.

Prior to construction, the contractor should verify underground clearance of any existing utility lines or structures that must be removed or protected in place during construction, or may conflict with any proposed shoring system. Any tieback anchors and/or soil nails that extend beyond the site property limits will require permission from the adjacent property owner. Special attention will be required to protect existing settlement sensitive improvement in close proximity to the proposed excavation, such as any adjacent structures or streets located along the boundary of the site.

Typical cantilever temporary shoring, where deflection of the shoring will not impact the performance of adjacent structures or streets, may be designed using the active equivalent fluid pressures of 40 pounds per square foot (psf) per foot of depth (or pcf) for a level condition, and a 50 pcf for a 2:1 (horizontal to vertical) sloping condition. Braced (i.e. internal bracing -rakers) or tied-back shoring is recommended in areas where the shoring will be located close to existing structures or streets in order to limit shoring deflections or required due to the proposed depth of excavation. Braced or tied-back shoring with a level backfill may be designed using an active trapezoidal soil pressure of $24H$ in pounds per square foot (psf) per foot of depth (or pcf) for level condition and 30 pcf for a 2:1 (horizontal to vertical) sloping condition, where H is equal to the depth in feet of the excavation being shored (shape of the trapezoid should be $0.2H$, $0.6H$, $0.2H$).

Any building, equipment, or traffic loads located within a 1:1 (horizontal to vertical) projection from the base of the shoring should be added to the applicable lateral earth pressure. A minimum additional uniform lateral pressure of 100 psf for the upper 10 feet should be added to the appropriate lateral earth pressures to account for typical vehicle traffic loading. The proposed shoring should be designed for a maximum shoring deflection of up to 1-inch adjacent to the street (non-surcharged condition) and up to a maximum of 0.5-inches adjacent to existing buildings (surcharged condition). Surcharge loads on basement walls and shoring systems from existing structures located within the 1:1 (h:v) surcharge influence zone of the excavation, shoring, and basement should be determined and considered in the design.

If temporary gravity grouted tie-backs are used anchors may be designed using a preliminary bond stress of 400 pounds per square foot (psf), and if pressure/post-grouted tieback anchors are used, anchors may be designed using a preliminary bond

stress of up to 2,500 pounds per square foot (psf). However, the tieback designer should make an independent evaluation in order to verify the preliminary bond stress is adequate for site conditions. Tieback bond stress should be verified by field testing. Tieback anchors should be designed, constructed, and tested in accordance with the requirements of the Post-Tensioning Institute (PTI).

For design purposes, tieback should obtain their load-carrying capacity from the soil behind a plane taken to be 3 horizontal feet from the bottom of the shoring facing and inclined at an angle of 60 degrees measured from the horizontal extending to the top of the excavation. Passive resistance of soldier piles (drilled or driven) may be assumed to be an equivalent fluid pressure of 350 pcf to a maximum value of 3,500 psf. The passive earth pressure may be increased by 100 percent for isolated piles. Piles with spacing greater than 3 times of pile diameter can be considered as isolated piles. In order to develop full lateral resistance, firm contact between the soldier pile and undisturbed soils must be assured. For vertical shoring capacity, an allowable skin friction of 500 psf may be used for the portion of pier below the proposed development excavation. End bearing should be neglected. Drilling of shafts for soldier piles may require casing or drilling mud to prevent caving.

Due to the nature of the site soils, it is expected that continuous lagging between soldier piles will be required. The time between lagging excavation and lagging placement should be as short as possible. Soldier piles should be designed for the full-anticipated pressures. Due to arching in the soils, the pressure on the lagging will be less. However, it is recommended that the lagging be designed for the full design active fluid pressure but be limited to a maximum of 400 psf. Therefore, the design lagging pressure should consider a parabolic earth pressure distribution with an active equivalent fluid pressure of 40 pounds per square foot (psf) per foot of depth (or pcf) up to a maximum of 400 psf. The maximum span for lagging for this project should be 10 feet.

The components of the shoring system should be designed by a California licensed structural and/or civil engineer specializing in the design of shoring systems. Field pullout testing should be performed during construction to verify the estimated pullout resistance used in the design and/or post grout tubes should be used to ensure adequate design capacities are obtained. Ultimately, it is the specialty contractor's responsibility to obtain the required pullout capacity, which may require design and/or field modifications. LGC should review the shoring plans prior to construction to verify that geotechnical recommendations are properly implemented into the project plans.

It is highly recommended that a program of documentation and monitoring be devised and put into practice before the onset of any groundwork. The contractor should establish survey points on the shoring, adjacent streets, and neighboring buildings within 100 feet of the excavation perimeter prior to any excavation. These survey points should be used to monitor the movement of the shoring and existing improvements during construction excavation.

The monitoring program should include, but not necessarily be limited to detailed documentation of the existing improvements, buildings and utilities around the excavation, with particular attention to any distress that is already present prior to the start of work. A licensed surveyor should be retained to establish monuments on the shoring and the surrounding ground prior to excavation. Such monuments should be monitored for horizontal and vertical movement during construction. Results of the monitoring program should be provided immediately to the project structural (shoring) engineer and LGC for review and evaluation.

4.1.7 Fill Placement and Compaction

From a geotechnical perspective, the on-site soils are suitable for use as compacted fill, provided they are screened of rocks greater than 8-inches in maximum dimension, organic material, and construction debris. Areas prepared to receive structural fill and/or other surface improvements should be scarified to a minimum depth of 6-inches, brought to at least optimum-moisture content, and recompacted to at least 90 percent relative compaction (based on ASTM Test Method D1557). The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts generally not exceeding 8-inches in loose thickness. Placement and compaction of fill should be performed in accordance with local grading ordinances under the observation and testing of the geotechnical consultant.

If possible, imported soils should contain no materials over 3- to 8-inches in maximum dimension and have a very low to low expansion potential.

4.1.8 Trench Backfill and Compaction

The on-site soils may generally be suitable as trench backfill provided, they are screened of rocks and other material over 3- to 6-inches in diameter and organic matter. Trench backfill should be compacted in uniform lifts (generally not exceeding 8-inches in compacted thickness) by mechanical means to at least 90 percent relative compaction (per ASTM Test Method D1557).

If trenches are shallow and the use of conventional equipment may result in damage to the utilities; clean sand, having sand equivalent (SE) of 30 or greater, should be used to bed and shade the utilities. Sand backfill should be densified. The densification may be accomplished by jetting or flooding and then tamping to ensure adequate compaction. A representative from LGC should observe, probe, and test the backfill to verify compliance with the project specifications.

4.2 Foundation Design

4.2.1 General Foundation Selection

Recommendations for preliminary foundation design and construction are presented

herein. Based on the results of representative expansion potential laboratory testing of the representative on-site soils, the proposed structures should be designed for a low or medium expansion potential (i.e., a 20 to 90 Expansion Index). The following post-tension and mat slab foundation recommendations are provided.

The information and recommendations presented in this section are not meant to supersede design by the project structural engineer or civil engineer specializing in the structural design nor impede those recommendations by a corrosion consultant. Should conflict arise, modifications to the foundation design provided herein can be provided.

4.2.2 Bearing Capacity

Shallow foundations may be designed for a maximum allowable bearing capacity of 2,000 lb/ft² (gross), for continuous footings a minimum of 18-inches wide and 12-inches deep; and spread footings 24-inches wide and 18-inches deep, into certified compacted fill or competent formational material. A factor of safety greater than 3 was used in evaluating the above bearing capacity value. This value may be increased by 300 psf for each additional foot in depth and 150 psf for each additional foot of width to a maximum value of 4,000 psf.

Lateral forces on footings may be resisted by passive earth resistance and friction at the bottom of the footing. Foundations may be designed for a coefficient of friction of 0.35, and a passive earth pressure of 250 lb/ft²/ft. The passive earth pressure incorporates a factor-of-safety of greater than 1.5.

All footing excavations should be cut square and level as much as possible, and should be free of sloughed materials including sand, rocks and gravel, and trash debris. Subgrade soils should be pre-moistened for the assumed medium or high expansion potential (to be confirmed at the completion of grading). These allowable bearing pressures are applicable for level (ground slope equal to or flatter than 5:1[horizontal to vertical]) conditions only.

Bearing values indicated above are for total dead loads and frequently applied live loads. The above vertical bearing may be increased by one-third for short durations of loading which will include the effect of wind or seismic forces.

4.2.3 Post-Tension Foundation

Based on our review, the site may be considered suitable for the support of the proposed structure using a post-tensioned slab-on-grade foundation system for the anticipated low to medium expansion potential. The following section summaries our recommendations for the foundation system. Table 3 contains the geotechnical recommendations for the construction of a PT slab-on-grade foundation. The structural engineer should design the foundation system based on these parameters including the foundation settlement as indicated in the following section to the allowable deflection criteria determined by the structural engineer/architect.

As indicated above, the underslab vapor/moisture retarder (i.e., an equivalent

capillary break method) may consist of a minimum 15-mil vapor barrier in conformance with ASTM E 1745 Class A material, placed in general conformance with ASTM E1643, underlain by a minimum 1-inch of sand, as needed. The sand layer requirements above the vapor barrier are the purview of the foundation engineer/structural engineer and should be provided in accordance with ACI Publication 302 “Guide for Concrete Floor and Slab Construction”. These recommendations must be confirmed (and/or altered) by the foundation engineer, based upon the performance expectations of the foundation. Ultimately, the design of the moisture retarder system and recommendations for concrete placement and concrete mix design, which will address bleeding, shrinkage, and curling are the purview of the foundation engineer, in consideration of the project requirements provided by the architect and developer. The underslab vapor/moisture retarder described above is considered a suitable alternative in accordance with the Capillary Break Section 4.505.2.1 of the CAL Green code.

Table 3		
Preliminary Geotechnical Parameters for Post-Tensioned Foundation Design		
Parameter	Value	
Expansion Classification (Assumed to be confirmed at the completion of grading):	Low and Medium Expansion	
Thornthwaite Moisture Index (from Figure 3.3):	-20	
Constant Soil Suction (from Figure 3.4):	PF 3.6	
Center Lift	<u>Low</u>	<u>Medium</u>
Edge moisture variation distance (from Figure 3.6), e_m :	9.0 feet	9.0 feet
Center lift, y_m :	0.35 inches	0.5 inches
Edge Lift	<u>Low</u>	<u>Medium</u>
Edge moisture variation distance (from Figure 3.6), e_m :	5.2 feet	5.0 feet
Edge lift, y_m :	0.65 inches	1.1 inches
Expansion Potential:	<u>Low</u> (21-50)	<u>Medium</u> (51-90)
Soluble Sulfate Content for Design of Concrete Mix in Contact with Site Soils in Accordance with American Concrete Institute Standard 318, Section 4.3:	Negligible Exposure (Exposure Class S0)	
Corrosivity of Earth Materials to Ferrous Metals:	Corrosive	
Modulus of Subgrade Reaction, k (assuming presaturation as indicated below):	100 pci (low) 85 pci (medium to high)	
Additional Recommendations: 1. Presaturate slab subgrade to at least 1.2 times optimum moisture to minimum depth of 12 for low expansion potential and at least 1.2 times optimum moisture to a minimum depth of 18 inches below ground surface for medium expansion potential. 2. Install a 15-mil moisture/vapor barrier in direct contact with the concrete (unless superseded by the Structural/Post-tension Engineer*) with minimum 1 inches of sand below the moisture/vapor barrier. 3. Minimum perimeter foundation embedment below finish grade for moisture cut off should be 12 and 18 inches, respectively for low and medium expansion potentials, respectively. 4. Minimum slab thickness should be 5 inches.		

* The above sand and moisture/vapor barrier recommendations are traditionally included with geotechnical foundation recommendations although they are generally not a major factor influencing the geotechnical performance of the foundation. The sand and moisture/vapor barrier requirements are the purview of the foundation engineer/corrosion engineer (in accordance with ACI Publication 302 "Guide for Concrete Floor and Slab Construction") and the homebuilder to ensure that the concrete cures more evenly than it would otherwise, is protected from corrosive environments, and moisture penetration of through the floor is acceptable to future homeowners. Therefore, the recommendations provided herein may be superseded by the requirements of the previously mentioned parties.

4.2.4 Mat Foundations

A mat foundation can be used for support of proposed residential buildings. An

allowable soil bearing pressure of 1,500 psf may be used for the design of the mat at the surface under the slab area.
for the design of the mat at the surface under the slab area.

The allowable bearing value is for total dead loads and frequently applied live loads and may be increased by one-third for short durations of loading which will include the effect of wind or seismic forces. A coefficient of vertical subgrade reaction, k, of 85 pounds per cubic inch (pci) may be used to evaluate the pressure distribution beneath the mat foundation.

The magnitude of total and differential settlements of the mat foundation will be a function of the structural design and stiffness of the mat. Based on assumed structural loads, we estimate that total static settlement will be on the order of an inch at the center of the mat foundation. Post construction differential settlement can be taken as one-half of the maximum estimated settlement.

Resistance to lateral loads can be provided by friction acting at the base of foundations and by passive earth pressure. Foundations may be designed for a coefficient of friction of 0.35.

Coordination with the structural engineer will be required in order to ensure structural loads are adequately distributed throughout the mat foundation to avoid localized stress concentrations resulting in potential settlement. The foundation plan should be reviewed by LGC to confirm preliminary estimated total and differential static settlements.

4.2.5 Foundation Settlement

Based on our current understanding of the project, the results of our site investigation and the recommended remedial grading with shallow foundations embedded into compacted fills or competent bedrock, we estimate the post-construction static settlement of the site to be less than 1-inch with a differential settlement of approximately of 0.5-inches in 30 feet.

For buildings located above the proposed segmental wall, with a portion of the building underlain by the geogrid reinforced soils, the proposed foundation should be designed for a minimum of a medium expansion potential and for a differential settlement of up to 2-inches in 30 feet. Recommendations to reduce the potential for differential settlements in the vicinity of the segmental walls are provided herein in Section 4.4.

4.2.6 Building Clearance and Foundation Setbacks

All building foundations located close to slopes should have a minimum setback per Figure 1808.7.1 of the 2022 CBC. The setback distances should be measured from competent materials on the outer slope face, excluding any weathered and loose materials.

Per the 2022 CBC Section 1808.7.1 and Figure 1808.7.1, building clearance from the

toe of an ascending slope should be equal one-half of the total slope height to a maximum setback of 15 feet. Retaining walls may be constructed at the base of the slope to achieve the required building clearances.

Per the 2022 CBC Section 1808.7.2 and Figure 1808.7.1, the building foundation constructed on or near a descending slope should be setback or deepened to provide a minimum footing setback equal to the total height of slope (H) divided by 3 (H/3). The footing setback should be a minimum of 5 feet for slopes up to 15 feet in height and vary up to 40 feet for slopes up to 120 feet in height. The footing setbacks should be measured from the edge of the footing to the competent materials on the outer slope face.

4.3 Lateral Earth Pressures for Retaining Walls

The following lateral earth pressures may be used for the design of any future site retaining walls. Due to the expansive nature of some of the on-site clayey formational materials, we recommend site retaining walls be backfilled with either the very low expansive bedrock or sandy soils (with minus 3-inch rock) or approved select soils. Approved select soils should consist of clean, granular soils (less than 15 percent passing the No. 200 sieve) of very low expansion potential (expansion index 20 or less based on UBC. 18-2). The recommended lateral pressures for approved select soils for level or sloping backfill are presented in Table 4.

Table 4			
Lateral Earth Pressures for Retaining Walls			
Conditions	Equivalent Fluid Weight (pcf)		
	Level Backfill	2:1 Backfill Sloping Upwards	Dynamic Load Increment (pcf) *
	Approved Select Material	Approved Select Material	
Active	35	50	Level - $10H^2$ 2H:1V - $17H^2$
At Rest	55	80	$16H^2$
Passive	250	--	--

* For walls with greater than 6-feet in backfill height, the above seismic earth pressure should be added to the static pressures given in the table above. The seismic earth pressure should be considered as a triangular distribution with the resultant acting at 0.4H in relation to the base of the retaining wall footing (where H is the retained height). The incremental seismic load was determined in general accordance with the standard of practice in the industry for determining earth pressures as a result of seismic events.

For design purposes, the recommended equivalent fluid pressure for each case for walls founded above the static ground water and backfilled with approved select soils is provided in Table 4. The equivalent fluid pressure values assume free-draining conditions. If conditions other than those assumed above are anticipated, the equivalent fluid pressure values should be provided on an individual-case basis by the geotechnical engineer. Surcharge loading effects from the adjacent structures should be evaluated by the geotechnical and structural engineers.

Retaining wall structures should be provided with appropriate drainage and appropriately waterproofed. The outlet pipe should be sloped to drain to a suitable outlet. Typical wall drainage design is illustrated in Figure 3. It should be noted that the recommended subdrain does not provide protection against seepage through the face of the wall and/or efflorescence. Efflorescence is generally a white crystalline powder (discoloration) that results when water, which contains soluble salts, migrates over a period of time through the face of a retaining wall and evaporates. If such seepage or efflorescence is undesirable, retaining walls should be waterproofed to reduce this potential.

Lateral earth pressures are provided as equivalent fluid unit weights, in psf/ft of depth or pcf. These values do not contain an appreciable factor of safety. A soil unit weight of 120 pcf may be assumed for calculating the actual weight of soil. For sliding resistance, a friction coefficient of 0.35 may be used at the concrete and soil interface. Wall footings should be designed in accordance with structural considerations. Refer to Section 4.2.2 for passive resistance and allowable soil bearing.

4.4 Segmental Retaining Wall Recommendations

Segmental retaining walls that may be constructed on the site are anticipated to have a level or up to a 2:1 (horizontal to vertical) sloping backfill above the walls. The zone of influence for geogrid-reinforced modular block walls is defined by a 1:1 (horizontal to vertical) projection from the heel of the bottom geogrid to the finished ground surface overlying the wall. Any building or vehicle loads within this zone should be considered in the wall design.

The following geotechnical parameters presented in Table 5 may be utilized by the wall engineer in design of the on-site segmental walls. Design of segmental retaining walls should be per the National Concrete Masonry Association (NCMA) guidelines (or equivalent guidelines).

Table 5			
Design Soil Strength Parameters for Segmental Retaining Walls			
	Cohesion (psf)	Friction Angle Peak/Ultimate (Degrees)	Unit Weight (pcf)
Infill (Reinforced) Soil	50	35/30	120
Retained (Backfill) Soil	100	35/30	120
Foundation Soil	100	35/30	120

The design acceleration of 0.411g (or 2/3 PGAm), should be used for the proposed design. A Pseudo-Static Coefficient of 0.28g should be used for Slope Stability Analysis. Once the wall designer designs the wall considering external, internal, and local wall stability, LGC will then check the global slope stability. Where global slope stability is the controlling factor, additional geogrid will be added to the design and/or the geogrid will be lengthened, as needed. Thus, the final design is expected to satisfy both the “conventional method” of modular wall design as well as global slope stability.

All excavations should be made in accordance with Cal OSHA, as a general guideline. The backfill soils (having an expansion index less than 30 per UBC. 18-I-B) should be compacted to at least 90 percent relative compaction (based on ASTM Test Methods D2922 and D3017). The walls should be constructed and backfilled as soon as possible after back-cut excavation. Prolonged exposure of back-cut slopes may result in some localized slope instability. Excavation safety is the sole responsibility of the contractor.

The subject walls may be backfilled using the on-site native soils. For closed face walls we recommend a minimum 1-foot-wide drainage gallery be constructed immediately behind the face of the wall using Class II Permeable material and augmented with a perforated 4-inch PVC pipe, or per the wall manufactures specifications. This drainage layer and drain is not a requirement for open faced walls. The remainder of the wall may be backfilled using the on-site native soils. The subject segmental retaining walls should be constructed founded onto competent soils (i.e., compacted fills or competent native soils), or per manufactures specifications. For preliminary purposes, the allowable bearing capacities to be used in the wall design is 1,500 pounds per square foot.

From a geotechnical perspective, the on-site soils are generally suitable for use as compacted fill, provided they are screened of rocks greater than 8 inches in maximum dimension, organic materials, and construction debris. Fill soils should be brought to at least optimum-moisture content, and recompact to at least 90 percent relative compaction (based on ASTM Test Method D1557). The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts generally not exceeding 8 inches in compacted thickness. Placement and compaction of fill should be performed in accordance with local grading ordinances under full-time observation

and testing of the geotechnical consultant. The geotechnical consultant shall review and approve all fill materials, including on-site and import materials.

Prior to placement of the geogrid, the surface of the compacted fill shall be prepared such that it has a maximum variation of 6 vertical inches over a distance of 15 feet. Each geogrid layer shall be pulled taut and secured in-place prior to placing backfill material on the geogrid. The geogrid layers shall be continuous and no splice and/or connection system will be accepted. The contractor shall not operate tracked construction equipment directly upon the geogrid reinforcement but shall use rubber tired equipment. All passes with tracked equipment for the purposes of obtaining compaction shall be done in straight lines and shall minimize the turning movements of the equipment to reduce the potential for displacing and/or damaging the geo-grids.

The manufacturer shall provide the owner with quality control testing for each lot of blocks which are shipped to the site. The contractor shall install the block per the manufacturer's recommended procedures.

All excavations should be made in accordance with Cal OSHA, as a general guideline. All excavations should be made at 1:1 inclinations or flatter. Once excavation has been initiated, the segmental retaining wall should be constructed as soon as possible after back-cut excavation. Prolonged exposure of back-cut slopes may result in some localized slope instability. Excavations should be planned so that they are not initiated without sufficient time to backfill them prior to weekends, holidays, or forecasted rain. ***Excavation safety is the sole responsibility of the contractor.***

We recommend the contractors proposed plan of operations be reviewed by this office prior to initiation of work and closely monitored by representatives of this office during excavation and construction.

A backdrain should be installed at the heel of the wall back-cut consisting of a 4-inch PVC pipe surrounded by ¾-inch crushed rock and wrapped in a filter fabric and outletted through the wall face or to another suitable outlet. If water seepage is encountered along the wall back-cut, a continuous chimney drain consisting of a one-foot layer Caltrans Class II permeable material shall be placed at the heel along the back-cut behind the geogrid, as necessary. The chimney drains should be outletted through the backdrain at the heel of the cut. The outlet pipes should be constructed at the low points of the subdrains and have a minimum 2 percent fall to the outlet location. Additional subdrains may be needed if seepage and/or areas of potential seepage are encountered during grading operations.

Positive drainage of surface water away from the base and top of the proposed segmental retaining walls are important. A concrete V-ditch shall be constructed behind the top of each of the proposed walls to prevent surface water from infiltrating the backfill soil. The V-ditch shall be designed and placed by the project civil engineer in accordance with the local codes.

Where proposed residential structures are located above the proposed segmental walls, where the proposed reinforced zones will encroach into the proposed buildings, the following recommendations should be considered in the design and site construction. The fill behind the wall within the reinforced zone should be comprised of on-site sandy granular soils with

a low expansion potential. Sandy/granular soils will interlock with the geogrid layers which is expected to reduce the potential for long-term, creep-type lateral deformation of the segmental wall, beyond the initial elastic deformation. As a result, the long-term differential settlement potential behind/above the segmental wall is expected to be reduced. Further, the backcut for wall construction should be excavated at a gradient no steeper than 2:1 (horizontal to vertical). This will help reduce the differential fill thickness beneath the proposed structures. The fills outside the reinforced zone should also consist of soils with relatively low expansion potentials and should be compacted to a minimum 93 percent relative compaction.

4.5 Soldier Pile Wall Recommendations

The following preliminary geotechnical parameters may be utilized by the soldier pile wall consultant for design of the permanent wall system. The recommendations provided herein with regard to the proposed wall design are based on assumed conditions, extrapolated from the data gathered from our site investigation and geotechnical analysis. The wall designer should independently evaluate the parameters provided and conduct an additional investigation if they consider necessary.

based on assumed conditions, extrapolated from the data gathered from our site investigation and geotechnical analysis. The wall designer should independently evaluate the parameters provided and conduct an additional investigation if they consider necessary.

Prior to construction, the contractor should verify underground clearance of any existing utility lines or structures that must be removed or protected in place during construction or may conflict with any proposed foundation system.

Typical cantilever soldier pile wall design, where deflection of the wall will not impact the performance of adjacent structures or streets, may be designed using the active equivalent fluid pressures of 40 pounds per square foot (psf) per foot of depth (or pcf). Restrained walls (with soil nails or tied-back) is recommended to limit deflections or required due to the proposed wall height. Restrained or tied-back shoring with a level backfill may be designed using an active trapezoidal soil pressure of $38H$ in pounds per square foot (psf), where H is equal to the depth in feet of the wall (shape of the trapezoid should be $0.2H, 0.6H, 0.2H$) or may be designed using an active triangular soil pressure of 60 pounds per square foot (psf). Any building, equipment, or traffic loads located within a 1:1 (horizontal to vertical) projection from the base of the wall should be added to the applicable lateral earth pressure. A minimum additional uniform lateral pressure of 100 psf for the upper 10 feet should be added to the appropriate lateral earth pressures to account for typical vehicle traffic loading. the appropriate lateral earth pressures to account for typical vehicle traffic loading. he appropriate lateral earth pressures to account for typical vehicle traffic loading.

A seismic earth pressure of 17 pcf should be added to the static pressures given in Table 4 above. The seismic earth pressure should be considered as an inverted triangular distribution with the resultant acting at $0.6H$ in relation to the base of the retaining wall footing (where H is the retained height).

Passive resistance of soldier piles may be assumed to be an equivalent fluid pressure of 350 pcf for level and 150 pcf for sloping down conditions to a maximum value of 3,500 psf. The passive earth pressure may be increased by 100 percent for isolated piles. Piles with spacing greater than 3 times of pile diameter can be considered as isolated piles. In order to develop the full lateral resistance, firm contact between the soldier pile and undisturbed soils must be assured. For vertical capacity, an allowable skin friction of 500 psf may be used for the embedded depth. End bearing should be neglected.

4.6 Preliminary Pavement Recommendations

Preliminary pavement sections utilizing asphalt concrete (AC), Portland Cement Concrete Pavement PCCP), and vehicular concrete pavers, are presented in the following sections.

4.6.1 Asphalt Concrete (AC) Pavement

Based on an assumed R-value of 7 (obtained during the preliminary investigation of an adjacent property), we utilized an assumed R-Value of 7 and recommend the following preliminary minimum street sections for Traffic Indices of 5, 6, and 7 (as indicated in Table 6). These recommendations should be confirmed with R-value testing of representative near-surface soils at the completion of grading. Final AC sections should be confirmed by the project civil engineer based upon the projected Traffic Index. In addition, additional sections can be provided based on other traffic indices.

Table 6			
Preliminary AC Pavement Design Sections			
Assumed Traffic Index	5	6	7
R-Value Subgrade	7	7	7
AC Thickness	4.0 inches	4.0 inches	4.0 inches
Aggregate Base Thickness	7.0 inches	12.0 inches	15.0 inches

The aggregate base material should conform to the specifications for Crushed Aggregate Base or Crushed Miscellaneous Base (Standard Specifications for Public Works Construction –SSPWC Section 200-2). The subgrade should achieve a minimum relative compaction of 95 percent. The base material should be compacted to achieve a minimum relative compaction of 95 percent. Aggregate base and subgrade materials should be moisture-conditioned to a relatively uniform moisture content at or slightly over optimum.

4.6.2 Portland Cement Concrete Pavement

Portland Cement Concrete Pavement (PCCP) may be designed using a minimum of 8-inches of Portland Cement Concrete over 8-inches of compacted aggregate base.

The modulus of rupture of the PCCP should be a minimum of 500 pounds per square inch (psi) at 28 days. Contraction joints should be placed at maximum 15-foot spacing. Where the outer edge of a concrete pavement connects to an asphalt pavement, the concrete slab should be thickened by 50 percent at a taper not to exceed a slope of 1 in 10. In addition, additional sections can be provided based on other desired anticipated traffic loadings.

The aggregate base material should conform to the specifications for Crushed Aggregate Base or Crushed Miscellaneous Base (Standard Specifications for Public Works Construction - SSPWC Section 200-2). The subgrade should achieve a minimum relative compaction of 95 percent. The base material should be compacted to achieve a minimum relative compaction of 95 percent. Base and subgrade materials should be moisture-conditioned to a relatively uniform moisture content at or slightly over optimum.

4.6.3 Vehicular Concrete Paver Pavement

Typical vehicular pavers are 3-1/8 inches in thickness and the manufacturers usually recommend that the pavers be underlain by a 1-inch-thick sand layer. Based on ASCE 58-10 for interlocking pavers and considering a Traffic Index (TI) of 6 and an R-Value of 7 for the subgrade soils, we recommend that the vehicular pavers and sand layer be underlain by a minimum of 16-inches of aggregate base.

The aggregate base material should conform to the specifications for Crushed Aggregate Base or Crushed Miscellaneous Base (Standard Specifications for Public Works Construction –SSPWC Section 200-2). The subgrade should achieve a minimum relative compaction of 95 percent per ASTM- D1557. The base material should be compacted to achieve a minimum relative compaction of 95 percent. Base and subgrade materials should be moisture-conditioned to a relatively uniform moisture content at or slightly over optimum.

4.7 Nonstructural Concrete Flatwork

Preliminary nonstructural concrete flatwork designs are presented in the following sections. Portland Cement Concrete (PCC) flatwork (such as sidewalks, walkways, patios, entryways, etc.) have a high potential for cracking due to changes in soil volume related to soil-moisture fluctuations because these slabs are typically much thinner than foundation slabs and are not reinforced with the same dynamics as foundation elements. To reduce the potential for excessive cracking and lifting, concrete may be designed in accordance with the minimum guidelines outlined in Table 7. These guidelines will reduce the potential for irregular cracking and promote cracking along construction joints but will not eliminate all cracking

or lifting. Thickening the concrete and/or adding reinforcement will further reduce cosmetic distress.

Table 7		
Nonstructural Concrete Flatwork		
	Private Sidewalks	Patio/Entryways
Minimum Thickness (in inches)	4	5
Presaturation	Presoak to 12-inches prior to placement	Presoak to 12-inches prior to placement
Reinforcement	--	No. 3 at 24 inches on centers or 6x6 No. 6 by No. 6 Welded Wire Mesh
Crack Control	Saw cut or deep tool joint to a minimum of 1/3 the concrete thickness	Saw cut or deep tool joint to a minimum of 1/3 the concrete thickness
Maximum Joint Spacing	5 feet	6 feet
Aggregate Base	--	2 inches

4.8 Corrosivity to Concrete and Metal

The National Association of Corrosion Engineers (NACE) defines corrosion as “a deterioration of a substance or its properties because of a reaction with its environment.” From a geotechnical viewpoint, the “environment” is the prevailing foundation soils and the “substances” are the reinforced concrete foundations or various buried metallic elements such as rebar, piles, pipes, etc., which are in direct contact with or within close vicinity of the foundation soil.

In general, soil environments that are detrimental to concrete have high concentrations of soluble sulfates and/or pH values of less than 5.5. ACI 318R-14 Table 19.3.1.1, provides specific guidelines for the concrete mix design when the soluble sulfate content of the soils exceeds 0.1 percent by weight or 1,000 ppm. The minimum amount of chloride ions in the soil environment that are corrosive to steel, either in the form of reinforcement protected by concrete cover, or plain steel substructures such as steel pipes or piles, is 500 ppm per California Test 532.

Laboratory testing of representative on-site soils indicated that the on-site soils tested are

classified as having a Sulfate Exposure Class of S0 (per Table 19.3.1.2 of the ACI 318-19). As a preliminary recommendation, concrete in contact with on-site soils should be designed in accordance with ACI 318-19 Table 19.3.2.1 for the S0/negligible or not applicable category. It is also our opinion that on-site soil should be considered moderately corrosive to buried metals. Site grading will redistribute the materials, which may result in soils with different corrosion potentials. Therefore, the as-graded soil conditions should be verified with confirmatory sampling and testing during the grading phase of the project.

Despite the minimum recommendation above, LGC is not a corrosion-engineering firm. Therefore, we recommend that after site grading, consultation with a competent corrosion engineer be initiated to evaluate the actual corrosion potential of the site and to provide recommendations to reduce the corrosion potential with respect to the proposed improvements, as necessary. The recommendations of the corrosion engineer may supersede the above requirements.

4.9 Freestanding Walls

Freestanding wall footings should be founded a minimum of 24-inches below the lowest adjacent grade. To reduce the potential for unsightly cracks, we recommend inclusion of construction joints at 10- to 20-foot intervals.

Due to the potential creep of soils, where free standing walls are constructed close to a top-of-slope, some tilt of the wall should be anticipated. To reduce the amount of tilt, a combination of grade beam and caisson foundations may be used to support the wall. The system should consist of a minimum of 12-inch diameter caissons placed at 8 feet maximum on centers, and each 8 feet long and connected together at top with 12-inch by 12-inch grade beam.

4.10 Control of Surface Water and Drainage Control

Positive drainage of surface water away from structures is very important. No water should be allowed to pond adjacent to buildings. Positive drainage may be accomplished by providing drainage away from the building at a gradient of at least 2-percent for a distance of at least 5 feet, and further maintained by a swale or drainage path at a gradient of at least 1-percent. Where necessary, drainage paths may be shortened by use of area drains and collector pipes.

Planters with open bottoms adjacent to buildings should be avoided. Planters should not be designed adjacent to buildings unless provisions for drainage, such as catch basins, liners, and/or area drains, are made. Overwatering must be avoided.

4.11 Construction Observation and Testing

The recommendations provided in this report are based on limited subsurface observations and geotechnical analysis. The interpolated subsurface conditions should be checked in the field during construction by a representative of LGC.

Geotechnical observation and testing should be performed by the geotechnical consultant during site excavations, subgrade for slab/foundation, backfill of utility trenches, preparation of any subgrade and placement of aggregate base, or when any unusual soil conditions are encountered at the site. Grading plans, foundation plans, and final project drawings should be reviewed by this office prior to construction.

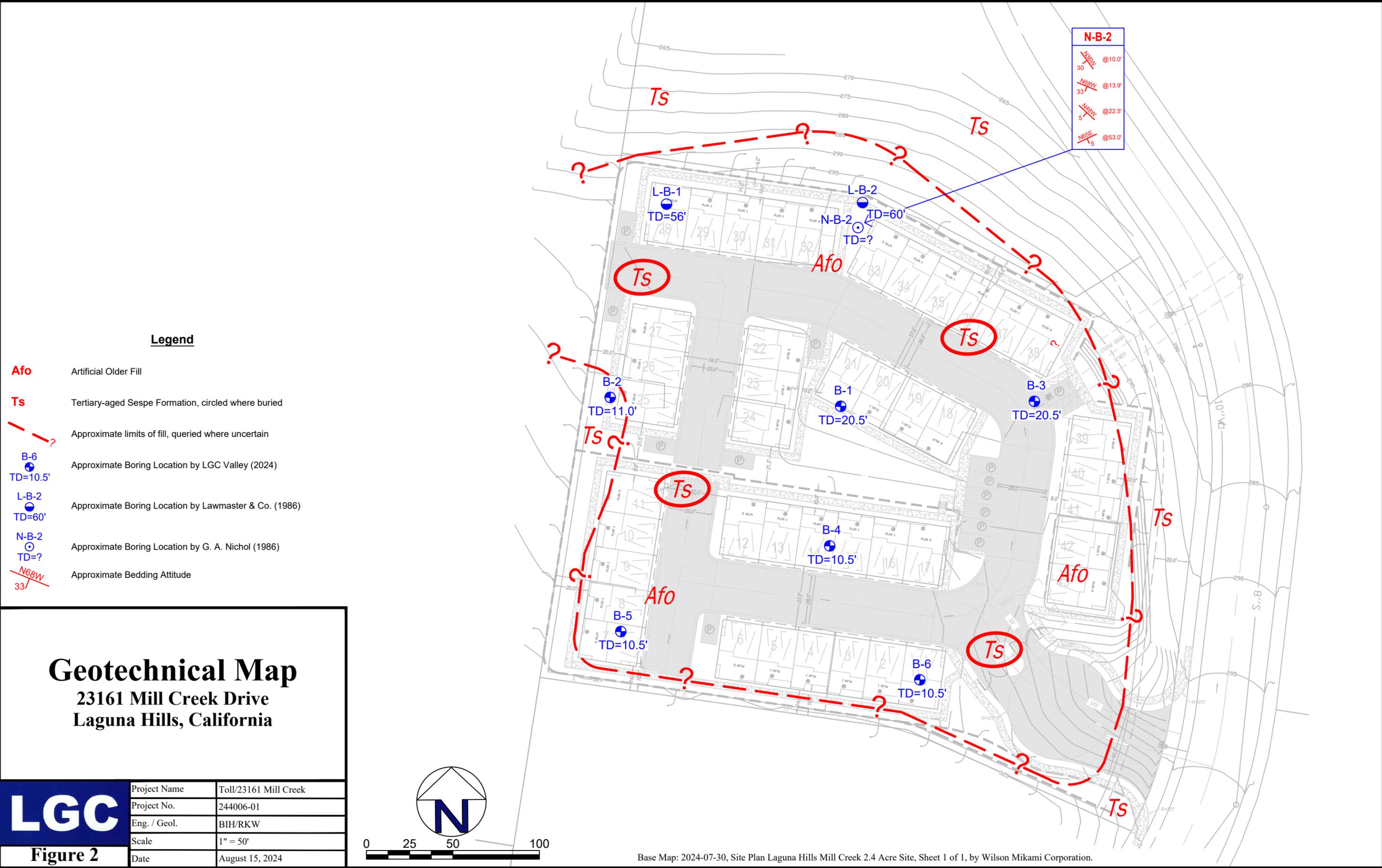
5.0 LIMITATIONS

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report. The samples taken and submitted for laboratory testing, the observations made, and the in-situ field testing performed are believed representative of the entire project; however, soil and geologic conditions revealed by excavation may be different than our preliminary findings. If this occurs, the changed conditions must be evaluated by the project soils engineer and geologist and design(s) adjusted as required or alternate design(s) recommended.

This report is issued with the understanding that it is the responsibility of the owner, or of his/her representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and/or project engineer and incorporated into the plans, and the necessary steps are taken to see that the contractor and/or subcontractor properly implements the recommendations in the field. The contractor and/or subcontractor should notify the owner if they consider any of the recommendations presented herein to be unsafe.

The findings of this report are valid as of the present date. However, changes in the conditions of a property can and do occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties.

In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control.



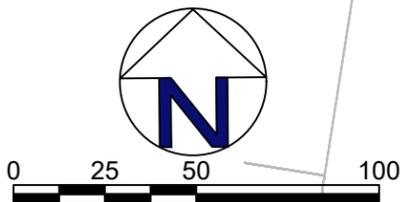
Legend

- Afo** Artificial Older Fill
- Ts** Tertiary-aged Sespe Formation, circled where buried
- Approximate limits of fill, queried where uncertain
- B-6
Approximate Boring Location by LGC Valley (2024)
- L-B-2
Approximate Boring Location by Lawmaster & Co. (1986)
- N-B-2
Approximate Boring Location by G. A. Nichol (1986)
- Approximate Bedding Attitude

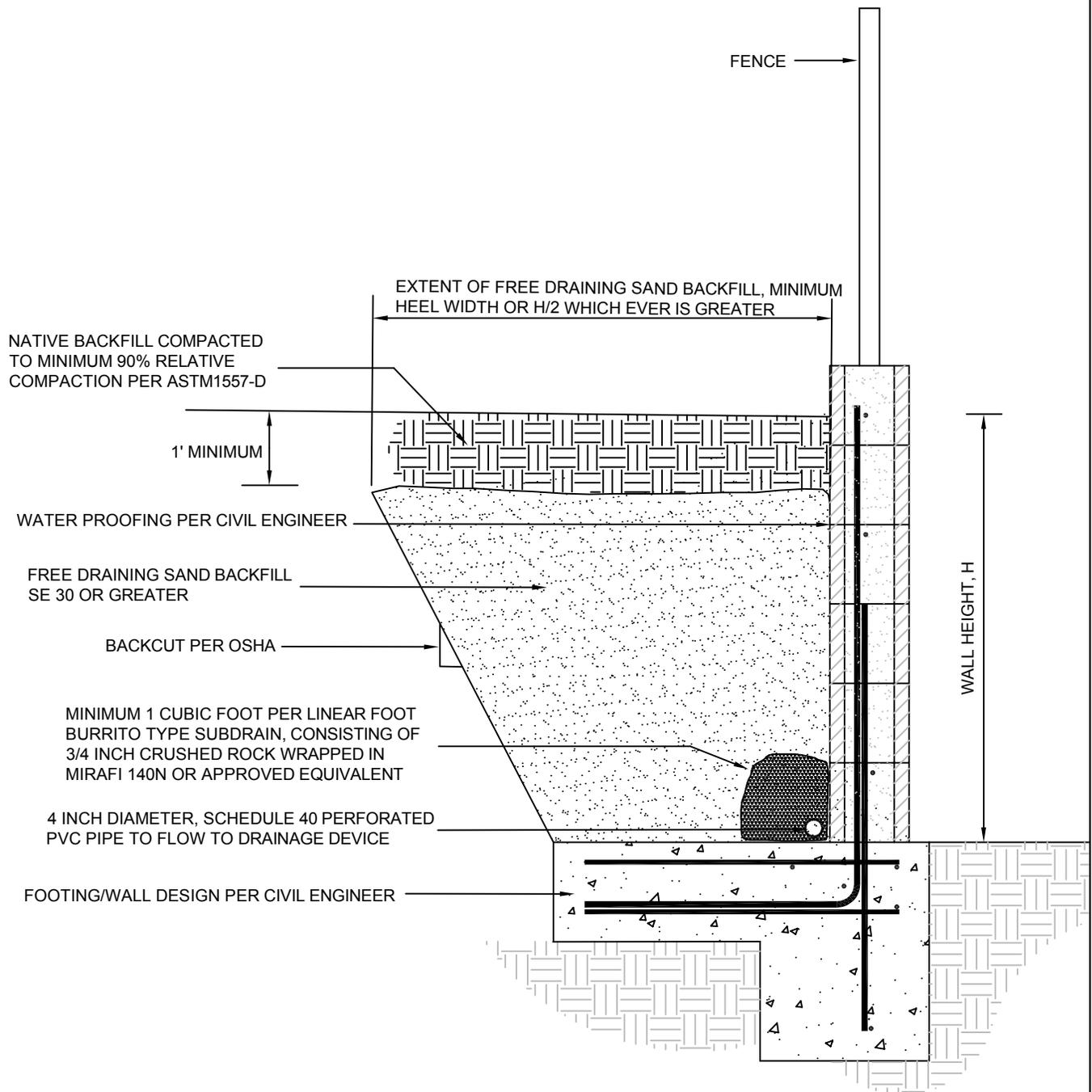
Geotechnical Map
 23161 Mill Creek Drive
 Laguna Hills, California

LGC	Project Name	Toll/23161 Mill Creek
	Project No.	244006-01
	Eng. / Geol.	BIH/RKW
	Scale	1" = 50'
	Date	August 15, 2024

Figure 2



Base Map: 2024-07-30, Site Plan Laguna Hills Mill Creek 2.4 Acre Site, Sheet 1 of 1, by Wilson Mikami Corporation.



**Figure 3:
Retaining Wall
Detail, Sand
Backfill**

Project Name	Toll/Laguna Hills
Project No.	244006-01
Eng. / Geol.	BIH/RKW
Scale	Not-To-Scale
Date	August 15, 2024

APPENDIX A

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APPENDIX B

Geotechnical Boring Logs (Current Study)

Geotechnical Boring Log B-1

Date: May 8, 2024	Page: 1 of 1
Project Name: Toll/23161 Mill Creek	Project Number: 244006-01
Drilling Company: Martini Drilling	Type of Rig: Hollow Stem Auger
Drive Weight: 140 pounds	Drop: 30 inches Hole Dia: 8 inches
Elevation of Top of Hole: +298 Feet	Hole Location: See Geotechnical Map

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
								Logged By: MET Sampled By: MET	
298	0						SM	@ 0' 4.5-inches of asphalt concrete over 8-inches of aggregate base	
293	5		B1 @1'-5'				CL/SM	Artificial Fill, Older (Afo): @ 1' Silty to clayey fine to medium SAND, very minor gravel; red brown to dark brown, damp, medium dense	COR, AL, EI
			1	50/6"	110.9	6.9	CL/SM	Sespe Formation (Ts): @ 5' Silty fine to medium sandy CLAYSTONE to silty fine to coarse SANDSTONE, very minor gravel; dark brown to red brown, damp, hard to very dense	
			2	50/6"	110.5	8.2	SM	@ 6' Silty fine to medium SANDSTONE, very minor gravel; red brown, damp, very dense	
288	10		B2 @10'-15'					@ 10' Silty fine to medium SANDSTONE, minor gravel; pale red brown, slightly damp, very dense; sample disturbed - rock in sampler	
283	15		3	50/2"	114.2	2.0		@ 15' Silty fine to medium SANDSTONE, minor gravel; red brown, damp, very dense	DS
278	20		4	50/6"					
			5	50/4"					
								Total Depth = 20.5 Feet No Ground Water Encountered Backfilled 5/8/2024 with Native Soil and Concrete Plug	

LGC		<p style="text-align: center;">LGC VALLEY, INC.</p> <p style="text-align: center;">THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITION ENCOUNTERED.</p>
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Geotechnical Boring Log B-2

Date: May 8, 2024	Page: 1 of 1
Project Name: Toll/23161 Mill Creek	Project Number: 244006-01
Drilling Company: Martini Drilling	Type of Rig: Hollow Stem Auger
Drive Weight: 140 pounds	Drop: 30 inches Hole Dia: 8 inches
Elevation of Top of Hole: +306 Feet	Hole Location: See Geotechnical Map

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
								Logged By: MET Sampled By: MET	
306	0						SM	@ 0' 5.5-inches of asphalt concrete over 6-inches of aggregate base	
			1 B1 @1'-6"	50/6"	111.3	14.0		Sespe Formation (Ts): @ 1' Silty fine to medium SANDSTONE, very minor gravel; red brown, damp, very dense	
301	5		2	86/8.5"	111.7	12.4		@ 5' Becomes a very silty fine to medium SANDSTONE	
296	10		3	88/9"	116.0	12.2	SM/ML	@ 10' Silty fine SANDSTONE to fine sandy SILTSTONE; red brown to dark red brown, damp, very dense to hard	
								Total Depth = 11 Feet No Ground Water Encountered Backfilled 5/8/2024 with Native Soil and Concrete Plug	

LGC

= Ring Sample
 = SPT

LGC VALLEY, INC.
 THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIOND ENCOUNTERED.

Geotechnical Boring Log B-3

Date: May 8, 2024	Page: 1 of 1
Project Name: Toll/23161 Mill Creek	Project Number: 244006-01
Drilling Company: Martini Drilling	Type of Rig: Hollow Stem Auger
Drive Weight: 140 pounds	Drop: 30 inches Hole Dia: 8 inches
Elevation of Top of Hole: +297 Feet	Hole Location: See Geotechnical Map

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
								Logged By: MET Sampled By: MET	
297	0						SM	@ 0' 5.5-inches of asphalt concrete over 8-inches of aggregate base	
			1 B1 @1'-6'	69	119.3	5.7	SM	Artificial Fill, Older (Afo): @ 1.1' Silty fine to coarse SAND, minor gravel and minor clay; red brown, damp, medium dense	
292	5		2	82	119.6	4.2		Sespe Formation (Ts): @ 2.5' Silty fine to coarse SANDSTONE, very minor gravel and minor clay; red brown, damp, dense @ 5' Silty fine to coarse SANDSTONE, very minor gravel; red brown, damp, dense @ 10' Increase in coarse sand	
			3	50/6"	119.1	7.5			
287	10		4	50/6"	110.4	5.7			
282	15		5	50/5"					
277	20		6	50/5"				@ 20' Decrease in coarse sand	
								Total Depth = 20.5 Feet No Ground Water Encountered Backfilled 5/8/2024 with Native Soil & Concrete Plug	

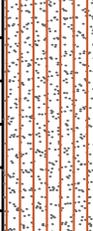
LGC

= Ring Sample
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LGC VALLEY, INC.
 THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITION ENCOUNTERED.

Geotechnical Boring Log B-4

Date: May 8, 2024	Page: 1 of 1
Project Name: Toll/23161 Mill Creek	Project Number: 244006-01
Drilling Company: Martini Drilling	Type of Rig: Hollow Stem Auger
Drive Weight: 140 pounds	Drop: 30 inches Hole Dia: 8 inches
Elevation of Top of Hole: +308 Feet	Hole Location: See Geotechnical Map

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
								Logged By: MET Sampled By: MET	
308	0		B1 @1'-3'				SC/SM	@ 0' 3-inches of asphalt concrete over 5-inches of aggregate base	EI, RDS, COR
			1	50/6"	113.4	12.1		Artificial Fill, Older (Afo): @ 0.8' Silty fine to medium SAND, very minor gravel; dark red brown, damp, medium dense	CN
303	5		2	86/9"	113.9	8.8	SM	@ 1.5' Clayey fine to coarse SAND, very minor gravel; dark brown to red brown, damp, medium dense	
298	10		3	50/6"	110.3	9.4		Sespe Formation (Ts): @ 3' Silty fine to coarse SANDSTONE; pale red brown, damp, very dense @ 10' Becomes a very silty fine to coarse SANDSTONE	
Total Depth = 10.5 Feet No Ground Water Encountered Backfilled 5/8/2024 with Native Soil and Concrete Plug									

LGC	 = Ring Sample  = SPT	<p style="text-align: center;">LGC VALLEY, INC.</p> <p style="text-align: center;">THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITION ENCOUNTERED.</p>
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Geotechnical Boring Log B-5

Date: May 8, 2024	Page: 1 of 1
Project Name: Toll/23161 Mill Creek	Project Number: 244006-01
Drilling Company: Martini Drilling	Type of Rig: Hollow Stem Auger
Drive Weight: 140 pounds	Drop: 30 inches Hole Dia: 8 inches
Elevation of Top of Hole: +317 Feet	Hole Location: See Geotechnical Map

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
								Logged By: MET Sampled By: MET	
317	0						SM	@ 0' 8-inches of Asphalt over 5-inches of aggregate base	
			1	52	115.8	13.4	SM	Artificial Fill, Older (Afo): @ 1.1' Silty fine to medium SAND, very minor gravel, slightly clayey; red brown, damp, medium dense	CN
312	5		2	85/9"	115.6	9.6	SM	Sespe Formation (Ts): @3.5' Silty fine to medium SANDSTONE, very minor gravel; red brown, damp, very dense @7.5' Becomes a silty fine to medium SANDSTONE	
			3	50/6"	111.3	8.4	SM		
307	10		4	50/6"	105.2	6.5	SW	@10' Fine to coarse SANDSTONE; red brown to gray brown, damp, very dense	
Total Depth = 10.5 Feet No Ground Water Encountered Backfilled 5/8/2024 with Native Soil and Concrete Plug									

LGC

■ = Ring Sample
⊗ = SPT

LGC VALLEY, INC.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITION ENCOUNTERED.

Geotechnical Boring Log B-6

Date: May 8, 2024	Page: 1 of 1
Project Name: Toll/23161 Mill Creek	Project Number: 244006-01
Drilling Company: Martini Drilling	Type of Rig: Hollow Stem Auger
Drive Weight: 140 pounds	Drop: 30 inches Hole Dia: 8 inches
Elevation of Top of Hole: +312 Feet	Hole Location: See Geotechnical Map

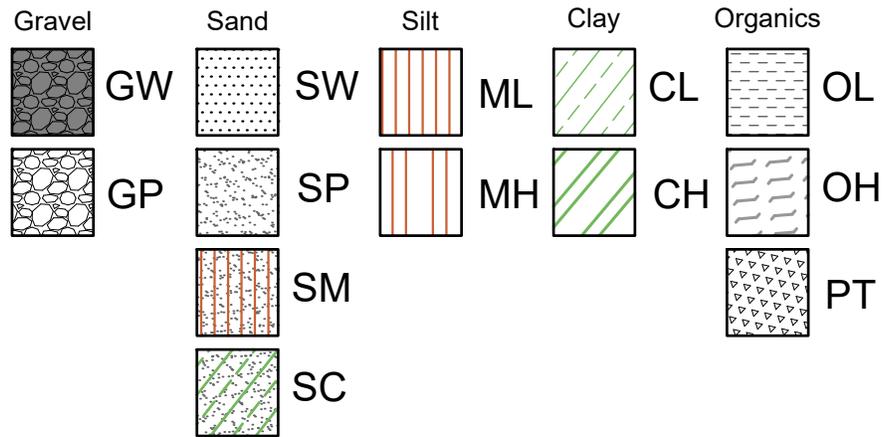
Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
								Logged By: MET Sampled By: MET	
312	0						SW	@ 0' 8-inches of asphalt concrete over 5-inches of aggregate base	
			1 B1 @2.5'-5'	86/11"	118.1	6.0	SW	Artificial Fill, Older (Afo): @ 1.1' Silty fine to coarse gravelly SAND, minor fine cobbles; dark red brown, damp, medium dense	SA, SE
307	5		2	80/8.5"	111.9	9.9	SM	Sespe Formation (Ts): @ 2.5' Silty fine to coarse gravelly SANDSTONE, minor fine cobbles; red brown, damp, very dense	
								@ 5' Silty fine to coarse SANDSTONE, very minor gravel; red brown, damp, very dense	
302	10		3	50/6"	105.1	9.8			
								Total Depth = 10.5 Feet No Ground Water Encountered Backfilled 5/8/2024 with Native Soil and Concrete Plug	

LGC

= Ring Sample
 = SPT

LGC VALLEY, INC.
 THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITION ENCOUNTERED.

Key to Boring Logs



Symbol	Laboratory Test
SA	Sieve Analysis
H	Hydrometer Analysis
SHA	Sieve & Hydrometer Analysis
-200	Percent Passing #200 Sieve
AL	Atterburge Limits
MAX	Maximum Density
DS	Undisturbed Direct Shear
RDS	Remolded Direct Shear
SE	Sand Equivalent
EI	Expansion Index
P	Permeability
CN	Consolidation
COL	Collapse
UC	Unconfined Compression
S	Sulfate Content
pHR	pH & Resistivity
COR	Corrosion Suite (pH, Resistivity, Chloride, Sulfate)
RV	R-Value

APPENDIX C

Laboratory Testing Procedures and Test Results (Current Study)

The laboratory testing program was directed towards providing quantitative data relating to the relevant engineering properties of the soils. Samples considered representative of site conditions were tested in general accordance with American Society for Testing and Materials (ASTM) procedure and/or California Test Methods (CTM), where applicable. The following summary is a brief outline of the test type, and the results are presented on the following pages. LGC has reviewed the laboratory test data, procedures, and results with respect to the subject site, concurs with, and accepts responsibility as geotechnical engineer of record for their work (laboratory testing).

Soil Classification: Soils were classified according to the Unified Soil Classification System (USCS) in accordance with ASTM Test Methods D2487 and D2488. This system relies on the Atterberg limits and grain size distribution of a soil. The soil classifications (or group symbol) are shown on the laboratory test data and boring logs.

Atterberg Limits: The liquid and plastic limits (“Atterberg limits”) were determined in accordance with ASTM Test Method D4318 for engineering classification of fine-grained material and presented on the following table:

Sample Location	Sample Description	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-1 #B1 @ 1-5’	Silty to clayey fine to medium SAND	27	15	12

Chloride Content: Chloride content was tested in accordance with CTM 422. The results are presented below:

Sample Location	Sample Description	Chloride Content (ppm)	Potential Degree of Chloride Attack*
B-1 #B1 @ 1-5’	Silty to clayey fine to medium SAND	125	Negligible
B-4 #B1 @ 1-3’	Clayey fine to medium SAND	140	Negligible

* Extrapolation from California Test Method 532, Method for Estimating the Time to Corrosion of Reinforced Concrete Substructures and previous experience.

Laboratory Testing Procedures and Test Results (Current Study) (continued)

Consolidation: Consolidation tests were performed on selected, relatively undisturbed ring samples (per Modified ASTM Test Method D2435). Samples (2.42 inches in diameter and 1 inch in height) were placed in a consolidometer and increasing loads were applied. The samples were allowed to consolidate under “double drainage” and total deformation for each loading step was recorded. The percent consolidation for each load step was recorded as the ratio of the amount of vertical compression to the original sample height. The consolidation pressure curves are presented on the attached figures at the end of this appendix.

Direct Shear (Remolded or Undisturbed): Direct shear tests were performed on selected remolded and/or undisturbed samples, which were soaked for a minimum of 24 hours under a surcharge equal to the applied normal force during testing. After transfer of the sample to the shear box, and reloading the sample, pore pressures set up in the sample due to the transfer were allowed to dissipate for a period of approximately 1 hour prior to application of shearing force. The samples were tested under various normal loads, a motor-driven, strain-controlled, direct-shear testing apparatus at a strain rate of less than 0.001 to 0.5 inch per minute (depending upon the soil type). The test results are presented on the following table and/or on the attached figures at the end of this appendix.

Sample Location	Sample Description	Peak/Ultimate Friction Angle (degrees)	Peak/Ultimate Apparent Cohesion (psf)
B-1 #4 @15'	Undisturbed	29/29	278/96
B-4 #B1 @ 1-3'	Clayey fine to medium SAND (Remolded)	30/30	227/198

Expansion Index Tests: The expansion potential of selected materials was evaluated by the Expansion Index Test, UBC Standard No. 18-I-B and/or ASTM D4829. Specimens are molded under a given compactive energy to approximately the optimum moisture content and approximately 50 percent saturation or approximately 90 percent relative compaction. The prepared 1-inch thick by 4-inch diameter specimens are loaded to an equivalent 144 psf surcharge and are inundated with tap water until volumetric equilibrium is reached. The results of these tests are presented in the table below:

Sample Location	Sample Description	Expansion Index	Expansion Potential
B-1 #B1 @ 1-5'	Silty to clayey fine to medium SAND	14	Very Low
B-4 #B1 @ 1-3'	Clayey fine to medium SAND	38	Low

Laboratory Testing Procedures and Test Results (Current Study) (continued)

Maximum Dry Density Tests: The maximum dry density and optimum moisture content of typical materials were determined in accordance with ASTM Test Method D1557. The results of these tests are presented in the table below:

Sample Location	Sample Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
B-4 #B1 @ 1-3'	Clayey fine to medium SAND	133.5	8.0

Moisture and Density Determination Tests: Moisture content (ASTM D2216) and dry density determinations (ASTM D2937) were performed on relatively undisturbed samples obtained from the test borings. The results of these tests are presented on the boring logs. Where applicable, only moisture content was determined from undisturbed or disturbed samples.

Grain Size Distribution/Sieve Analysis: Representative samples were dried, weighed, and soaked in water until individual soil particles were separated (per ASTM D421) and then washed on a No. 200 sieve. The portion retained on the No. 200 sieve was dried and then sieved on a U.S. Standard brass sieve set in accordance with ASTM D422 (CTM 202). The sieve analysis curve is presented on the attached figure at the end of this appendix. The percent passing the #200 sieve is presented on the following table:

Sample Location	Sample Description	Percent Passing #200 Sieve
B-6 #B1 @2.5-5'	Silty fine to coarse gravelly SAND	26.5

Laboratory Testing Procedures and Test Results (Current Study) (continued)

Minimum Resistivity and pH Tests: Minimum resistivity and pH tests were performed in general accordance with CTM 643 and standard geochemical methods. The electrical resistivity of a soil is a measure of its resistance to the flow of electrical current. As a result of soil's resistivity decreases corrosivity increases. The results are presented in the table below:

Sample Location	Sample Description	pH	Minimum Resistivity (ohms-cm)	Potential Degree of Corrosivity*
B-1 #B1 @ 1-5'	Silty to clayey fine to medium SAND	7.82	1,700	Moderately Corrosive
B-4 #B1 @ 1-3'	Clayey fine to medium SAND	8.15	1,300	Moderately Corrosive

* NACE Corrosion Basics, 1984.

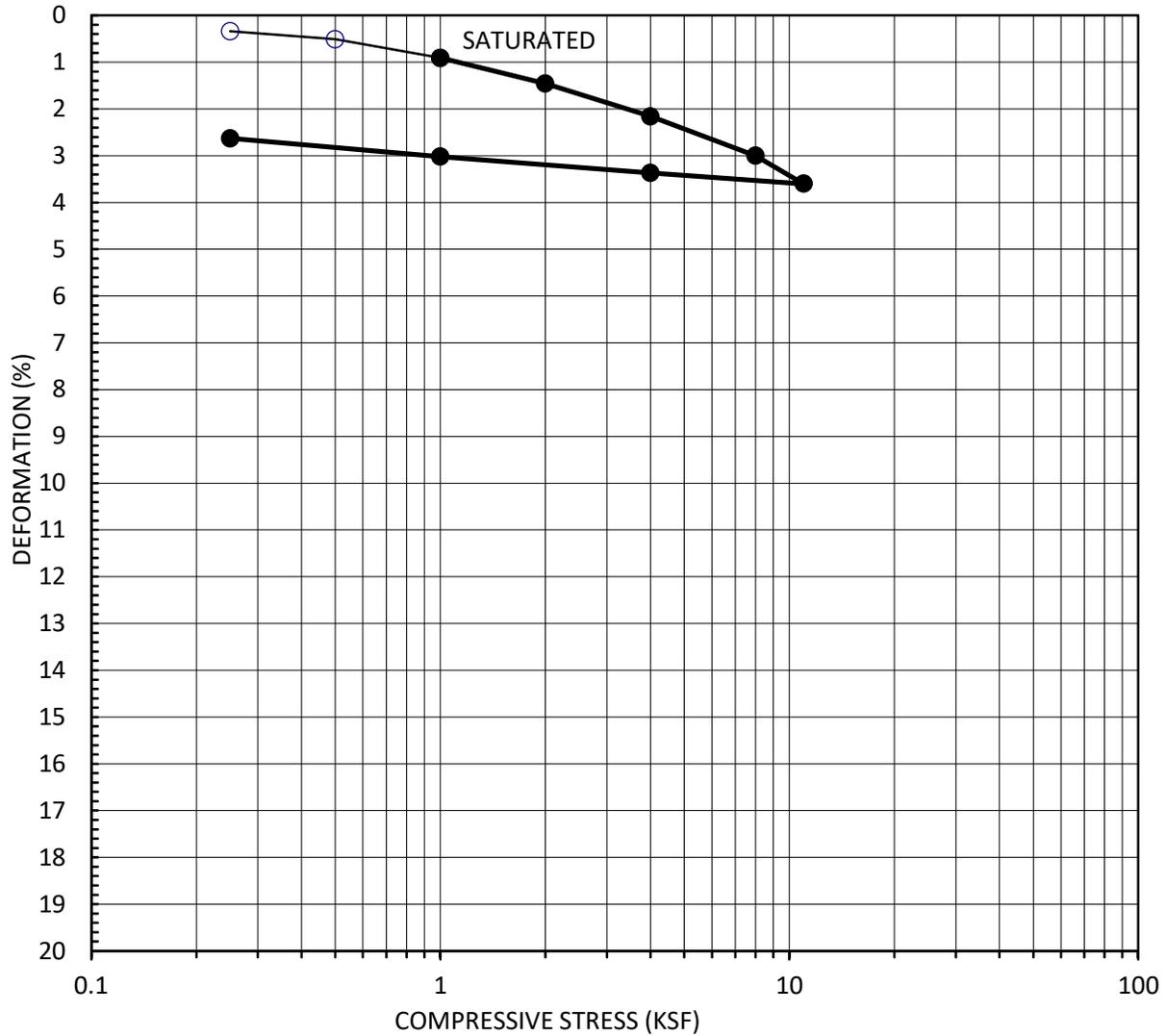
Sand Equivalent: The sand equivalent (SE) of selected samples was determined in accordance with ASTM D2419. The sand equivalent results are used to determine the applicability of material for use as backfill and to assess whether flooding or jetting is a suitable compaction method. The results are presented in the table below:

Sample Location	Sample Description	Sand Equivalent Value
B-6 #B1 @2.5-5'	Silty fine to coarse gravelly SAND	14

Soluble Sulfates: The soluble sulfate contents of selected samples were determined by standard geochemical methods (CTM417). The soluble sulfate content is used to determine the appropriate cement type and maximum water-cement ratios. The test results are presented in the table below:

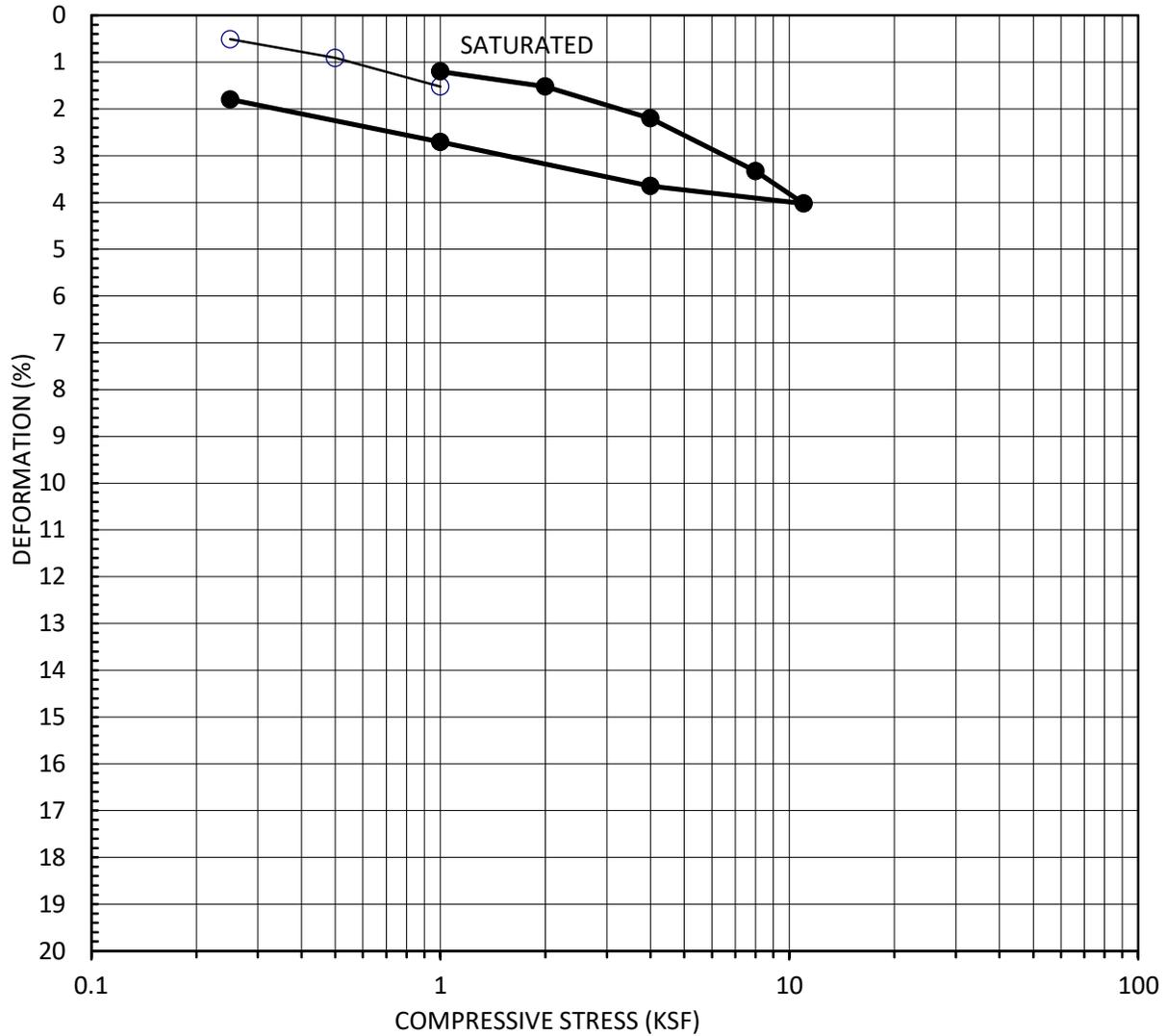
Sample Location	Sample Description	Sulfate Content (% by weight)	Exposure Class (Exposure Severity)*
B-1 #B1 @ 1-5'	Silty to clayey fine to medium SAND	0.007	S0 (Not Applicable)
B-4 #B1 @ 1-3'	Clayey fine to medium SAND	0.005	S0 (Not Applicable)

* Per ACI 318-19 Table 19.3.2.1 (ACI, 2019).



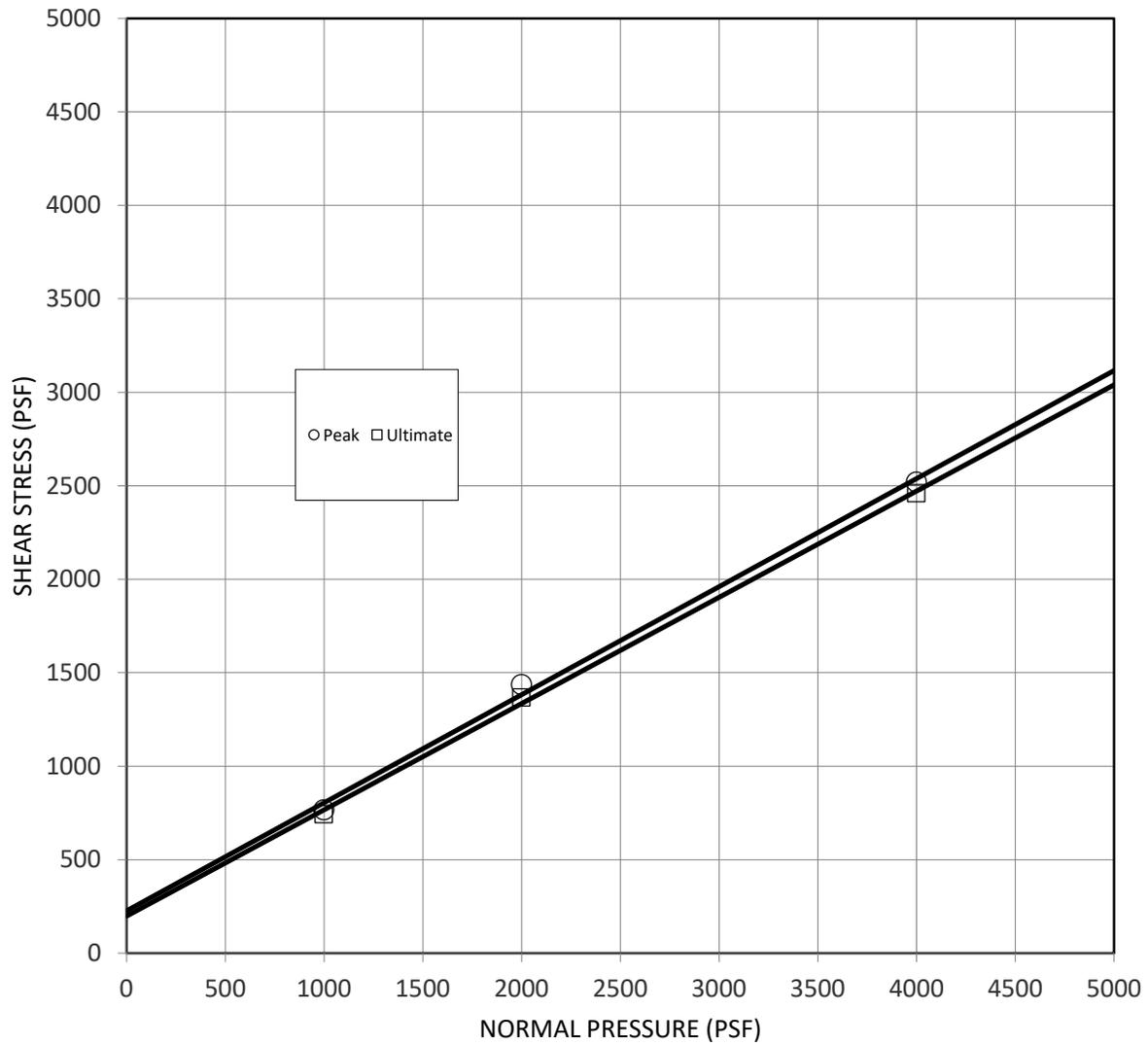
Symbol	Boring No.	Sample No.	Depth (Ft.)	Soil Type	Init. Moisture Content (%)	Init. Dry Density (PCF)	Init. Void Ratio
○	B-4	1	2.5	SM	12.1	115.1	0.463

EGLAB, INC.	Project Name: Toll / Mill Creek 2
	Client: LGC Valley, Inc. Job No.: 244006-01 EGLAB Project No.: 24-059-009
CONSOLIDATION	
08/24	(ASTM D2435)
Figure	



Symbol	Boring No.	Sample No.	Depth (Ft.)	Soil Type	Init. Moisture Content (%)	Init. Dry Density (PCF)	Init. Void Ratio
○	B-5	1	2.5	CL/SC	13.4	118.4	0.423

EGLAB, INC.	Project Name: Toll / Mill Creek 2
	Client: LGC Valley, Inc. Job No.: 244006-01 EGLAB Project No.: 24-059-009
CONSOLIDATION	
08/24	(ASTM D2435)
Figure	

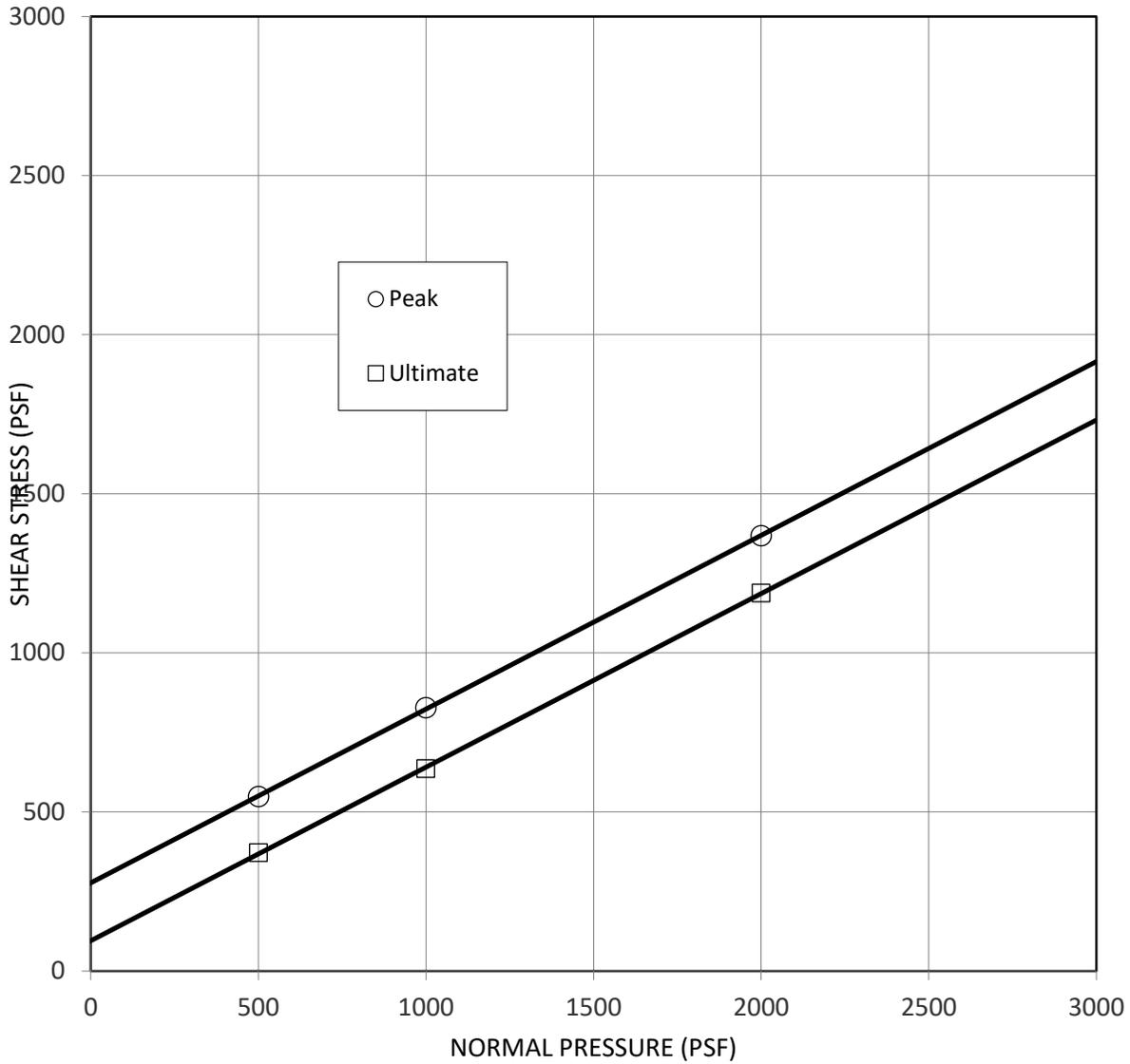


Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Type	Symbol	Cohesion (PSF)	Friction Angle
B-1	4	15.0	Ring	SM	○	227	30
					□	198	30

Normal Stress (psf)	Initial Moisture (%)	Final Moisture (%)	γ_d (pcf)	S (%)
1000	7.9	21.8	102.8	92
2000	7.9	21.3	103.5	92
4000	7.9	20.3	104.8	90

EGLAB, INC.	Project Name: Toll / Mill Creek 2	
	Client: LGC Valley, Inc.	Project No.: 244006-01
EGLAB Project No.: 24-059-009		DIRECT SHEAR
08/24	(ASTM D3080)	

Figure



Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Type	Symbol	Cohesion (PSF)	Friction Angle
B-4	B1	1.0-3.0	Bulk	SC	○	278	29
					□	96	29

Note: Sample was remolded to **90 %** maximum relative density and optimum moisture

Maximum Dry Density: **133.5 pcf**

Optimum Moisture: **8.0 %**

Normal Stress (psf)	Initial Moisture (%)	Final Moisture (%)
500	7.8	19.5
1000	7.8	19.0
2000	7.8	18.1

EGLAB, INC.	Project Address: Toll / Mill Creek 2	
	Client:	LGC Valley, Inc.
	Project No.:	244006-01
	EGLAB Project No.:	24-059-009

DIRECT SHEAR

08/24

(ASTM D3080)

Figure

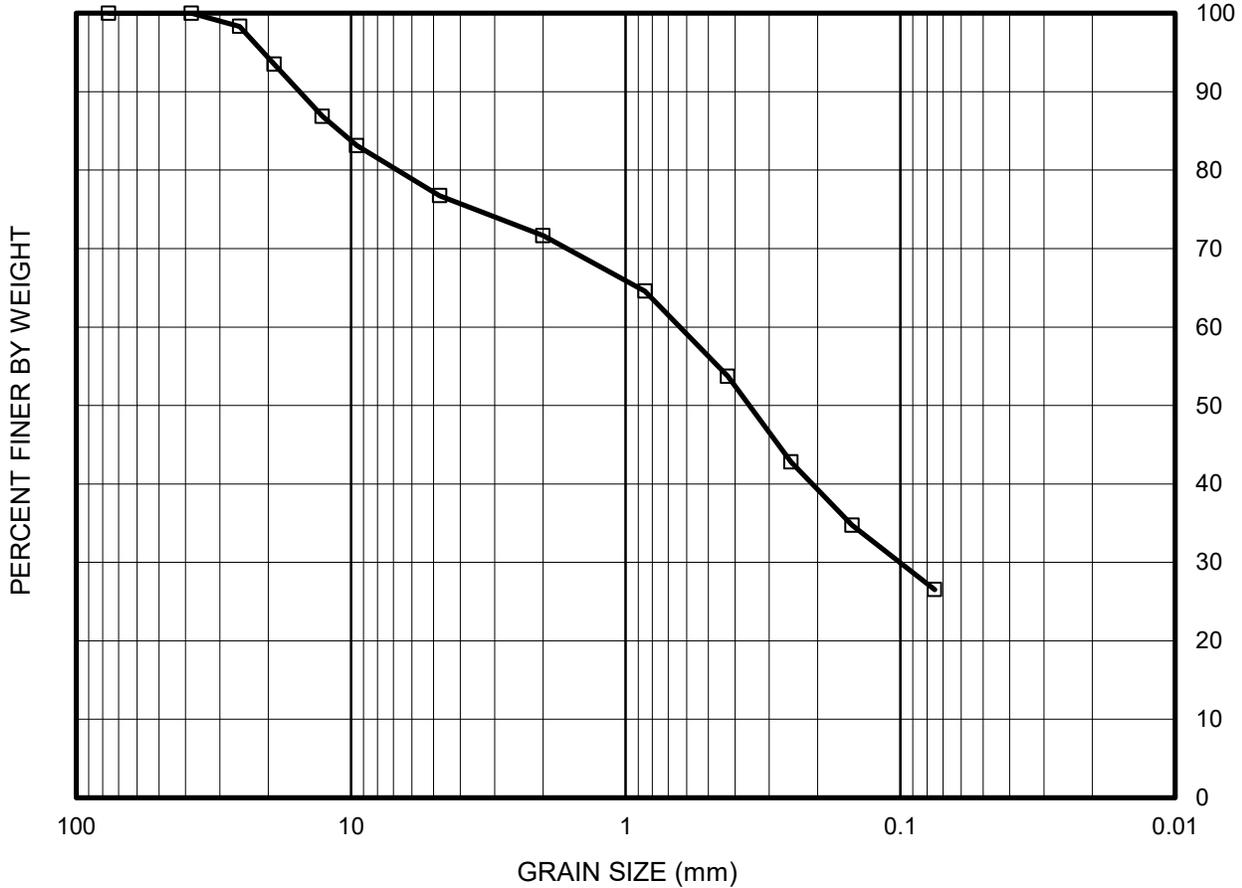
GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COAR	MEDIUM	FINE	

U.S. STANDARD SIEVE OPENING

U.S. STANDARD SIEVE NUMBER

HYDROMETER

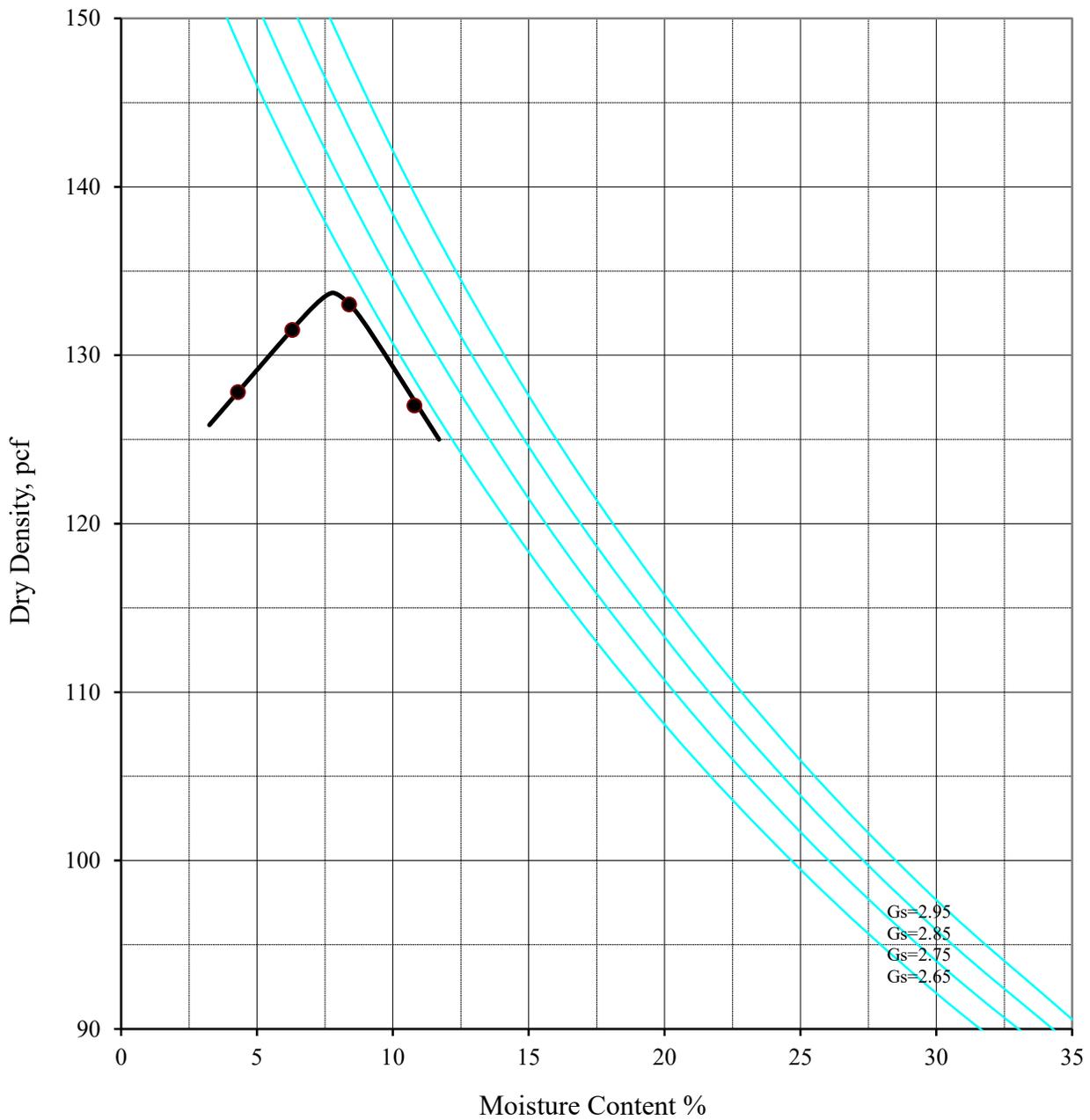
3" 1.5" 1" 3/4" 1/2" 3/8" #4 #10 #20 #40 #60 #100 #200



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	B-6	B1	2.5-5.0	Bulk	SC	N/A	N/A

Gravel:	23.3%
Sand:	50.2%
Fine:	26.5%

EGLAB, INC.	Project Name: Toll / Mill Creek 2
	Client Job No.: 244006-01 Client Name: LGC Valley, Inc. EGLAB Project No.: 24-059-009
GRAIN SIZE DISTRIBUTION CURVE	
08/07/24	FIGURE



Method "A"

Maximum Dry Density = **133.5** pcf

Optimum Moisture Content = **8.0** %

EGLAB, INC.

Modified Proctor
(ASTM D1557)

Boring No: B-4

Sample: B1

Depth : 1.0-3.0 feet

Description : Clayey sand (SC), reddish brown,
trace of gravel

Project Name:

Toll / Mill Creek 2

Client Name:

LGC Valley, Inc.

Job No.:

244006-01

EGLAB Project No.:

24-059-009

Date :

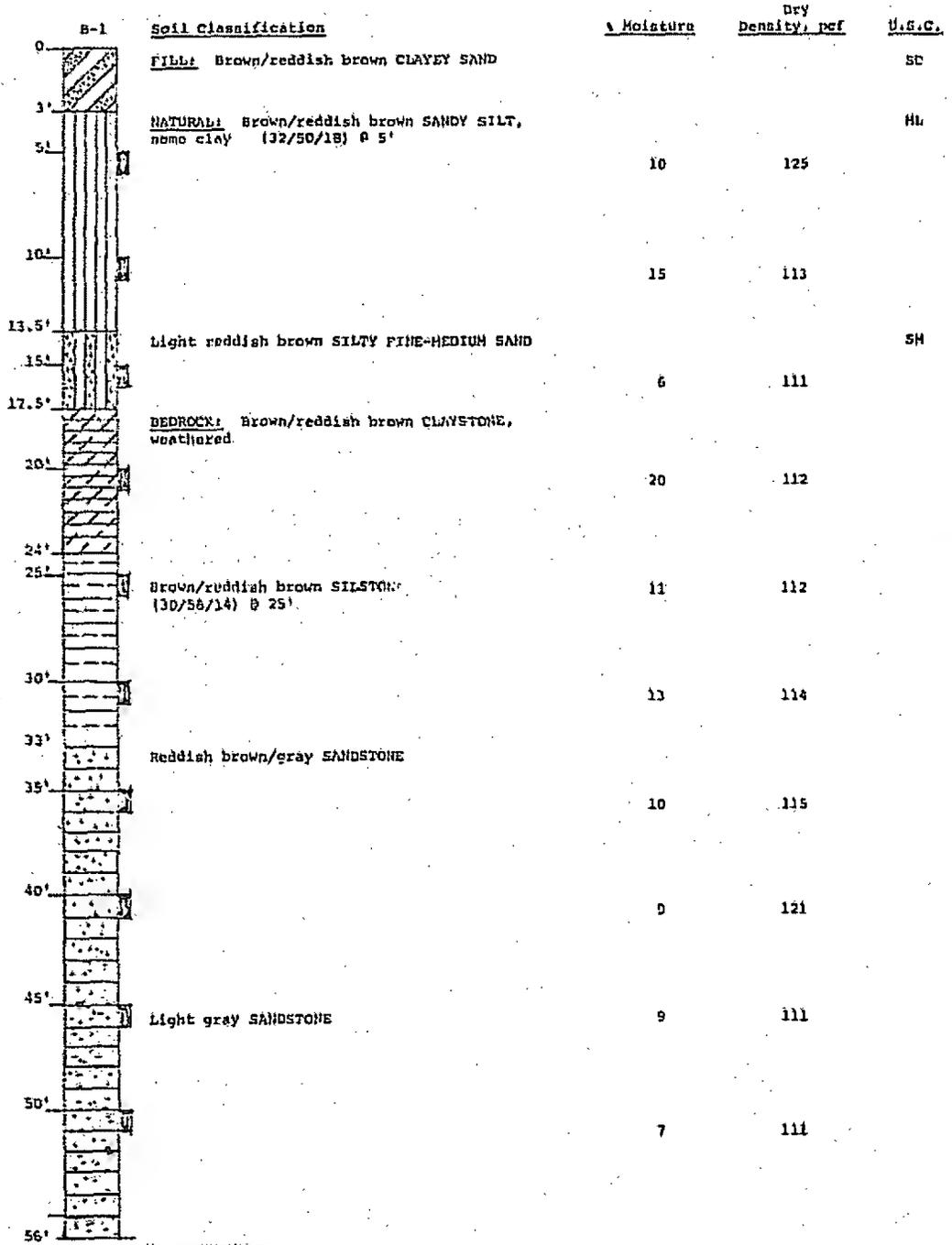
Aug-24

Figure

APPENDIX D

Previous Geotechnical Borings Logs (by Others)

TEST BORING LOG



NO GROUNDWATER
NO CAVING

LEGEND:

- Undisturbed core sample
- (%sand/% silt/% clay) @ sample depth
- U.S.C. - Unified Soil Classification System Group Symbol

PLATE B-1

FILE NO. 85-10789
H. V. LAWMASTER & CO., INC.

TEST BORING LOG

B-2	Soil Classification	% Moisture	Dry Density, pcf	U.S.C.
0'	<u>FILL:</u> Brown/reddish brown CLAYEY SAND with silt			SC
3'		11	115	
5'	<u>NATURAL:</u> Brown/reddish brown SANDY SILT, some clay (32/50/18) @ 8'			ML
8'		12	112	
13'	<u>BEDROCK:</u> Brown/reddish brown CLAYSTONE	10	121	
15'				
18'		11	119	
20'				
23'		12	102	
24'	Light grayish brown SANDSTONE			
28'		10	102	
33'		14	114	
34'	Yellowish brown SILTSTONE/SANDSTONE			
38'		5	111	
43'		6	114	
48'		10	115	
53'		8	116	
58'		11	113	
60'	<u>NO GROUNDWATER</u> <u>NO CAVING</u>			

PLATE B-2

FILE NO. 85-10789
H. V. LAWMASTER & CO., INC.

APPENDIX E

General Earthwork and Grading Specifications for Rough Grading

1.0 General

1.1 Intent: These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 The Geotechnical Consultant of Record: Prior to commencement of work, the owner shall employ a qualified Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to confirm that the attained level of compaction is being accomplished as specified. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor: The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation, and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the project plans and specifications. The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading,

the number of “equipment” of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate personnel will be available for observation and testing. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified. It is the contractor’s sole responsibility to provide proper fill compaction.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing: Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 10 percent organic matter. Nesting of organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed. The contractor is responsible for all hazardous waste relating to his work. The Geotechnical Consultant does not have expertise in this area. If hazardous waste is a concern, then the Client should acquire the services of a qualified environmental assessor.

2.2 Processing: Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free from oversize

material and the working surface is reasonably uniform, flat, and free from uneven features that would inhibit uniform compaction.

2.3 **Overexcavation:** In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured, or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 **Benching:** Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

2.5 **Evaluation/Acceptance of Fill Areas:** All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 **Fill Material**

3.1 **General:** Material to be used as fill shall be essentially free from organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 **Oversize:** Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversized material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 **Import:** If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined, and appropriate tests performed.

4.0 **Fill Placement and Compaction**

- 4.1 **Fill Layers:** Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.
- 4.2 **Fill Moisture Conditioning:** Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557-91).
- 4.3 **Compaction of Fill:** After each layer has been moisture conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557-91). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.
- 4.4 **Compaction of Fill Slopes:** In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheeps-foot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557-91.
- 4.5 **Compaction Testing:** Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).
- 4.6 **Frequency of Compaction Testing:** Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.
- 4.7 **Compaction Test Locations:** The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with

sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

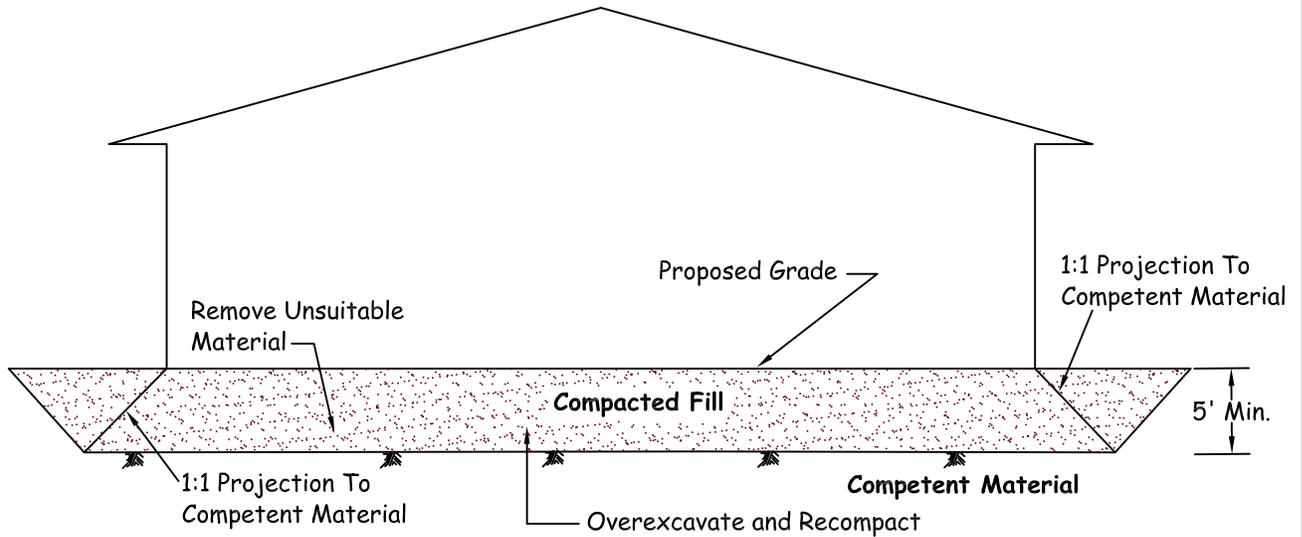
6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

- 7.1** The Contractor shall follow all OSHA and Cal/OSHA requirements for safety of trench excavations.
- 7.2** All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 ($SE > 30$). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.
- 7.3** The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.
- 7.4** The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.
- 7.5** Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

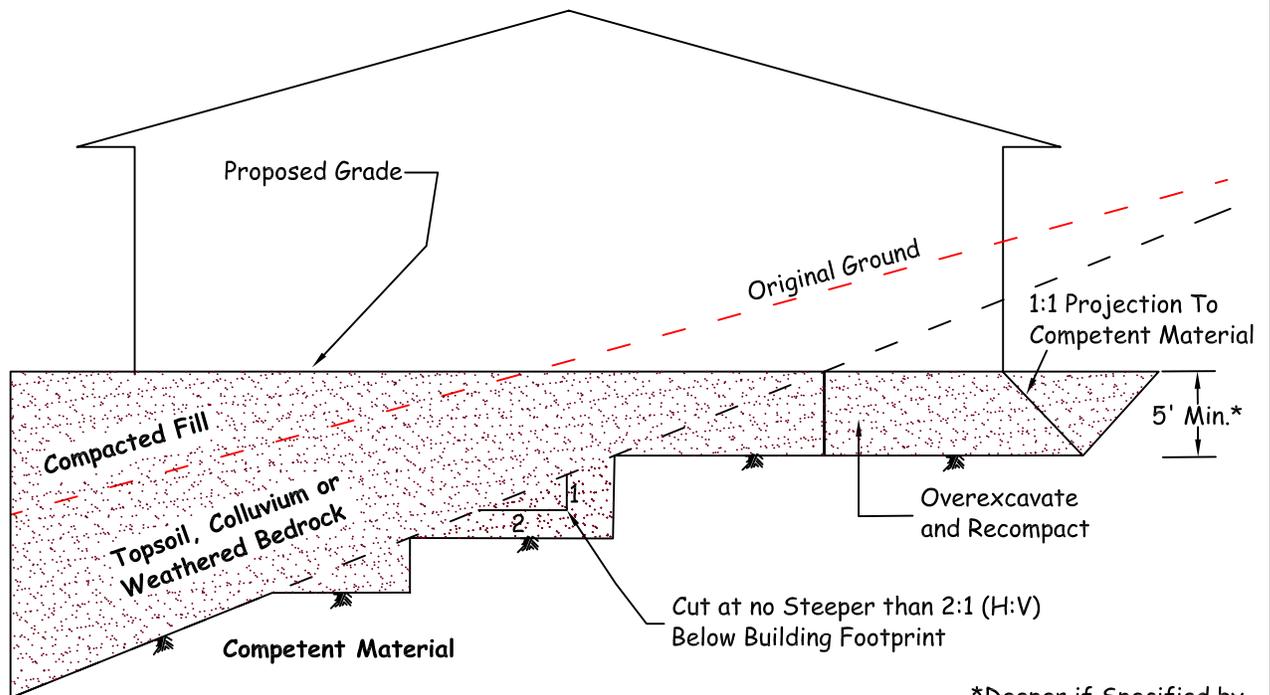
Cut Lot (Exposing Unsuitable Soils at Design Grade)



Note 1: Removal Bottom Should be Graded With Minimum 2% Fall Towards Street or Other Suitable Area (as Determined by Soils Engineer) to Avoid Ponding Below Building

Note 2: Where Design Cut Lots are Excavated Entirely Into Competent Material, Overexcavation May Still be Required for Hard-Rock Conditions or for Materials With Variable Expansion Characteristics.

Cut/Fill Transition Lot

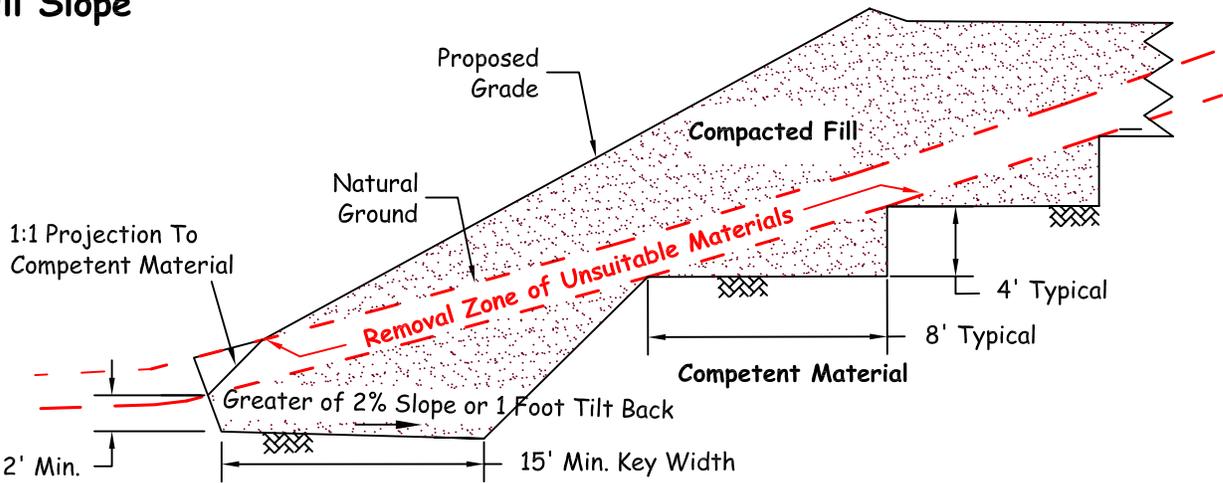


*Deeper if Specified by Soils Engineer

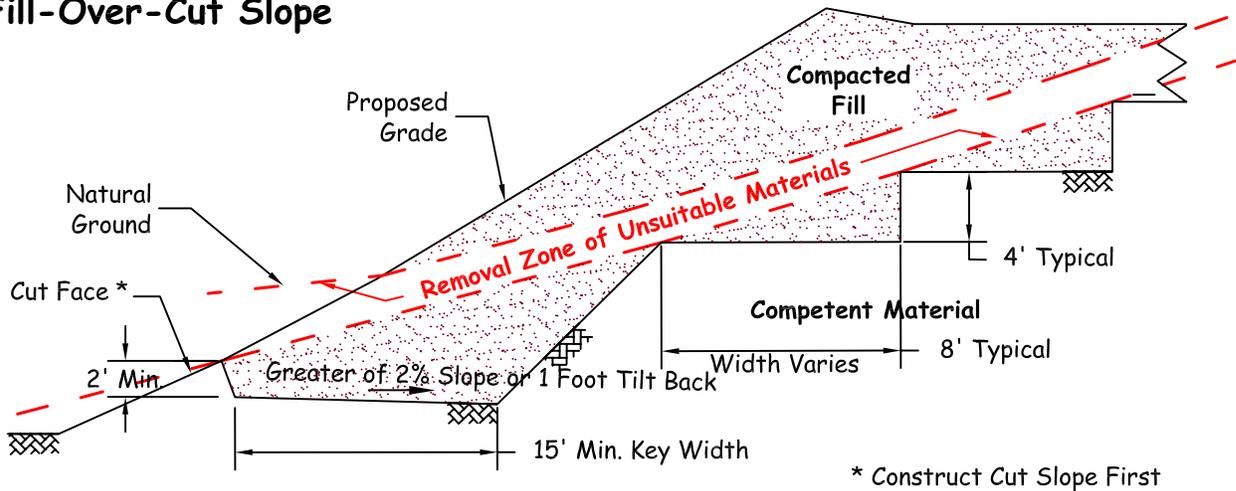
LGC

CUT AND TRANSITION LOT OVEREXCAVATION DETAIL

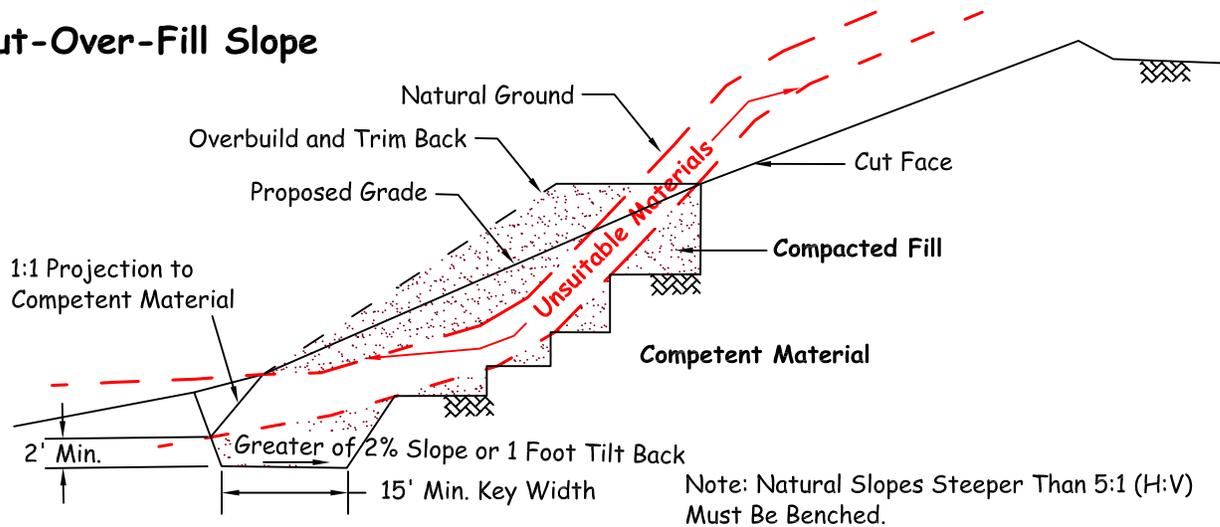
Fill Slope



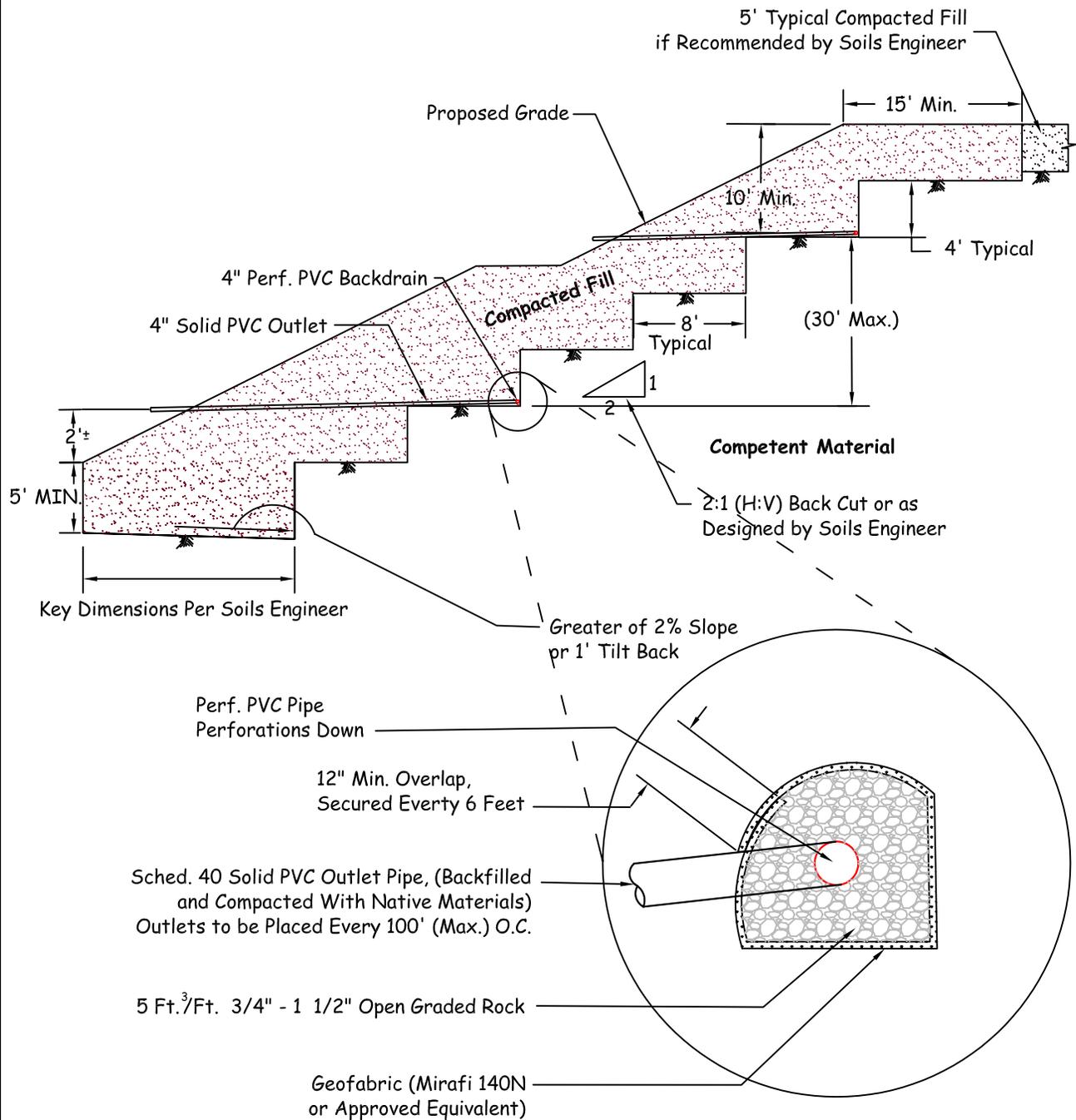
Fill-Over-Cut Slope



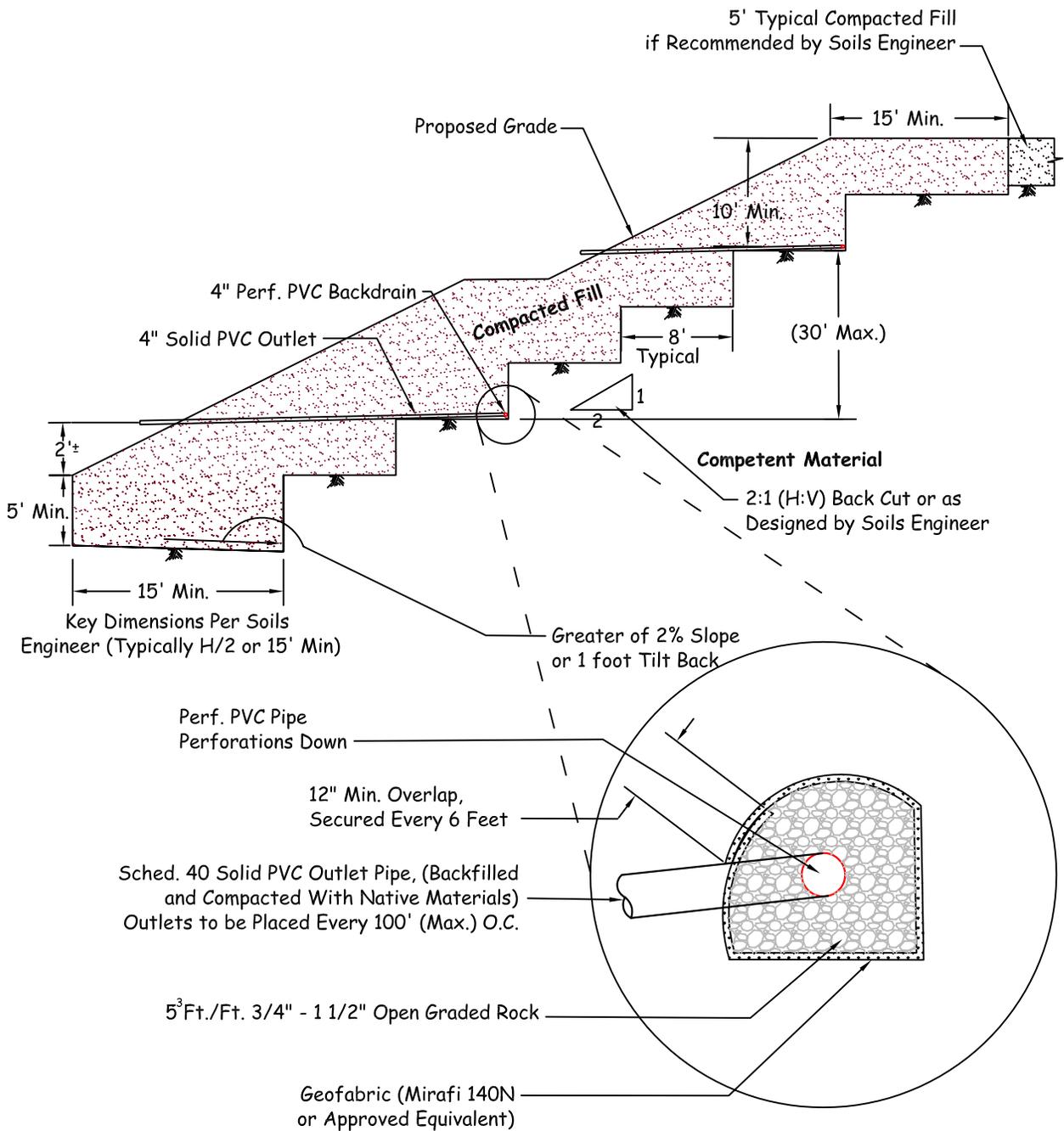
Cut-Over-Fill Slope



KEYING AND BENCHING



TYPICAL BUTTRESS DETAIL



TYPICAL STABILIZATION FILL DETAIL

Attachment G

Preliminary Drainage Report

23161 MILL CREEK PROJECT

CITY OF LAGUNA HILLS

PRELIMINARY HYDROLOGY REPORT

Prepared for:

Toll Brothers
350 Commerce, Suite 200
Irvine, CA 92602

January, 2025

Prepared by:

 **WILSON • MIKAMI • CORPORATION**
9 CORPORATE PARK • SUITE 100 • IRVINE • CA • 92606
PHONE: (949) 679-0090 FAX: (949) 679-0091

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I. INTRODUCTION

A. PROJECT DESCRIPTION:

Toll Brothers is proposing the development of a 2.4 acre site within the City of Laguna Hills, at Mill Creek Drive (Refer to Project Location Map, Figure 1). The site will consist of 18 duplex units, 36 residences.

The existing project site is currently a commercial building and parking lot and surface drains through a series of v-gutters down the drive entrance on onto Mill Creek Drive. There are currently no underground storm drain pipes.

The drainage from the project is collected by a series of area drains and catch basins to collect street flow. The south half of the property drains out to Mill Creek through a proposed parkway culvert near the proposed driveway. The north half of the property drains out to Mill Creek Drive through a second proposed parkway culvert near the northeast corner of the site.

B. PURPOSE:

This drainage report is intended to analyze the proposed drainage facilities associated with the project improvements and determine that the receiving facilities are not overburdened.

C. METHODOLOGY:

The existing and proposed conditions were analyzed utilizing the Advanced Engineering Software (AES) package for Orange County (RATSCX) (ref. 2). A rational method hydrology analysis was performed on both the existing pre-development, and proposed post-development condition for the 25 and 100-year storm events. The results are summarized in the table below and included in Appendix A and B of this report.

Existing Condition	Area (ac)	Q25 (cfs)	Q100 (cfs)
Sub-area A	2.2	8.0	10.3
Sub-area B	0.2	0.9	1.1
Total	2.4	8.9	11.4
Proposed Condition			
Sub-area A	0.9	3.4	4.4
Sub-area B	1.5	5.4	7.0
Total	2.4	8.8	11.4

The storm volumes were analyzed using the Civil D unit hydrograph (ref 3) module for Orange County. The point precipitation values were taken from NOAA Atlas 14 for the Laguna Hills area. The unit hydrograph results can be found in Appendix C (existing) and D (proposed) and are summarized below:

Existing Condition-Unit Hydrograph

Storm Event	Storm Duration	Total Tributary Area (ac)	Pervious Percent Ap	Total Storm Volume (ac-ft)
100-Year	24 Hour	2.4 ac	22%	1.054 ac-ft

Proposed Condition-Unit Hydrograph

Storm Event	Storm Duration	Total Tributary Area (ac)	Pervious Percent Ap	Total Storm Volume (ac-ft)
00-Year	24 Hour	2.4 ac	26%	1.048 ac-ft

The storm volume and peak flow rates in the existing condition does not exceed the expected storm volume or peak flow rates in the proposed condition and no on-site detention is required.

D. CONCLUSION:

These analyses and calculations confirm that the proposed development does not overburden the downstream drainage facility or increase flow onto Mill Creek Drive and no on-site detention is required. Additionally, protection of onsite structures will be maintained for the 100-year storm event.

II. REFERENCES

1. Orange County Hydrology Manual, 1986/1996 Addendum
2. Advanced Engineering Software (AES) RATSCX, 2016
3. Civil Design Software (CIVILD), 2018

PROJECT LOCATION



PROJECT LOCATION

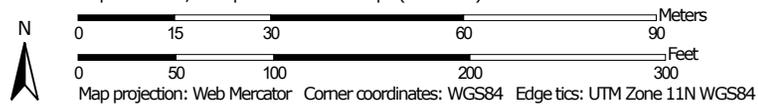
FIGURE MAP 1

Hydrologic Soil Group—Orange County and Part of Riverside County, California



Soil Map may not be valid at this scale.

Map Scale: 1:1,170 if printed on A landscape (11" x 8.5") sheet.



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Orange County and Part of Riverside County, California
 Survey Area Data: Version 17, Aug 30, 2023

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

Date(s) aerial images were photographed: Jan 17, 2023—Feb 8, 2023

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
104	Alo variant clay, 15 to 30 percent slopes	D	1.1	27.4%
105	Alo variant clay, 30 to 50 percent slopes	D	2.9	72.6%
173	Myford sandy loam, 2 to 9 percent slopes	C	0.0	0.0%
Totals for Area of Interest			4.1	100.0%

Description

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

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

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

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

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

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

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



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aeriels](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.128 (0.107-0.154)	0.171 (0.143-0.206)	0.230 (0.192-0.277)	0.279 (0.231-0.340)	0.349 (0.279-0.440)	0.404 (0.316-0.522)	0.463 (0.352-0.614)	0.525 (0.388-0.717)	0.613 (0.433-0.875)	0.684 (0.466-1.01)
10-min	0.183 (0.154-0.220)	0.245 (0.206-0.295)	0.329 (0.275-0.398)	0.400 (0.331-0.487)	0.500 (0.400-0.631)	0.579 (0.453-0.748)	0.663 (0.505-0.879)	0.752 (0.556-1.03)	0.878 (0.621-1.26)	0.980 (0.668-1.45)
15-min	0.221 (0.186-0.266)	0.296 (0.249-0.357)	0.398 (0.333-0.481)	0.484 (0.401-0.589)	0.604 (0.483-0.763)	0.701 (0.548-0.905)	0.802 (0.611-1.06)	0.910 (0.672-1.24)	1.06 (0.751-1.52)	1.18 (0.808-1.76)
30-min	0.312 (0.262-0.375)	0.417 (0.350-0.503)	0.560 (0.468-0.677)	0.681 (0.564-0.830)	0.850 (0.680-1.07)	0.986 (0.771-1.27)	1.13 (0.859-1.50)	1.28 (0.946-1.75)	1.50 (1.06-2.14)	1.67 (1.14-2.47)
60-min	0.420 (0.352-0.505)	0.562 (0.471-0.677)	0.754 (0.631-0.911)	0.916 (0.759-1.12)	1.14 (0.915-1.45)	1.33 (1.04-1.72)	1.52 (1.16-2.02)	1.72 (1.27-2.36)	2.01 (1.42-2.87)	2.25 (1.53-3.33)
2-hr	0.600 (0.504-0.722)	0.799 (0.670-0.962)	1.07 (0.896-1.29)	1.30 (1.08-1.59)	1.64 (1.31-2.07)	1.91 (1.49-2.47)	2.20 (1.68-2.92)	2.51 (1.86-3.44)	2.97 (2.10-4.24)	3.34 (2.28-4.95)
3-hr	0.739 (0.620-0.889)	0.979 (0.821-1.18)	1.31 (1.10-1.58)	1.60 (1.32-1.95)	2.01 (1.61-2.54)	2.35 (1.83-3.03)	2.71 (2.06-3.59)	3.10 (2.29-4.24)	3.67 (2.60-5.24)	4.14 (2.82-6.14)
6-hr	1.03 (0.867-1.24)	1.36 (1.14-1.64)	1.82 (1.52-2.20)	2.22 (1.84-2.70)	2.78 (2.22-3.52)	3.24 (2.54-4.19)	3.74 (2.85-4.96)	4.28 (3.16-5.84)	5.05 (3.57-7.22)	5.70 (3.88-8.44)
12-hr	1.36 (1.14-1.63)	1.80 (1.51-2.17)	2.40 (2.01-2.90)	2.91 (2.41-3.55)	3.63 (2.90-4.59)	4.21 (3.29-5.44)	4.82 (3.67-6.39)	5.47 (4.04-7.47)	6.39 (4.52-9.12)	7.13 (4.86-10.6)
24-hr	1.78 (1.57-2.06)	2.37 (2.09-2.74)	3.17 (2.79-3.68)	3.84 (3.35-4.48)	4.77 (4.04-5.76)	5.51 (4.57-6.78)	6.28 (5.09-7.92)	7.10 (5.60-9.19)	8.24 (6.24-11.1)	9.16 (6.71-12.8)
2-day	2.19 (1.94-2.53)	2.93 (2.59-3.39)	3.93 (3.46-4.56)	4.78 (4.17-5.58)	5.96 (5.04-7.19)	6.91 (5.73-8.50)	7.90 (6.40-9.96)	8.95 (7.06-11.6)	10.4 (7.90-14.1)	11.6 (8.52-16.2)
3-day	2.42 (2.14-2.79)	3.24 (2.86-3.74)	4.36 (3.84-5.06)	5.31 (4.64-6.20)	6.65 (5.63-8.03)	7.73 (6.41-9.52)	8.86 (7.18-11.2)	10.1 (7.94-13.0)	11.8 (8.93-15.9)	13.2 (9.65-18.4)
4-day	2.60 (2.30-3.01)	3.50 (3.09-4.05)	4.72 (4.16-5.48)	5.76 (5.03-6.73)	7.24 (6.12-8.73)	8.42 (6.98-10.4)	9.67 (7.83-12.2)	11.0 (8.68-14.3)	12.9 (9.78-17.4)	14.5 (10.6-20.1)
7-day	2.98 (2.63-3.44)	4.01 (3.54-4.64)	5.42 (4.77-6.29)	6.62 (5.78-7.74)	8.33 (7.04-10.0)	9.70 (8.04-11.9)	11.2 (9.03-14.1)	12.7 (10.0-16.5)	14.9 (11.3-20.1)	16.7 (12.2-23.3)
10-day	3.22 (2.85-3.72)	4.35 (3.84-5.03)	5.90 (5.20-6.84)	7.22 (6.30-8.44)	9.09 (7.69-11.0)	10.6 (8.79-13.0)	12.2 (9.87-15.4)	13.9 (11.0-18.0)	16.3 (12.4-22.0)	18.3 (13.4-25.5)
20-day	3.86 (3.41-4.46)	5.27 (4.65-6.09)	7.20 (6.34-8.35)	8.85 (7.73-10.3)	11.2 (9.48-13.5)	13.1 (10.9-16.1)	15.1 (12.3-19.1)	17.3 (13.6-22.4)	20.4 (15.5-27.5)	22.9 (16.8-32.0)
30-day	4.56 (4.03-5.26)	6.24 (5.50-7.21)	8.56 (7.54-9.93)	10.6 (9.22-12.3)	13.4 (11.3-16.2)	15.7 (13.0-19.3)	18.2 (14.7-22.9)	20.8 (16.4-27.0)	24.6 (18.7-33.2)	27.8 (20.3-38.7)
45-day	5.39 (4.76-6.22)	7.36 (6.50-8.51)	10.1 (8.90-11.7)	12.5 (10.9-14.6)	15.9 (13.4-19.1)	18.6 (15.5-23.0)	21.6 (17.5-27.2)	24.8 (19.6-32.1)	29.5 (22.3-39.7)	33.3 (24.4-46.4)
60-day	6.24 (5.51-7.20)	8.47 (7.47-9.79)	11.6 (10.2-13.4)	14.3 (12.5-16.7)	18.2 (15.4-21.9)	21.4 (17.7-26.3)	24.8 (20.1-31.3)	28.5 (22.5-37.0)	34.0 (25.7-45.8)	38.4 (28.2-53.6)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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PF graphical

III. APPENDICES

APPENDIX A

EXISTING CONDITION RATIONAL METHOD AND HYDROLOGY MAP

25-YEAR

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
(c) Copyright 1983-2016 Advanced Engineering Software (aes)
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 *****
* KHOSHBIN MILL CREEK PROPERTY *
* EXISTING CONDITION 25-YEAR HYDROLOGY *
* BY KAM 091524 *

FILE NAME: EX_MC2.DAT
TIME/DATE OF STUDY: 12:57 09/16/2024

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

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

USER SPECIFIED STORM EVENT (YEAR) = 25.00
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) II 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	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

- Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
 - (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) = 203.00
ELEVATION DATA: UPSTREAM (FEET) = 316.50 DOWNSTREAM (FEET) = 304.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 5.000
* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 4.824

SUBAREA Tc AND LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
-------------------------------	-------------------	-----------------	-----------------	-----------------	-----------	--------------

COMMERCIAL D 0.18 0.20 0.100 75 5.00
 SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
 SUBAREA RUNOFF(CFS) = 0.78
 TOTAL AREA(ACRES) = 0.18 PEAK FLOW RATE(CFS) = 0.78

 FLOW PROCESS FROM NODE 11.00 TO NODE 12.00 IS CODE = 61

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>(STANDARD CURB SECTION USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 304.00 DOWNSTREAM ELEVATION(FEET) = 299.70
 STREET LENGTH(FEET) = 185.00 CURB HEIGHT(INCHES) = 6.0
 STREET HALFWIDTH(FEET) = 10.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 5.00
 INSIDE STREET CROSSFALL(DECIMAL) = 0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

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

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.14
 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

STREET FLOW DEPTH(FEET) = 0.24
 HALFSTREET FLOOD WIDTH(FEET) = 5.58
 AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.66
 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.63
 STREET FLOW TRAVEL TIME(MIN.) = 1.16 T_c (MIN.) = 6.16
 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.287

SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN
COMMERCIAL	D	0.19	0.20	0.100	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
 SUBAREA AREA(ACRES) = 0.19 SUBAREA RUNOFF(CFS) = 0.73
 EFFECTIVE AREA(ACRES) = 0.37 AREA-AVERAGED F_m (INCH/HR) = 0.02
 AREA-AVERAGED F_p (INCH/HR) = 0.20 AREA-AVERAGED A_p = 0.10
 TOTAL AREA(ACRES) = 0.4 PEAK FLOW RATE(CFS) = 1.42

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH(FEET) = 0.25 HALFSTREET FLOOD WIDTH(FEET) = 6.31
 FLOW VELOCITY(FEET/SEC.) = 2.75 DEPTH*VELOCITY(FT*FT/SEC.) = 0.69
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 388.00 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.) = 6.16
 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.287
 SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN
COMMERCIAL	D	0.96	0.20	0.100	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
 SUBAREA AREA(ACRES) = 0.96 SUBAREA RUNOFF(CFS) = 3.69
 EFFECTIVE AREA(ACRES) = 1.33 AREA-AVERAGED F_m (INCH/HR) = 0.02
 AREA-AVERAGED F_p (INCH/HR) = 0.20 AREA-AVERAGED A_p = 0.10

TOTAL AREA (ACRES) = 1.3 PEAK FLOW RATE (CFS) = 5.11

FLOW PROCESS FROM NODE 12.00 TO NODE 13.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM (FEET) = 299.70 DOWNSTREAM (FEET) = 296.00
CHANNEL LENGTH THRU SUBAREA (FEET) = 119.00 CHANNEL SLOPE = 0.0311
CHANNEL BASE (FEET) = 0.00 "Z" FACTOR = 7.500
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH (FEET) = 1.00
* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 4.155
SUBAREA LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.55	0.20	0.100	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 6.13
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY (FEET/SEC.) = 5.70
AVERAGE FLOW DEPTH (FEET) = 0.38 TRAVEL TIME (MIN.) = 0.35
Tc (MIN.) = 6.51
SUBAREA AREA (ACRES) = 0.55 SUBAREA RUNOFF (CFS) = 2.05
EFFECTIVE AREA (ACRES) = 1.88 AREA-AVERAGED Fm (INCH/HR) = 0.02
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
TOTAL AREA (ACRES) = 1.9 PEAK FLOW RATE (CFS) = 7.00

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH (FEET) = 0.40 FLOW VELOCITY (FEET/SEC.) = 5.84
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 13.00 = 507.00 FEET.

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

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

=====

MAINLINE Tc (MIN.) = 6.51
* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 4.155
SUBAREA LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
NATURAL FAIR COVER "CHAPARRAL, BROADLEAF"	D	0.27	0.20	1.000	81

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA AREA (ACRES) = 0.27 SUBAREA RUNOFF (CFS) = 0.96
EFFECTIVE AREA (ACRES) = 2.15 AREA-AVERAGED Fm (INCH/HR) = 0.04
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.21
TOTAL AREA (ACRES) = 2.1 PEAK FLOW RATE (CFS) = 7.96

FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 21

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

=====

INITIAL SUBAREA FLOW-LENGTH (FEET) = 70.00
ELEVATION DATA: UPSTREAM (FEET) = 302.00 DOWNSTREAM (FEET) = 272.00

Tc = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 5.000
* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 4.824

SUBAREA Tc AND LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
NATURAL FAIR COVER "CHAPARRAL, BROADLEAF"	D	0.21	0.20	1.000	81	5.00

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA RUNOFF (CFS) = 0.87
TOTAL AREA (ACRES) = 0.21 PEAK FLOW RATE (CFS) = 0.87

=====
END OF STUDY SUMMARY:

TOTAL AREA (ACRES) = 0.2 TC (MIN.) = 5.00
EFFECTIVE AREA (ACRES) = 0.21 AREA-AVERAGED Fm (INCH/HR) = 0.20
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 1.000
PEAK FLOW RATE (CFS) = 0.87
=====

=====
END OF RATIONAL METHOD ANALYSIS

100-YEAR

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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Analysis prepared by:

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

***** DESCRIPTION OF STUDY *****
* KHOSHBIN MILL CREEK PROPERTY *
* EXISTING CONDITION 100-YEAR HYDROLOGY *
* BY KAM 091524 *

FILE NAME: EX_MC2.DAT
TIME/DATE OF STUDY: 12:57 09/16/2024

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

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

USER SPECIFIED STORM EVENT (YEAR) = 100.00
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) III 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:

- Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
 - (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) = 203.00
ELEVATION DATA: UPSTREAM (FEET) = 316.50 DOWNSTREAM (FEET) = 304.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 5.000
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 6.187

SUBAREA Tc AND LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
-------------------------------	-------------------	-----------------	-----------------	-----------------	-----------	--------------

COMMERCIAL D 0.18 0.20 0.100 91 5.00
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 1.00
TOTAL AREA(ACRES) = 0.18 PEAK FLOW RATE(CFS) = 1.00

FLOW PROCESS FROM NODE 11.00 TO NODE 12.00 IS CODE = 61

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>(STANDARD CURB SECTION USED)<<<<<

=====

UPSTREAM ELEVATION(FEET) = 304.00 DOWNSTREAM ELEVATION(FEET) = 299.70
STREET LENGTH(FEET) = 185.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 10.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 5.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

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

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.47
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

STREET FLOW DEPTH(FEET) = 0.25
HALFSTREET FLOOD WIDTH(FEET) = 6.38
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.80
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.71
STREET FLOW TRAVEL TIME(MIN.) = 1.10 Tc(MIN.) = 6.10
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.520

SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.19	0.20	0.100	91

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.19 SUBAREA RUNOFF(CFS) = 0.94
EFFECTIVE AREA(ACRES) = 0.37 AREA-AVERAGED Fm(INCH/HR) = 0.02
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 0.4 PEAK FLOW RATE(CFS) = 1.83

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH(FEET) = 0.27 HALFSTREET FLOOD WIDTH(FEET) = 7.18
FLOW VELOCITY(FEET/SEC.) = 2.89 DEPTH*VELOCITY(FT*FT/SEC.) = 0.78
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 388.00 FEET.

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

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

=====

MAINLINE Tc(MIN.) = 6.10
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.520
SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.96	0.20	0.100	91

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.96 SUBAREA RUNOFF(CFS) = 4.75
EFFECTIVE AREA(ACRES) = 1.33 AREA-AVERAGED Fm(INCH/HR) = 0.02
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10

TOTAL AREA (ACRES) = 1.3 PEAK FLOW RATE (CFS) = 6.58

FLOW PROCESS FROM NODE 12.00 TO NODE 13.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM (FEET) =	299.70	DOWNSTREAM (FEET) =	296.00
CHANNEL LENGTH THRU SUBAREA (FEET) =	119.00	CHANNEL SLOPE =	0.0311
CHANNEL BASE (FEET) =	0.00	"Z" FACTOR =	7.500
MANNING'S FACTOR =	0.015	MAXIMUM DEPTH (FEET) =	1.00
* 100 YEAR RAINFALL INTENSITY (INCH/HR) =	5.357		

SUBAREA LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.55	0.20	0.100	91

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 7.90
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY (FEET/SEC.) = 6.07
AVERAGE FLOW DEPTH (FEET) = 0.42 TRAVEL TIME (MIN.) = 0.33
Tc (MIN.) = 6.43
SUBAREA AREA (ACRES) = 0.55 SUBAREA RUNOFF (CFS) = 2.64
EFFECTIVE AREA (ACRES) = 1.88 AREA-AVERAGED Fm (INCH/HR) = 0.02
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
TOTAL AREA (ACRES) = 1.9 PEAK FLOW RATE (CFS) = 9.03

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH (FEET) = 0.44 FLOW VELOCITY (FEET/SEC.) = 6.28
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 13.00 = 507.00 FEET.

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

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

=====

MAINLINE Tc (MIN.) = 6.43
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 5.357
SUBAREA LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
NATURAL FAIR COVER "CHAPARRAL, BROADLEAF"	D	0.27	0.20	1.000	95

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA AREA (ACRES) = 0.27 SUBAREA RUNOFF (CFS) = 1.25
EFFECTIVE AREA (ACRES) = 2.15 AREA-AVERAGED Fm (INCH/HR) = 0.04
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.21
TOTAL AREA (ACRES) = 2.1 PEAK FLOW RATE (CFS) = 10.28

FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 21

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

=====

INITIAL SUBAREA FLOW-LENGTH (FEET) = 70.00
ELEVATION DATA: UPSTREAM (FEET) = 302.00 DOWNSTREAM (FEET) = 272.00

Tc = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 5.000
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 6.187

SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
NATURAL FAIR COVER "CHAPARRAL, BROADLEAF"	D	0.21	0.20	1.000	95	5.00

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA RUNOFF(CFS) = 1.13
TOTAL AREA(ACRES) = 0.21 PEAK FLOW RATE(CFS) = 1.13

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 0.2 TC(MIN.) = 5.00
EFFECTIVE AREA(ACRES) = 0.21 AREA-AVERAGED Fm(INCH/HR) = 0.20
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 1.000
PEAK FLOW RATE(CFS) = 1.13

=====

END OF RATIONAL METHOD ANALYSIS

HYDROLOGY MAP

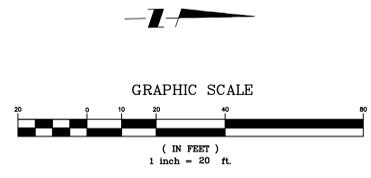
S:\1\0501_00\mg\PRE\0004-EXISTING HYDROL.DWG 9/16/24



LEGEND

- WATERSHED BOUNDARY
- - - SUB-AREA BOUNDARY
- FLOWLINE AND DIRECTION OF FLOW
- (A5) SUBAREA LABEL
- (0.30) AREA (ACRES)
- (20) NODE NUMBER

Q25 25-YEAR PEAK FLOW IN CFS
 Q100 100-YEAR PEAK FLOW IN CFS
 WS 100 100-YEAR PEAK FLOW WATER SURFACE ELEVATION
 QCONF 100-YEAR CONFLUENCE PEAK FLOW IN CFS
 MIN MINUTES
 TC TIME OF CONCENTRATION (100-YEAR STORM) IN MIN
 CFS CUBIC FEET PER SECOND
 EG EXISTING GRADE ELEVATION
 FG FINISH GRADE ELEVATION
 FS FINISH SURFACE ELEVATION
 FL FLOW LINE ELEVATION
 INV INVERT OF PIPE
 L=870' LENGTH OF FLOWPATH IN FEET
 Lp=92' LENGTH OF PIPE IN FEET



NO.	DATE	REVISIONS

DESIGNED BY:	ES
DRAFTED BY:	ES
CHECKED BY:	KM
DATE:	9/24

WILSON MIKAMI CORPORATION
 9 CORPORATE PARK, SUITE 100
 IRVINE, CA 92606
 T: 949-679-0090

LAGUNA HILLS
KHOSHBIN MILL CREEK PROPERTY
EXISTING CONDITION HYDROLOGY MAP

PROJECT NO.
10501.00
 SHEET **1**
 OF **1**

APPENDIX B
PROPOSED CONDITION RATIONAL METHOD
AND HYDROLOGY MAP

25-YEAR

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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Analysis prepared by:

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

***** DESCRIPTION OF STUDY *****
* KHOSHBIN MILL CREEK PROPOSED CONDITION HYDROLOGY *
* 25-YEAR HYDROLOGY *
* BY KAM 011525 *

FILE NAME: KOSH.DAT
TIME/DATE OF STUDY: 16:11 01/15/2025

=====
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
=====

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

USER SPECIFIED STORM EVENT (YEAR) = 25.00
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) II ASSUMED FOR RATIONAL METHOD

Table with 9 columns: NO., HALF-WIDTH (FT), CROWN TO CROSSFALL (FT), STREET-CROSSFALL IN- / OUT- / SIDE / SIDE / WAY, CURB HEIGHT (FT), GUTTER WIDTH (FT), GUTTER LIP (FT), GUTTER HIKE (FT), MANNING FACTOR (n). Row 1: 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) = 240.00
ELEVATION DATA: UPSTREAM (FEET) = 312.40 DOWNSTREAM (FEET) = 309.20

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 6.456
* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 4.174

SUBAREA Tc AND LOSS RATE DATA (AMC II):

Table with 7 columns: DEVELOPMENT TYPE / LAND USE, SCS SOIL GROUP, AREA (ACRES), Fp (INCH/HR), Ap (DECIMAL), SCS CN, Tc (MIN.)

COMMERCIAL D 0.10 0.20 0.100 75 6.46
 SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
 SUBAREA RUNOFF(CFS) = 0.37
 TOTAL AREA(ACRES) = 0.10 PEAK FLOW RATE(CFS) = 0.37

 FLOW PROCESS FROM NODE 11.00 TO NODE 11.00 IS CODE = 81

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

=====

MAINLINE T_c (MIN.) = 6.46
 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.174
 SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN
RESIDENTIAL "11+ DWELLINGS/ACRE"	D	0.24	0.20	0.200	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.200
 SUBAREA AREA(ACRES) = 0.24 SUBAREA RUNOFF(CFS) = 0.89
 EFFECTIVE AREA(ACRES) = 0.34 AREA-AVERAGED F_m (INCH/HR) = 0.03
 AREA-AVERAGED F_p (INCH/HR) = 0.20 AREA-AVERAGED A_p = 0.17
 TOTAL AREA(ACRES) = 0.3 PEAK FLOW RATE(CFS) = 1.27

 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) = 303.20 DOWNSTREAM(FEET) = 302.50
 FLOW LENGTH(FEET) = 47.00 MANNING'S N = 0.010
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 3.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 5.69
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 1.27
 PIPE TRAVEL TIME(MIN.) = 0.14 T_c (MIN.) = 6.59
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 287.00 FEET.

 FLOW PROCESS FROM NODE 12.00 TO NODE 12.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION(MIN.) = 6.59
 RAINFALL INTENSITY(INCH/HR) = 4.12
 AREA-AVERAGED F_m (INCH/HR) = 0.03
 AREA-AVERAGED F_p (INCH/HR) = 0.20
 AREA-AVERAGED A_p = 0.17
 EFFECTIVE STREAM AREA(ACRES) = 0.34
 TOTAL STREAM AREA(ACRES) = 0.34
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.27

 FLOW PROCESS FROM NODE 10.00 TO NODE 13.00 IS CODE = 21

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

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 254.00
ELEVATION DATA: UPSTREAM(FEET) = 312.40 DOWNSTREAM(FEET) = 308.20

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 6.326
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.222
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL D 0.10 0.20 0.100 75 6.33
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 0.38
TOTAL AREA(ACRES) = 0.10 PEAK FLOW RATE(CFS) = 0.38

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

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

=====

MAINLINE Tc(MIN.) = 6.33
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.222
SUBAREA LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"11+ DWELLINGS/ACRE" D 0.26 0.20 0.200 75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA AREA(ACRES) = 0.26 SUBAREA RUNOFF(CFS) = 0.98
EFFECTIVE AREA(ACRES) = 0.36 AREA-AVERAGED Fm(INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.17
TOTAL AREA(ACRES) = 0.4 PEAK FLOW RATE(CFS) = 1.36

FLOW PROCESS FROM NODE 13.00 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) = 302.70 DOWNSTREAM(FEET) = 302.50
FLOW LENGTH(FEET) = 11.00 MANNING'S N = 0.010
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS 3.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.23
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 1.36
PIPE TRAVEL TIME(MIN.) = 0.03 Tc(MIN.) = 6.36
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 265.00 FEET.

FLOW PROCESS FROM NODE 12.00 TO NODE 12.00 IS CODE = 1

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

=====

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 6.36
RAINFALL INTENSITY(INCH/HR) = 4.21
AREA-AVERAGED Fm(INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.17

EFFECTIVE STREAM AREA (ACRES) = 0.36
 TOTAL STREAM AREA (ACRES) = 0.36
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 1.36

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	1.27	6.59	4.124	0.20 (0.03)	0.17	0.3	10.00
2	1.36	6.36	4.211	0.20 (0.03)	0.17	0.4	10.00

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	2.60	6.36	4.211	0.20 (0.03)	0.17	0.7	10.00
2	2.60	6.59	4.124	0.20 (0.03)	0.17	0.7	10.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 2.60 Tc (MIN.) = 6.36
 EFFECTIVE AREA (ACRES) = 0.69 AREA-AVERAGED Fm (INCH/HR) = 0.03
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.17
 TOTAL AREA (ACRES) = 0.7
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 287.00 FEET.

 FLOW PROCESS FROM NODE 12.00 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) = 302.50 DOWNSTREAM (FEET) = 296.20
 FLOW LENGTH (FEET) = 103.00 MANNING'S N = 0.010
 ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 12.000
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 3.9 INCHES
 PIPE-FLOW VELOCITY (FEET/SEC.) = 11.59
 ESTIMATED PIPE DIAMETER (INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW (CFS) = 2.60
 PIPE TRAVEL TIME (MIN.) = 0.15 Tc (MIN.) = 6.50
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 14.00 = 390.00 FEET.

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

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

=====

MAINLINE Tc (MIN.) = 6.50
 * 25 YEAR RAINFALL INTENSITY (INCH/HR) = 4.157
 SUBAREA LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.14	0.20	0.100	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA AREA (ACRES) = 0.14 SUBAREA RUNOFF (CFS) = 0.52
 EFFECTIVE AREA (ACRES) = 0.83 AREA-AVERAGED Fm (INCH/HR) = 0.03
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.16
 TOTAL AREA (ACRES) = 0.8 PEAK FLOW RATE (CFS) = 3.07

 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) = 296.20 DOWNSTREAM(FEET) = 294.30
FLOW LENGTH(FEET) = 45.00 MANNING'S N = 0.010
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS 4.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 10.60
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 3.07
PIPE TRAVEL TIME(MIN.) = 0.07 Tc(MIN.) = 6.57
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 15.00 = 435.00 FEET.

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

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

=====

MAINLINE Tc(MIN.) = 6.57
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.131
SUBAREA LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
COMMERCIAL D 0.10 0.20 0.100 75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.10 SUBAREA RUNOFF(CFS) = 0.37
EFFECTIVE AREA(ACRES) = 0.93 AREA-AVERAGED Fm(INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.15
TOTAL AREA(ACRES) = 0.9 PEAK FLOW RATE(CFS) = 3.42

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) = 294.30 DOWNSTREAM(FEET) = 292.30
FLOW LENGTH(FEET) = 50.00 MANNING'S N = 0.010
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS 5.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 10.70
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 3.42
PIPE TRAVEL TIME(MIN.) = 0.08 Tc(MIN.) = 6.65
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 16.00 = 485.00 FEET.

FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 21

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

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 262.00
ELEVATION DATA: UPSTREAM(FEET) = 306.00 DOWNSTREAM(FEET) = 301.70

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 6.414
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.189
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL D 0.13 0.20 0.100 75 6.41

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
SUBAREA RUNOFF(CFS) = 0.49
TOTAL AREA(ACRES) = 0.13 PEAK FLOW RATE(CFS) = 0.49

FLOW PROCESS FROM NODE 21.00 TO NODE 21.00 IS CODE = 81

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

=====

MAINLINE T_c (MIN.) = 6.41
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.189
SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN
COMMERCIAL	D	0.06	0.20	0.100	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
SUBAREA AREA(ACRES) = 0.06 SUBAREA RUNOFF(CFS) = 0.23
EFFECTIVE AREA(ACRES) = 0.19 AREA-AVERAGED F_m (INCH/HR) = 0.02
AREA-AVERAGED F_p (INCH/HR) = 0.20 AREA-AVERAGED A_p = 0.10
TOTAL AREA(ACRES) = 0.2 PEAK FLOW RATE(CFS) = 0.71

FLOW PROCESS FROM NODE 21.00 TO NODE 21.00 IS CODE = 81

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

=====

MAINLINE T_c (MIN.) = 6.41
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.189
SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN
RESIDENTIAL "11+ DWELLINGS/ACRE"	D	0.26	0.20	0.200	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.200
SUBAREA AREA(ACRES) = 0.26 SUBAREA RUNOFF(CFS) = 0.97
EFFECTIVE AREA(ACRES) = 0.45 AREA-AVERAGED F_m (INCH/HR) = 0.03
AREA-AVERAGED F_p (INCH/HR) = 0.20 AREA-AVERAGED A_p = 0.16
TOTAL AREA(ACRES) = 0.4 PEAK FLOW RATE(CFS) = 1.68

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) = 296.70 DOWNSTREAM(FEET) = 296.50
FLOW LENGTH(FEET) = 21.00 MANNING'S N = 0.010
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS 5.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.23
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 1.68
PIPE TRAVEL TIME(MIN.) = 0.07 T_c (MIN.) = 6.48
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 22.00 = 283.00 FEET.

FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 81

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

MAINLINE Tc(MIN.) = 6.48
 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.165
 SUBAREA LOSS RATE DATA(AMC II):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
 COMMERCIAL D 0.14 0.20 0.100 75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA AREA(ACRES) = 0.14 SUBAREA RUNOFF(CFS) = 0.52
 EFFECTIVE AREA(ACRES) = 0.59 AREA-AVERAGED Fm(INCH/HR) = 0.03
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.14
 TOTAL AREA(ACRES) = 0.6 PEAK FLOW RATE(CFS) = 2.20

 FLOW PROCESS FROM NODE 22.00 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) = 296.50 DOWNSTREAM(FEET) = 296.30
 FLOW LENGTH(FEET) = 22.00 MANNING'S N = 0.010
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 5.51
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 2.20
 PIPE TRAVEL TIME(MIN.) = 0.07 Tc(MIN.) = 6.55
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 25.00 = 305.00 FEET.

 FLOW PROCESS FROM NODE 25.00 TO NODE 25.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====
 TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION(MIN.) = 6.55
 RAINFALL INTENSITY(INCH/HR) = 4.14
 AREA-AVERAGED Fm(INCH/HR) = 0.03
 AREA-AVERAGED Fp(INCH/HR) = 0.20
 AREA-AVERAGED Ap = 0.14
 EFFECTIVE STREAM AREA(ACRES) = 0.59
 TOTAL STREAM AREA(ACRES) = 0.59
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.20

 FLOW PROCESS FROM NODE 20.00 TO NODE 23.00 IS CODE = 21

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

=====
 INITIAL SUBAREA FLOW-LENGTH(FEET) = 173.00
 ELEVATION DATA: UPSTREAM(FEET) = 306.00 DOWNSTREAM(FEET) = 300.80

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000
 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.824
 SUBAREA Tc AND LOSS RATE DATA(AMC II):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
 COMMERCIAL D 0.07 0.20 0.100 75 5.00
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF(CFS) = 0.30

TOTAL AREA (ACRES) = 0.07 PEAK FLOW RATE (CFS) = 0.30

FLOW PROCESS FROM NODE 23.00 TO NODE 23.00 IS CODE = 81

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

=====

MAINLINE Tc (MIN.) = 5.00
* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 4.824
SUBAREA LOSS RATE DATA (AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"11+ DWELLINGS/ACRE" D 0.18 0.20 0.200 75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA AREA (ACRES) = 0.18 SUBAREA RUNOFF (CFS) = 0.77
EFFECTIVE AREA (ACRES) = 0.25 AREA-AVERAGED Fm (INCH/HR) = 0.03
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.17
TOTAL AREA (ACRES) = 0.2 PEAK FLOW RATE (CFS) = 1.08

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) = 297.80 DOWNSTREAM (FEET) = 297.60
FLOW LENGTH (FEET) = 21.00 MANNING'S N = 0.010
ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS 4.0 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 4.64
ESTIMATED PIPE DIAMETER (INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 1.08
PIPE TRAVEL TIME (MIN.) = 0.08 Tc (MIN.) = 5.08
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 24.00 = 194.00 FEET.

FLOW PROCESS FROM NODE 24.00 TO NODE 24.00 IS CODE = 81

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

=====

MAINLINE Tc (MIN.) = 5.08
* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 4.783
SUBAREA LOSS RATE DATA (AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
COMMERCIAL D 0.03 0.20 0.100 75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA (ACRES) = 0.03 SUBAREA RUNOFF (CFS) = 0.13
EFFECTIVE AREA (ACRES) = 0.28 AREA-AVERAGED Fm (INCH/HR) = 0.03
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.16
TOTAL AREA (ACRES) = 0.3 PEAK FLOW RATE (CFS) = 1.20

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) = 297.60 DOWNSTREAM (FEET) = 296.30
FLOW LENGTH (FEET) = 245.00 MANNING'S N = 0.010

ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 5.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 3.85
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 1.20
 PIPE TRAVEL TIME(MIN.) = 1.06 Tc(MIN.) = 6.14
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 25.00 = 439.00 FEET.

 FLOW PROCESS FROM NODE 25.00 TO NODE 25.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) = 6.14
 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.295
 SUBAREA LOSS RATE DATA(AMC II):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
 RESIDENTIAL
 "11+ DWELLINGS/ACRE" D 0.20 0.20 0.200 75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
 SUBAREA AREA(ACRES) = 0.20 SUBAREA RUNOFF(CFS) = 0.77
 EFFECTIVE AREA(ACRES) = 0.48 AREA-AVERAGED Fm(INCH/HR) = 0.04
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.18
 TOTAL AREA(ACRES) = 0.5 PEAK FLOW RATE(CFS) = 1.84

 FLOW PROCESS FROM NODE 25.00 TO NODE 25.00 IS CODE = 1

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

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 6.14
 RAINFALL INTENSITY(INCH/HR) = 4.30
 AREA-AVERAGED Fm(INCH/HR) = 0.04
 AREA-AVERAGED Fp(INCH/HR) = 0.20
 AREA-AVERAGED Ap = 0.18
 EFFECTIVE STREAM AREA(ACRES) = 0.48
 TOTAL STREAM AREA(ACRES) = 0.48
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.84

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	2.20	6.55	4.141	0.20(0.03)	0.14	0.6	20.00
2	1.84	6.14	4.295	0.20(0.04)	0.18	0.5	20.00

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	3.98	6.14	4.295	0.20(0.03)	0.16	1.0	20.00
2	3.97	6.55	4.141	0.20(0.03)	0.16	1.1	20.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 3.98 Tc(MIN.) = 6.14
 EFFECTIVE AREA(ACRES) = 1.03 AREA-AVERAGED Fm(INCH/HR) = 0.03
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.16

TOTAL AREA (ACRES) = 1.1
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 25.00 = 439.00 FEET.

FLOW PROCESS FROM NODE 25.00 TO NODE 25.00 IS CODE = 81

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

=====

MAINLINE Tc (MIN.) = 6.14
* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 4.295
SUBAREA LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "11+ DWELLINGS/ACRE"	D	0.12	0.20	0.200	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA AREA (ACRES) = 0.12 SUBAREA RUNOFF (CFS) = 0.46
EFFECTIVE AREA (ACRES) = 1.15 AREA-AVERAGED Fm (INCH/HR) = 0.03
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.16
TOTAL AREA (ACRES) = 1.2 PEAK FLOW RATE (CFS) = 4.42

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) = 296.30 DOWNSTREAM (FEET) = 274.00
FLOW LENGTH (FEET) = 60.00 MANNING'S N = 0.010
ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS 3.3 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 25.71
ESTIMATED PIPE DIAMETER (INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 4.42
PIPE TRAVEL TIME (MIN.) = 0.04 Tc (MIN.) = 6.18
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 26.00 = 499.00 FEET.

FLOW PROCESS FROM NODE 26.00 TO NODE 26.00 IS CODE = 81

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

=====

MAINLINE Tc (MIN.) = 6.18
* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 4.280
SUBAREA LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
NATURAL FAIR COVER "CHAPARRAL, BROADLEAF"	D	0.28	0.20	1.000	81

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA AREA (ACRES) = 0.28 SUBAREA RUNOFF (CFS) = 1.03
EFFECTIVE AREA (ACRES) = 1.43 AREA-AVERAGED Fm (INCH/HR) = 0.07
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.33
TOTAL AREA (ACRES) = 1.5 PEAK FLOW RATE (CFS) = 5.44

=====

END OF STUDY SUMMARY:
TOTAL AREA (ACRES) = 1.5 TC (MIN.) = 6.18
EFFECTIVE AREA (ACRES) = 1.43 AREA-AVERAGED Fm (INCH/HR) = 0.07
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.328
PEAK FLOW RATE (CFS) = 5.44

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	5.44	6.18	4.280	0.20 (0.07)	0.33	1.4	20.00
2	5.37	6.59	4.127	0.20 (0.06)	0.32	1.5	20.00

=====
=====
END OF RATIONAL METHOD ANALYSIS

100-YEAR

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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Analysis prepared by:

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

***** DESCRIPTION OF STUDY *****
* KHOSHBIN MILL CREEK PROPOSED CONDITION HYDROLOGY *
* 100-YEAR HYDROLOGY *
* BY KAM 011525 *

FILE NAME: KOSH.DAT
TIME/DATE OF STUDY: 16:11 01/15/2025

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

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

USER SPECIFIED STORM EVENT (YEAR) = 100.00
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) III 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- / PARK- 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	0.0313	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) = 240.00
ELEVATION DATA: UPSTREAM (FEET) = 312.40 DOWNSTREAM (FEET) = 309.20

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 6.456
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 5.344

SUBAREA Tc AND LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
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COMMERCIAL D 0.10 0.20 0.100 91 6.46
SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
SUBAREA RUNOFF(CFS) = 0.48
TOTAL AREA(ACRES) = 0.10 PEAK FLOW RATE(CFS) = 0.48

FLOW PROCESS FROM NODE 11.00 TO NODE 11.00 IS CODE = 81

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

=====

MAINLINE T_c (MIN.) = 6.46
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.344
SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN
RESIDENTIAL "11+ DWELLINGS/ACRE"	D	0.24	0.20	0.200	91

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.200
SUBAREA AREA(ACRES) = 0.24 SUBAREA RUNOFF(CFS) = 1.15
EFFECTIVE AREA(ACRES) = 0.34 AREA-AVERAGED F_m (INCH/HR) = 0.03
AREA-AVERAGED F_p (INCH/HR) = 0.20 AREA-AVERAGED A_p = 0.17
TOTAL AREA(ACRES) = 0.3 PEAK FLOW RATE(CFS) = 1.62

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) = 303.20 DOWNSTREAM(FEET) = 302.50
FLOW LENGTH(FEET) = 47.00 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.) = 6.11
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 1.62
PIPE TRAVEL TIME(MIN.) = 0.13 T_c (MIN.) = 6.58
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 287.00 FEET.

FLOW PROCESS FROM NODE 12.00 TO NODE 12.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 6.58
RAINFALL INTENSITY(INCH/HR) = 5.28
AREA-AVERAGED F_m (INCH/HR) = 0.03
AREA-AVERAGED F_p (INCH/HR) = 0.20
AREA-AVERAGED A_p = 0.17
EFFECTIVE STREAM AREA(ACRES) = 0.34
TOTAL STREAM AREA(ACRES) = 0.34
PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.62

FLOW PROCESS FROM NODE 10.00 TO NODE 13.00 IS CODE = 21

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

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 254.00
ELEVATION DATA: UPSTREAM(FEET) = 312.40 DOWNSTREAM(FEET) = 308.20

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 6.326
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.407
SUBAREA T_c AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS T_c
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL D 0.10 0.20 0.100 91 6.33
SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
SUBAREA RUNOFF(CFS) = 0.48
TOTAL AREA(ACRES) = 0.10 PEAK FLOW RATE(CFS) = 0.48

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

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

=====

MAINLINE T_c (MIN.) = 6.33
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.407
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"11+ DWELLINGS/ACRE" D 0.26 0.20 0.200 91
SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.200
SUBAREA AREA(ACRES) = 0.26 SUBAREA RUNOFF(CFS) = 1.26
EFFECTIVE AREA(ACRES) = 0.36 AREA-AVERAGED F_m (INCH/HR) = 0.03
AREA-AVERAGED F_p (INCH/HR) = 0.20 AREA-AVERAGED A_p = 0.17
TOTAL AREA(ACRES) = 0.4 PEAK FLOW RATE(CFS) = 1.74

FLOW PROCESS FROM NODE 13.00 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) = 302.70 DOWNSTREAM(FEET) = 302.50
FLOW LENGTH(FEET) = 11.00 MANNING'S N = 0.010
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS 4.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.68
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 1.74
PIPE TRAVEL TIME(MIN.) = 0.03 T_c (MIN.) = 6.35
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 265.00 FEET.

FLOW PROCESS FROM NODE 12.00 TO NODE 12.00 IS CODE = 1

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

=====

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 6.35
RAINFALL INTENSITY(INCH/HR) = 5.39
AREA-AVERAGED F_m (INCH/HR) = 0.03
AREA-AVERAGED F_p (INCH/HR) = 0.20
AREA-AVERAGED A_p = 0.17

EFFECTIVE STREAM AREA (ACRES) = 0.36
 TOTAL STREAM AREA (ACRES) = 0.36
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 1.74

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	1.62	6.58	5.285	0.20 (0.03)	0.17	0.3	10.00
2	1.74	6.35	5.394	0.20 (0.03)	0.17	0.4	10.00

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	3.34	6.35	5.394	0.20 (0.03)	0.17	0.7	10.00
2	3.33	6.58	5.285	0.20 (0.03)	0.17	0.7	10.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 3.34 Tc (MIN.) = 6.35
 EFFECTIVE AREA (ACRES) = 0.69 AREA-AVERAGED Fm (INCH/HR) = 0.03
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.17
 TOTAL AREA (ACRES) = 0.7
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 287.00 FEET.

 FLOW PROCESS FROM NODE 12.00 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) = 302.50 DOWNSTREAM (FEET) = 296.20
 FLOW LENGTH (FEET) = 103.00 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.) = 12.42
 ESTIMATED PIPE DIAMETER (INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW (CFS) = 3.34
 PIPE TRAVEL TIME (MIN.) = 0.14 Tc (MIN.) = 6.49
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 14.00 = 390.00 FEET.

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

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

=====

MAINLINE Tc (MIN.) = 6.49
 * 100 YEAR RAINFALL INTENSITY (INCH/HR) = 5.328
 SUBAREA LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.14	0.20	0.100	91

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA AREA (ACRES) = 0.14 SUBAREA RUNOFF (CFS) = 0.67
 EFFECTIVE AREA (ACRES) = 0.83 AREA-AVERAGED Fm (INCH/HR) = 0.03
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.16
 TOTAL AREA (ACRES) = 0.8 PEAK FLOW RATE (CFS) = 3.95

 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) = 296.20 DOWNSTREAM(FEET) = 294.30
FLOW LENGTH(FEET) = 45.00 MANNING'S N = 0.010
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS 5.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 11.33
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 3.95
PIPE TRAVEL TIME(MIN.) = 0.07 Tc(MIN.) = 6.56
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 15.00 = 435.00 FEET.

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

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

=====

MAINLINE Tc(MIN.) = 6.56
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.297
SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.10	0.20	0.100	91

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.10 SUBAREA RUNOFF(CFS) = 0.47
EFFECTIVE AREA(ACRES) = 0.93 AREA-AVERAGED Fm(INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.15
TOTAL AREA(ACRES) = 0.9 PEAK FLOW RATE(CFS) = 4.40

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) = 294.30 DOWNSTREAM(FEET) = 292.30
FLOW LENGTH(FEET) = 50.00 MANNING'S N = 0.010
DEPTH OF FLOW IN 12.0 INCH PIPE IS 5.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 11.42
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 4.40
PIPE TRAVEL TIME(MIN.) = 0.07 Tc(MIN.) = 6.63
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 16.00 = 485.00 FEET.

FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 21

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

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 262.00
ELEVATION DATA: UPSTREAM(FEET) = 306.00 DOWNSTREAM(FEET) = 301.70

Tc = K * [(LENGTH** 3.00) / (ELEVATION CHANGE)] ** 0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 6.414
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.364
SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	D	0.13	0.20	0.100	91	6.41

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF (CFS) = 0.63
TOTAL AREA (ACRES) = 0.13 PEAK FLOW RATE (CFS) = 0.63

FLOW PROCESS FROM NODE 21.00 TO NODE 21.00 IS CODE = 81

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

=====

MAINLINE Tc (MIN.) = 6.41
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 5.364
SUBAREA LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.06	0.20	0.100	91

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA (ACRES) = 0.06 SUBAREA RUNOFF (CFS) = 0.29
EFFECTIVE AREA (ACRES) = 0.19 AREA-AVERAGED Fm (INCH/HR) = 0.02
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
TOTAL AREA (ACRES) = 0.2 PEAK FLOW RATE (CFS) = 0.91

FLOW PROCESS FROM NODE 21.00 TO NODE 21.00 IS CODE = 81

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

=====

MAINLINE Tc (MIN.) = 6.41
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 5.364
SUBAREA LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "11+ DWELLINGS/ACRE"	D	0.26	0.20	0.200	91

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA AREA (ACRES) = 0.26 SUBAREA RUNOFF (CFS) = 1.25
EFFECTIVE AREA (ACRES) = 0.45 AREA-AVERAGED Fm (INCH/HR) = 0.03
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.16
TOTAL AREA (ACRES) = 0.4 PEAK FLOW RATE (CFS) = 2.16

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) = 296.70 DOWNSTREAM (FEET) = 296.50
FLOW LENGTH (FEET) = 21.00 MANNING'S N = 0.010
DEPTH OF FLOW IN 12.0 INCH PIPE IS 5.9 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 5.58
ESTIMATED PIPE DIAMETER (INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 2.16
PIPE TRAVEL TIME (MIN.) = 0.06 Tc (MIN.) = 6.48
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 22.00 = 283.00 FEET.

FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 81

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

=====

MAINLINE Tc (MIN.) = 6.48
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 5.334

SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.14	0.20	0.100	91

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA AREA(ACRES) = 0.14 SUBAREA RUNOFF(CFS) = 0.67
 EFFECTIVE AREA(ACRES) = 0.59 AREA-AVERAGED Fm(INCH/HR) = 0.03
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.14
 TOTAL AREA(ACRES) = 0.6 PEAK FLOW RATE(CFS) = 2.82

 FLOW PROCESS FROM NODE 22.00 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) = 296.50 DOWNSTREAM(FEET) = 296.30
 FLOW LENGTH(FEET) = 22.00 MANNING'S N = 0.010
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 7.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 5.84
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 2.82
 PIPE TRAVEL TIME(MIN.) = 0.06 Tc(MIN.) = 6.54
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 25.00 = 305.00 FEET.

 FLOW PROCESS FROM NODE 25.00 TO NODE 25.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION(MIN.) = 6.54
 RAINFALL INTENSITY(INCH/HR) = 5.31
 AREA-AVERAGED Fm(INCH/HR) = 0.03
 AREA-AVERAGED Fp(INCH/HR) = 0.20
 AREA-AVERAGED Ap = 0.14
 EFFECTIVE STREAM AREA(ACRES) = 0.59
 TOTAL STREAM AREA(ACRES) = 0.59
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.82

 FLOW PROCESS FROM NODE 20.00 TO NODE 23.00 IS CODE = 21

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

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 173.00
 ELEVATION DATA: UPSTREAM(FEET) = 306.00 DOWNSTREAM(FEET) = 300.80

Tc = K * [(LENGTH** 3.00) / (ELEVATION CHANGE)] ** 0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 6.187
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	D	0.07	0.20	0.100	91	5.00

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF(CFS) = 0.39
 TOTAL AREA(ACRES) = 0.07 PEAK FLOW RATE(CFS) = 0.39

FLOW PROCESS FROM NODE 23.00 TO NODE 23.00 IS CODE = 81

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

MAINLINE Tc(MIN.) = 5.00
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 6.187
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"11+ DWELLINGS/ACRE" D 0.18 0.20 0.200 91
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA AREA(ACRES) = 0.18 SUBAREA RUNOFF(CFS) = 1.00
EFFECTIVE AREA(ACRES) = 0.25 AREA-AVERAGED Fm(INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.17
TOTAL AREA(ACRES) = 0.2 PEAK FLOW RATE(CFS) = 1.38

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) = 297.80 DOWNSTREAM(FEET) = 297.60
FLOW LENGTH(FEET) = 21.00 MANNING'S N = 0.010
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
DEPTH OF FLOW IN 12.0 INCH PIPE IS 4.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.96
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 1.38
PIPE TRAVEL TIME(MIN.) = 0.07 Tc(MIN.) = 5.07
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 24.00 = 194.00 FEET.

FLOW PROCESS FROM NODE 24.00 TO NODE 24.00 IS CODE = 81

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

MAINLINE Tc(MIN.) = 5.07
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 6.138
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
COMMERCIAL D 0.03 0.20 0.100 91
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.03 SUBAREA RUNOFF(CFS) = 0.17
EFFECTIVE AREA(ACRES) = 0.28 AREA-AVERAGED Fm(INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.16
TOTAL AREA(ACRES) = 0.3 PEAK FLOW RATE(CFS) = 1.54

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) = 297.60 DOWNSTREAM(FEET) = 296.30
FLOW LENGTH(FEET) = 245.00 MANNING'S N = 0.010
DEPTH OF FLOW IN 12.0 INCH PIPE IS 5.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.12

 FLOW PROCESS FROM NODE 25.00 TO NODE 25.00 IS CODE = 81

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

MAINLINE Tc(MIN.) = 6.06
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.541
 SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
 RESIDENTIAL
 "11+ DWELLINGS/ACRE" D 0.12 0.20 0.200 91
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
 SUBAREA AREA(ACRES) = 0.12 SUBAREA RUNOFF(CFS) = 0.59
 EFFECTIVE AREA(ACRES) = 1.15 AREA-AVERAGED Fm(INCH/HR) = 0.03
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.16
 TOTAL AREA(ACRES) = 1.2 PEAK FLOW RATE(CFS) = 5.69

 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) = 296.30 DOWNSTREAM(FEET) = 274.00
 FLOW LENGTH(FEET) = 60.00 MANNING'S N = 0.010
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 3.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 27.61
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 5.69
 PIPE TRAVEL TIME(MIN.) = 0.04 Tc(MIN.) = 6.10
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 26.00 = 499.00 FEET.

 FLOW PROCESS FROM NODE 26.00 TO NODE 26.00 IS CODE = 81

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

MAINLINE Tc(MIN.) = 6.10
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.522
 SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
 NATURAL FAIR COVER
 "CHAPARRAL,BROADLEAF" D 0.28 0.20 1.000 95
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
 SUBAREA AREA(ACRES) = 0.28 SUBAREA RUNOFF(CFS) = 1.34
 EFFECTIVE AREA(ACRES) = 1.43 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.33
 TOTAL AREA(ACRES) = 1.5 PEAK FLOW RATE(CFS) = 7.01

 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES) = 1.5 TC(MIN.) = 6.10
 EFFECTIVE AREA(ACRES) = 1.43 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.329
 PEAK FLOW RATE(CFS) = 7.01

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
---------------	---------	-----------	---------------------	------------------	------------	------------	----------------

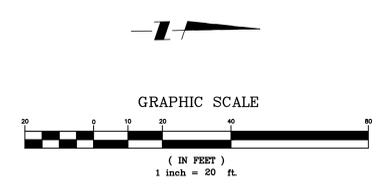
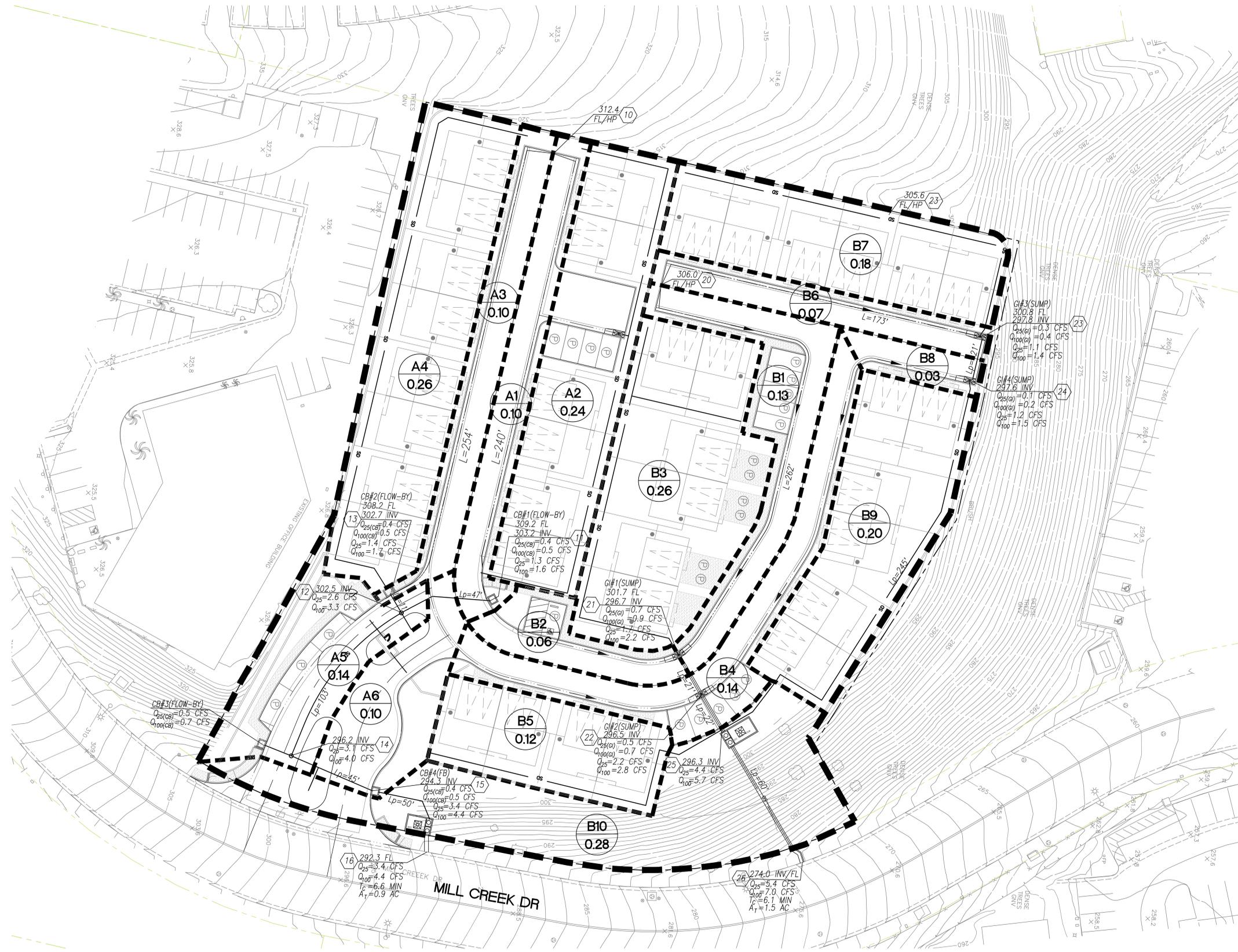
1	7.01	6.10	5.522	0.20 (0.07)	0.33	1.4	20.00
2	6.91	6.58	5.288	0.20 (0.06)	0.32	1.5	20.00

=====

END OF RATIONAL METHOD ANALYSIS

HYDROLOGY MAP

S:\110501.00\dwg\PREV\005-PROPOSED HYDROLOGY.dwg 1/15/25



LEGEND

- WATERSHED BOUNDARY
- - - SUB-AREA BOUNDARY
- FLOWLINE AND DIRECTION OF FLOW
- SUBAREA LABEL
- AREA (ACRES)
- NODE NUMBER
- Q25 25-YEAR PEAK FLOW IN CFS
- Q100 100-YEAR PEAK FLOW IN CFS
- WS 100 100-YEAR PEAK FLOW WATER SURFACE ELEVATION
- QCONP 100-YEAR CONFLUENCE PEAK FLOW IN CFS
- TC 100-YEAR TIME OF CONCENTRATION (100-YEAR STORM) IN MIN
- MIN MINUTES
- CFS CUBIC FEET PER SECOND
- EG EXISTING GRADE ELEVATION
- FG FINISH GRADE ELEVATION
- FS FINISH SURFACE ELEVATION
- FL FLOW LINE ELEVATION
- INV INVERT OF PIPE
- L=870' LENGTH OF FLOWPATH IN FEET
- Lp=92' LENGTH OF PIPE IN FEET

NO.	DATE	REVISIONS

DESIGNED BY:	ES
DRAFTED BY:	ES
CHECKED BY:	KM
DATE:	1/25

WILSON MIKAMI CORPORATION
 9 CORPORATE PARK, SUITE 100
 IRVINE, CA 92606
 T: 949-679-0090

LAGUNA HILLS
KHOSHBIN MILL CREEK PROPERTY
PROPOSED CONDITION HYDROLOGY MAP

PROJECT NO.
10501.00

SHEET **1**
 OF **1**

APPENDIX C

UNIT HYDROGRAPH EXISTING CONDITION

Unit Hydrograph Analysis

Copyright (c) CIVILCADD/CIVILDESIGN, 1989-2018, Version 9.0

Study date 01/17/25 File Name exkosh.out

+++++

Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6615

KHOSHBIN MILL CREEK
EXISTING CONDITION UNIT HYDROGRAPH 100-YEAR 24-HOUR
BY KAM 011525

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

+++++

***** Area-averaged max loss rate, Fm *****

Table with 7 columns: SCS curve No., Area (Ac.), Area Fraction, Soil Group, Fp (In/Hr), Ap (dec.), Fm (In/Hr). Row 1: 75.0, 2.4, 1.00, D, 0.200, 0.220, 0.044

Area-averaged adjusted loss rate Fm (In/Hr) = 0.044

***** Area-Averaged low loss rate fraction, Yb *****

Table with 6 columns: Area (Ac.), Area Fract, SCS CN (AMC2), SCS CN (AMC3), S, Pervious Yield Fr. Row 1: 0.53, 0.220, 75.0, 91.0, 0.99, 0.816. Row 2: 1.87, 0.780, 98.0, 98.0, 0.20, 0.958

Area-averaged catchment yield fraction, Y = 0.927

Area-averaged low loss fraction, Yb = 0.073

+++++

Direct entry of lag time by user

Watershed area = 2.40 (Ac.)

Catchment Lag time = 0.085 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 97.6944

Hydrograph baseflow = 0.00 (CFS)

Average maximum watershed loss rate (Fm) = 0.044 (In/Hr)

Average low loss rate fraction (Yb) = 0.073 (decimal)

FOOTHILL S-Graph Selected

Computed peak 5-minute rainfall = 0.520 (In)

Computed peak 30-minute rainfall = 1.090 (In)

Specified peak 1-hour rainfall = 1.450 (In)

Computed peak 3-hour rainfall = 2.430 (In)

Specified peak 6-hour rainfall = 3.360(In)
 Specified peak 24-hour rainfall = 5.630(In)

Rainfall depth area reduction factors:
 Using a total area of 2.40(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.520(In)
 30-minute factor = 1.000 Adjusted rainfall = 1.090(In)
 1-hour factor = 1.000 Adjusted rainfall = 1.450(In)
 3-hour factor = 1.000 Adjusted rainfall = 2.430(In)
 6-hour factor = 1.000 Adjusted rainfall = 3.360(In)
 24-hour factor = 1.000 Adjusted rainfall = 5.630(In)

U n i t H y d r o g r a p h

+++++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 29.02 (CFS))		
1	13.614	3.952
2	69.070	16.096
3	87.941	5.478
4	95.642	2.235
5	98.353	0.787
6	99.235	0.256
7	99.824	0.171
8	100.000	0.051

Total soil rain loss = 0.35(In)
 Total effective rainfall = 5.28(In)
 Peak flow rate in flood hydrograph = 10.00(CFS)

+++++

24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	5.0	10.0	15.0	20.0
0+ 5	0.0002	0.03	Q				
0+10	0.0011	0.14	Q				
0+15	0.0023	0.17	Q				
0+20	0.0036	0.19	Q				
0+25	0.0049	0.19	Q				
0+30	0.0063	0.20	Q				
0+35	0.0077	0.20	Q				
0+40	0.0090	0.20	Q				
0+45	0.0104	0.20	Q				
0+50	0.0118	0.20	Q				
0+55	0.0132	0.20	Q				
1+ 0	0.0146	0.20	Q				
1+ 5	0.0160	0.20	Q				
1+10	0.0174	0.20	Q				
1+15	0.0188	0.20	Q				
1+20	0.0202	0.21	Q				
1+25	0.0216	0.21	Q				

1+30	0.0230	0.21	Q				
1+35	0.0245	0.21	Q				
1+40	0.0259	0.21	Q				
1+45	0.0273	0.21	QV				
1+50	0.0288	0.21	QV				
1+55	0.0302	0.21	QV				
2+ 0	0.0317	0.21	QV				
2+ 5	0.0332	0.21	QV				
2+10	0.0346	0.21	QV				
2+15	0.0361	0.21	QV				
2+20	0.0376	0.21	QV				
2+25	0.0390	0.22	QV				
2+30	0.0405	0.22	QV				
2+35	0.0420	0.22	QV				
2+40	0.0435	0.22	QV				
2+45	0.0450	0.22	QV				
2+50	0.0465	0.22	QV				
2+55	0.0481	0.22	QV				
3+ 0	0.0496	0.22	QV				
3+ 5	0.0511	0.22	QV				
3+10	0.0526	0.22	QV				
3+15	0.0542	0.22	Q V				
3+20	0.0557	0.22	Q V				
3+25	0.0573	0.23	Q V				
3+30	0.0588	0.23	Q V				
3+35	0.0604	0.23	Q V				
3+40	0.0620	0.23	Q V				
3+45	0.0636	0.23	Q V				
3+50	0.0652	0.23	Q V				
3+55	0.0667	0.23	Q V				
4+ 0	0.0683	0.23	Q V				
4+ 5	0.0700	0.23	Q V				
4+10	0.0716	0.23	Q V				
4+15	0.0732	0.24	Q V				
4+20	0.0748	0.24	Q V				
4+25	0.0764	0.24	Q V				
4+30	0.0781	0.24	Q V				
4+35	0.0797	0.24	Q V				
4+40	0.0814	0.24	Q V				
4+45	0.0831	0.24	Q V				
4+50	0.0847	0.24	Q V				
4+55	0.0864	0.24	Q V				
5+ 0	0.0881	0.25	Q V				
5+ 5	0.0898	0.25	Q V				
5+10	0.0915	0.25	Q V				
5+15	0.0932	0.25	Q V				
5+20	0.0949	0.25	Q V				
5+25	0.0967	0.25	Q V				
5+30	0.0984	0.25	Q V				
5+35	0.1001	0.25	Q V				
5+40	0.1019	0.25	Q V				
5+45	0.1037	0.26	Q V				
5+50	0.1054	0.26	Q V				
5+55	0.1072	0.26	Q V				
6+ 0	0.1090	0.26	Q V				
6+ 5	0.1108	0.26	Q V				
6+10	0.1126	0.26	Q V				
6+15	0.1144	0.26	Q V				
6+20	0.1163	0.27	Q V				
6+25	0.1181	0.27	Q V				
6+30	0.1200	0.27	Q V				
6+35	0.1218	0.27	Q V				
6+40	0.1237	0.27	Q V				

6+45	0.1256	0.27	Q	V				
6+50	0.1274	0.27	Q	V				
6+55	0.1293	0.28	Q	V				
7+ 0	0.1313	0.28	Q	V				
7+ 5	0.1332	0.28	Q	V				
7+10	0.1351	0.28	Q	V				
7+15	0.1371	0.28	Q	V				
7+20	0.1390	0.28	Q	V				
7+25	0.1410	0.29	Q	V				
7+30	0.1430	0.29	Q	V				
7+35	0.1449	0.29	Q	V				
7+40	0.1470	0.29	Q	V				
7+45	0.1490	0.29	Q	V				
7+50	0.1510	0.29	Q	V				
7+55	0.1530	0.30	Q	V				
8+ 0	0.1551	0.30	Q	V				
8+ 5	0.1572	0.30	Q	V				
8+10	0.1592	0.30	Q	V				
8+15	0.1613	0.30	Q	V				
8+20	0.1634	0.31	Q	V				
8+25	0.1656	0.31	Q	V				
8+30	0.1677	0.31	Q	V				
8+35	0.1698	0.31	Q	V				
8+40	0.1720	0.31	Q	V				
8+45	0.1742	0.32	Q	V				
8+50	0.1764	0.32	Q	V				
8+55	0.1786	0.32	Q	V				
9+ 0	0.1808	0.32	Q	V				
9+ 5	0.1831	0.33	Q	V				
9+10	0.1853	0.33	Q	V				
9+15	0.1876	0.33	Q	V				
9+20	0.1899	0.33	Q	V				
9+25	0.1922	0.34	Q	V				
9+30	0.1946	0.34	Q	V				
9+35	0.1969	0.34	Q	V				
9+40	0.1993	0.34	Q	V				
9+45	0.2017	0.35	Q	V				
9+50	0.2041	0.35	Q	V				
9+55	0.2065	0.35	Q	V				
10+ 0	0.2090	0.36	Q	V				
10+ 5	0.2114	0.36	Q	V				
10+10	0.2139	0.36	Q	V				
10+15	0.2164	0.36	Q	V				
10+20	0.2190	0.37	Q	V				
10+25	0.2215	0.37	Q	V				
10+30	0.2241	0.38	Q	V				
10+35	0.2267	0.38	Q	V				
10+40	0.2294	0.38	Q	V				
10+45	0.2320	0.39	Q	V				
10+50	0.2347	0.39	Q	V				
10+55	0.2374	0.39	Q	V				
11+ 0	0.2401	0.40	Q	V				
11+ 5	0.2429	0.40	Q	V				
11+10	0.2457	0.41	Q	V				
11+15	0.2485	0.41	Q	V				
11+20	0.2514	0.41	Q	V				
11+25	0.2542	0.42	Q	V				
11+30	0.2572	0.42	Q	V				
11+35	0.2601	0.43	Q	V				
11+40	0.2631	0.43	Q	V				
11+45	0.2661	0.44	Q	V				
11+50	0.2692	0.44	Q	V				
11+55	0.2723	0.45	Q	V				

12+ 0	0.2754	0.45	Q	V			
12+ 5	0.2787	0.48	Q	V			
12+10	0.2825	0.55	Q	V			
12+15	0.2864	0.58	Q	V			
12+20	0.2905	0.59	Q	V			
12+25	0.2947	0.60	Q	V			
12+30	0.2989	0.61	Q	V			
12+35	0.3032	0.62	Q	V			
12+40	0.3075	0.63	Q	V			
12+45	0.3119	0.64	Q	V			
12+50	0.3163	0.65	Q	V			
12+55	0.3208	0.65	Q	V			
13+ 0	0.3254	0.66	Q	V			
13+ 5	0.3300	0.67	Q	V			
13+10	0.3347	0.68	Q	V			
13+15	0.3395	0.69	Q	V			
13+20	0.3443	0.70	Q	V			
13+25	0.3493	0.71	Q	V			
13+30	0.3543	0.73	Q	V			
13+35	0.3593	0.74	Q	V			
13+40	0.3645	0.75	Q	V			
13+45	0.3698	0.76	Q	V			
13+50	0.3752	0.78	Q	V			
13+55	0.3806	0.79	Q	V			
14+ 0	0.3862	0.81	Q	V			
14+ 5	0.3919	0.83	Q	V			
14+10	0.3978	0.85	Q	V			
14+15	0.4037	0.87	Q	V			
14+20	0.4099	0.89	Q	V			
14+25	0.4162	0.91	Q	V			
14+30	0.4226	0.94	Q	V			
14+35	0.4292	0.96	Q	V			
14+40	0.4361	0.99	Q	V			
14+45	0.4431	1.02	Q	V			
14+50	0.4503	1.05	Q	V			
14+55	0.4578	1.09	Q	V			
15+ 0	0.4656	1.13	Q	V			
15+ 5	0.4737	1.17	Q	V			
15+10	0.4821	1.23	Q	V			
15+15	0.4910	1.28	Q	V			
15+20	0.5003	1.35	Q	V			
15+25	0.5099	1.40	Q	V			
15+30	0.5195	1.39	Q	V			
15+35	0.5296	1.46	Q	V			
15+40	0.5407	1.61	Q	V			
15+45	0.5530	1.78	Q	V			
15+50	0.5673	2.08	Q	V			
15+55	0.5844	2.48	Q	V			
16+ 0	0.6074	3.35	Q	V			
16+ 5	0.6467	5.71	Q	V			
16+10	0.7156	10.00		Q	V		
16+15	0.7515	5.21		Q	V		
16+20	0.7734	3.18	Q		V		
16+25	0.7881	2.13	Q		V		
16+30	0.7999	1.71	Q		V		
16+35	0.8101	1.48	Q		V		
16+40	0.8190	1.30	Q		V		
16+45	0.8271	1.17	Q		V		
16+50	0.8345	1.08	Q		V		
16+55	0.8415	1.01	Q		V		
17+ 0	0.8481	0.96	Q			V	
17+ 5	0.8543	0.91	Q			V	
17+10	0.8602	0.86	Q			V	

17+15	0.8659	0.82	Q				V	
17+20	0.8713	0.79	Q				V	
17+25	0.8766	0.76	Q				V	
17+30	0.8816	0.73	Q				V	
17+35	0.8865	0.71	Q				V	
17+40	0.8913	0.69	Q				V	
17+45	0.8959	0.67	Q				V	
17+50	0.9004	0.65	Q				V	
17+55	0.9047	0.63	Q				V	
18+ 0	0.9090	0.62	Q				V	
18+ 5	0.9130	0.59	Q				V	
18+10	0.9165	0.51	Q				V	
18+15	0.9198	0.47	Q				V	
18+20	0.9229	0.45	Q				V	
18+25	0.9259	0.44	Q				V	
18+30	0.9289	0.43	Q				V	
18+35	0.9317	0.42	Q				V	
18+40	0.9346	0.41	Q				V	
18+45	0.9373	0.40	Q				V	
18+50	0.9400	0.39	Q				V	
18+55	0.9427	0.38	Q				V	
19+ 0	0.9453	0.38	Q				V	
19+ 5	0.9478	0.37	Q				V	
19+10	0.9503	0.36	Q				V	
19+15	0.9528	0.36	Q				V	
19+20	0.9552	0.35	Q				V	
19+25	0.9576	0.35	Q				V	
19+30	0.9599	0.34	Q				V	
19+35	0.9622	0.34	Q				V	
19+40	0.9645	0.33	Q				V	
19+45	0.9667	0.33	Q				V	
19+50	0.9689	0.32	Q				V	
19+55	0.9711	0.32	Q				V	
20+ 0	0.9733	0.31	Q				V	
20+ 5	0.9754	0.31	Q				V	
20+10	0.9775	0.30	Q				V	
20+15	0.9795	0.30	Q				V	
20+20	0.9816	0.30	Q				V	
20+25	0.9836	0.29	Q				V	
20+30	0.9856	0.29	Q				V	
20+35	0.9875	0.28	Q				V	
20+40	0.9895	0.28	Q				V	
20+45	0.9914	0.28	Q				V	
20+50	0.9933	0.28	Q				V	
20+55	0.9952	0.27	Q				V	
21+ 0	0.9970	0.27	Q				V	
21+ 5	0.9988	0.27	Q				V	
21+10	1.0007	0.26	Q				V	
21+15	1.0025	0.26	Q				V	
21+20	1.0042	0.26	Q				V	
21+25	1.0060	0.26	Q				V	
21+30	1.0077	0.25	Q				V	
21+35	1.0095	0.25	Q				V	
21+40	1.0112	0.25	Q				V	
21+45	1.0129	0.25	Q				V	
21+50	1.0145	0.24	Q				V	
21+55	1.0162	0.24	Q				V	
22+ 0	1.0178	0.24	Q				V	
22+ 5	1.0195	0.24	Q				V	
22+10	1.0211	0.23	Q				V	
22+15	1.0227	0.23	Q				V	
22+20	1.0243	0.23	Q				V	
22+25	1.0259	0.23	Q				V	

22+30	1.0274	0.23	Q				V
22+35	1.0290	0.23	Q				V
22+40	1.0305	0.22	Q				V
22+45	1.0320	0.22	Q				V
22+50	1.0336	0.22	Q				V
22+55	1.0351	0.22	Q				V
23+ 0	1.0366	0.22	Q				V
23+ 5	1.0380	0.21	Q				V
23+10	1.0395	0.21	Q				V
23+15	1.0410	0.21	Q				V
23+20	1.0424	0.21	Q				V
23+25	1.0438	0.21	Q				V
23+30	1.0453	0.21	Q				V
23+35	1.0467	0.21	Q				V
23+40	1.0481	0.20	Q				V
23+45	1.0495	0.20	Q				V
23+50	1.0509	0.20	Q				V
23+55	1.0523	0.20	Q				V
24+ 0	1.0536	0.20	Q				V

APPENDIX D

UNIT HYDROGRAPH PROPOSED CONDITION

Unit Hydrograph Analysis

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Study date 01/17/25 File Name PRKOSH.out

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Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6615

KHOSHBIN MILL CREEK DEVELOPMENT
PROPOSED CONDITION UNIT HYDROGRAPH 100-YEAR 24 HOUR STORM EVENT
BY KAM 011525

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

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***** Area-averaged max loss rate, Fm *****

Table with 7 columns: SCS curve No. (AMCII), Area (Ac.), Area Fraction, Soil Group, Fp (In/Hr), Ap (dec.), Fm (In/Hr). Row 1: 75.0, 2.4, 1.00, D, 0.200, 0.260, 0.052

Area-averaged adjusted loss rate Fm (In/Hr) = 0.052

***** Area-Averaged low loss rate fraction, Yb *****

Table with 6 columns: Area (Ac.), Area Fract, SCS CN (AMC2), SCS CN (AMC3), S, Pervious Yield Fr. Row 1: 0.62, 0.260, 75.0, 91.0, 0.99, 0.816. Row 2: 1.78, 0.740, 98.0, 98.0, 0.20, 0.958

Area-averaged catchment yield fraction, Y = 0.921

Area-averaged low loss fraction, Yb = 0.079

+++++

User entry of time of concentration = 0.088 (hours)

Watershed area = 2.40 (Ac.)

Catchment Lag time = 0.070 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 118.3712

Hydrograph baseflow = 0.00 (CFS)

Average maximum watershed loss rate (Fm) = 0.052 (In/Hr)

Average low loss rate fraction (Yb) = 0.079 (decimal)

FOOTHILL S-Graph Selected

Computed peak 5-minute rainfall = 0.520 (In)

Computed peak 30-minute rainfall = 1.090 (In)

Specified peak 1-hour rainfall = 1.450 (In)

Computed peak 3-hour rainfall = 2.430 (In)

Specified peak 6-hour rainfall = 3.360(In)
 Specified peak 24-hour rainfall = 5.630(In)

Rainfall depth area reduction factors:
 Using a total area of 2.40(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.520(In)
 30-minute factor = 1.000 Adjusted rainfall = 1.090(In)
 1-hour factor = 1.000 Adjusted rainfall = 1.450(In)
 3-hour factor = 1.000 Adjusted rainfall = 2.430(In)
 6-hour factor = 1.000 Adjusted rainfall = 3.360(In)
 24-hour factor = 1.000 Adjusted rainfall = 5.630(In)

U n i t H y d r o g r a p h

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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 29.02 (CFS))		
1	20.855	6.053
2	76.963	16.285
3	92.690	4.565
4	97.911	1.515
5	99.199	0.374
6	100.000	0.233

Total soil rain loss = 0.38(In)
 Total effective rainfall = 5.25(In)
 Peak flow rate in flood hydrograph = 10.00(CFS)

24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0003	0.04	Q				
0+10	0.0013	0.15	Q				
0+15	0.0026	0.18	Q				
0+20	0.0039	0.19	Q				
0+25	0.0052	0.19	Q				
0+30	0.0066	0.20	Q				
0+35	0.0079	0.20	Q				
0+40	0.0093	0.20	Q				
0+45	0.0107	0.20	Q				
0+50	0.0121	0.20	Q				
0+55	0.0134	0.20	Q				
1+ 0	0.0148	0.20	Q				
1+ 5	0.0162	0.20	Q				
1+10	0.0176	0.20	Q				
1+15	0.0190	0.20	Q				
1+20	0.0204	0.20	Q				
1+25	0.0218	0.20	Q				
1+30	0.0232	0.21	Q				
1+35	0.0247	0.21	Q				

1+40	0.0261	0.21	Q				
1+45	0.0275	0.21	QV				
1+50	0.0290	0.21	QV				
1+55	0.0304	0.21	QV				
2+ 0	0.0318	0.21	QV				
2+ 5	0.0333	0.21	QV				
2+10	0.0348	0.21	QV				
2+15	0.0362	0.21	QV				
2+20	0.0377	0.21	QV				
2+25	0.0392	0.21	QV				
2+30	0.0406	0.21	QV				
2+35	0.0421	0.22	QV				
2+40	0.0436	0.22	QV				
2+45	0.0451	0.22	QV				
2+50	0.0466	0.22	QV				
2+55	0.0481	0.22	QV				
3+ 0	0.0496	0.22	QV				
3+ 5	0.0512	0.22	QV				
3+10	0.0527	0.22	Q V				
3+15	0.0542	0.22	Q V				
3+20	0.0558	0.22	Q V				
3+25	0.0573	0.22	Q V				
3+30	0.0589	0.23	Q V				
3+35	0.0604	0.23	Q V				
3+40	0.0620	0.23	Q V				
3+45	0.0636	0.23	Q V				
3+50	0.0651	0.23	Q V				
3+55	0.0667	0.23	Q V				
4+ 0	0.0683	0.23	Q V				
4+ 5	0.0699	0.23	Q V				
4+10	0.0715	0.23	Q V				
4+15	0.0731	0.23	Q V				
4+20	0.0747	0.24	Q V				
4+25	0.0764	0.24	Q V				
4+30	0.0780	0.24	Q V				
4+35	0.0796	0.24	Q V				
4+40	0.0813	0.24	Q V				
4+45	0.0830	0.24	Q V				
4+50	0.0846	0.24	Q V				
4+55	0.0863	0.24	Q V				
5+ 0	0.0880	0.24	Q V				
5+ 5	0.0897	0.25	Q V				
5+10	0.0914	0.25	Q V				
5+15	0.0931	0.25	Q V				
5+20	0.0948	0.25	Q V				
5+25	0.0965	0.25	Q V				
5+30	0.0982	0.25	IQ V				
5+35	0.1000	0.25	IQ V				
5+40	0.1017	0.25	IQ V				
5+45	0.1035	0.25	IQ V				
5+50	0.1052	0.26	IQ V				
5+55	0.1070	0.26	IQ V				
6+ 0	0.1088	0.26	IQ V				
6+ 5	0.1106	0.26	IQ V				
6+10	0.1124	0.26	IQ V				
6+15	0.1142	0.26	IQ V				
6+20	0.1160	0.26	IQ V				
6+25	0.1178	0.27	IQ V				
6+30	0.1197	0.27	IQ V				
6+35	0.1215	0.27	IQ V				
6+40	0.1234	0.27	IQ V				
6+45	0.1252	0.27	IQ V				
6+50	0.1271	0.27	IQ V				

6+55	0.1290	0.27	Q	V				
7+ 0	0.1309	0.28	Q	V				
7+ 5	0.1328	0.28	Q	V				
7+10	0.1347	0.28	Q	V				
7+15	0.1367	0.28	Q	V				
7+20	0.1386	0.28	Q	V				
7+25	0.1406	0.28	Q	V				
7+30	0.1426	0.29	Q	V				
7+35	0.1445	0.29	Q	V				
7+40	0.1465	0.29	Q	V				
7+45	0.1485	0.29	Q	V				
7+50	0.1506	0.29	Q	V				
7+55	0.1526	0.29	Q	V				
8+ 0	0.1546	0.30	Q	V				
8+ 5	0.1567	0.30	Q	V				
8+10	0.1588	0.30	Q	V				
8+15	0.1608	0.30	Q	V				
8+20	0.1629	0.30	Q	V				
8+25	0.1651	0.31	Q	V				
8+30	0.1672	0.31	Q	V				
8+35	0.1693	0.31	Q	V				
8+40	0.1715	0.31	Q	V				
8+45	0.1737	0.32	Q	V				
8+50	0.1758	0.32	Q	V				
8+55	0.1780	0.32	Q	V				
9+ 0	0.1803	0.32	Q	V				
9+ 5	0.1825	0.32	Q	V				
9+10	0.1848	0.33	Q	V				
9+15	0.1870	0.33	Q	V				
9+20	0.1893	0.33	Q	V				
9+25	0.1916	0.33	Q	V				
9+30	0.1939	0.34	Q	V				
9+35	0.1963	0.34	Q	V				
9+40	0.1986	0.34	Q	V				
9+45	0.2010	0.35	Q	V				
9+50	0.2034	0.35	Q	V				
9+55	0.2058	0.35	Q	V				
10+ 0	0.2083	0.35	Q	V				
10+ 5	0.2107	0.36	Q	V				
10+10	0.2132	0.36	Q	V				
10+15	0.2157	0.36	Q	V				
10+20	0.2182	0.37	Q	V				
10+25	0.2208	0.37	Q	V				
10+30	0.2234	0.37	Q	V				
10+35	0.2260	0.38	Q	V				
10+40	0.2286	0.38	Q	V				
10+45	0.2312	0.38	Q	V				
10+50	0.2339	0.39	Q	V				
10+55	0.2366	0.39	Q	V				
11+ 0	0.2393	0.40	Q	V				
11+ 5	0.2421	0.40	Q	V				
11+10	0.2449	0.40	Q	V				
11+15	0.2477	0.41	Q	V				
11+20	0.2505	0.41	Q	V				
11+25	0.2534	0.42	Q	V				
11+30	0.2563	0.42	Q	V				
11+35	0.2592	0.43	Q	V				
11+40	0.2622	0.43	Q	V				
11+45	0.2652	0.44	Q	V				
11+50	0.2683	0.44	Q	V				
11+55	0.2713	0.45	Q	V				
12+ 0	0.2745	0.45	Q	V				
12+ 5	0.2778	0.48	Q	V				

12+10	0.2816	0.56	Q	V			
12+15	0.2856	0.58	Q	V			
12+20	0.2897	0.59	Q	V			
12+25	0.2939	0.60	Q	V			
12+30	0.2981	0.61	Q	V			
12+35	0.3023	0.62	Q	V			
12+40	0.3067	0.63	Q	V			
12+45	0.3110	0.63	Q	V			
12+50	0.3155	0.64	Q	V			
12+55	0.3199	0.65	Q	V			
13+ 0	0.3245	0.66	Q	V			
13+ 5	0.3291	0.67	Q	V			
13+10	0.3338	0.68	Q	V			
13+15	0.3386	0.69	Q	V			
13+20	0.3434	0.70	Q	V			
13+25	0.3483	0.71	Q	V			
13+30	0.3533	0.72	Q	V			
13+35	0.3584	0.74	Q	V			
13+40	0.3635	0.75	Q	V			
13+45	0.3688	0.76	Q	V			
13+50	0.3741	0.78	Q	V			
13+55	0.3796	0.79	Q	V			
14+ 0	0.3852	0.81	Q	V			
14+ 5	0.3909	0.83	Q	V			
14+10	0.3967	0.85	Q	V			
14+15	0.4027	0.87	Q	V			
14+20	0.4088	0.89	Q	V			
14+25	0.4151	0.91	Q	V			
14+30	0.4216	0.94	Q	V			
14+35	0.4282	0.96	Q	V			
14+40	0.4350	0.99	Q	V			
14+45	0.4420	1.02	Q	V			
14+50	0.4493	1.06	Q	V			
14+55	0.4568	1.09	Q	V			
15+ 0	0.4646	1.13	Q	V			
15+ 5	0.4727	1.18	Q	V			
15+10	0.4812	1.23	Q	V			
15+15	0.4901	1.29	Q	V			
15+20	0.4994	1.36	Q	V			
15+25	0.5090	1.39	Q	V			
15+30	0.5186	1.39	Q	V			
15+35	0.5287	1.47	Q	V			
15+40	0.5398	1.62	Q	V			
15+45	0.5523	1.81	Q	V			
15+50	0.5670	2.12	Q	V			
15+55	0.5848	2.58	Q	V			
16+ 0	0.6091	3.54	Q	V			
16+ 5	0.6545	6.58	Q	V			
16+10	0.7233	10.00	Q	V			
16+15	0.7556	4.69	Q	V			
16+20	0.7745	2.74	Q	V			
16+25	0.7873	1.86	Q	V			
16+30	0.7983	1.61	Q	V			
16+35	0.8077	1.36	Q	V			
16+40	0.8162	1.23	Q	V			
16+45	0.8240	1.13	Q	V			
16+50	0.8312	1.05	Q	V			
16+55	0.8381	0.99	Q	V			
17+ 0	0.8445	0.94	Q	V			
17+ 5	0.8506	0.89	Q	V			
17+10	0.8564	0.85	Q	V			
17+15	0.8620	0.81	Q	V			
17+20	0.8674	0.78	Q	V			

17+25	0.8725	0.75	Q				V	
17+30	0.8775	0.72	Q				V	
17+35	0.8823	0.70	Q				V	
17+40	0.8870	0.68	Q				V	
17+45	0.8916	0.66	Q				V	
17+50	0.8960	0.64	Q				V	
17+55	0.9003	0.63	Q				V	
18+ 0	0.9045	0.61	Q				V	
18+ 5	0.9084	0.57	Q				V	
18+10	0.9118	0.49	Q				V	
18+15	0.9150	0.46	Q				V	
18+20	0.9181	0.44	Q				V	
18+25	0.9210	0.43	Q				V	
18+30	0.9239	0.42	Q				V	
18+35	0.9268	0.41	Q				V	
18+40	0.9296	0.40	Q				V	
18+45	0.9323	0.40	Q				V	
18+50	0.9350	0.39	Q				V	
18+55	0.9376	0.38	Q				V	
19+ 0	0.9401	0.37	Q				V	
19+ 5	0.9427	0.37	Q				V	
19+10	0.9452	0.36	Q				V	
19+15	0.9476	0.35	Q				V	
19+20	0.9500	0.35	Q				V	
19+25	0.9523	0.34	Q				V	
19+30	0.9547	0.34	Q				V	
19+35	0.9569	0.33	Q				V	
19+40	0.9592	0.33	Q				V	
19+45	0.9614	0.32	Q				V	
19+50	0.9636	0.32	Q				V	
19+55	0.9658	0.31	Q				V	
20+ 0	0.9679	0.31	Q				V	
20+ 5	0.9700	0.30	Q				V	
20+10	0.9720	0.30	Q				V	
20+15	0.9741	0.30	Q				V	
20+20	0.9761	0.29	Q				V	
20+25	0.9781	0.29	Q				V	
20+30	0.9801	0.29	Q				V	
20+35	0.9820	0.28	Q				V	
20+40	0.9839	0.28	Q				V	
20+45	0.9858	0.28	Q				V	
20+50	0.9877	0.27	Q				V	
20+55	0.9896	0.27	Q				V	
21+ 0	0.9914	0.27	Q				V	
21+ 5	0.9932	0.26	Q				V	
21+10	0.9950	0.26	Q				V	
21+15	0.9968	0.26	Q				V	
21+20	0.9986	0.26	Q				V	
21+25	1.0003	0.25	Q				V	
21+30	1.0020	0.25	Q				V	
21+35	1.0038	0.25	Q				V	
21+40	1.0055	0.25	Q				V	
21+45	1.0071	0.24	Q				V	
21+50	1.0088	0.24	Q				V	
21+55	1.0104	0.24	Q				V	
22+ 0	1.0121	0.24	Q				V	
22+ 5	1.0137	0.24	Q				V	
22+10	1.0153	0.23	Q				V	
22+15	1.0169	0.23	Q				V	
22+20	1.0185	0.23	Q				V	
22+25	1.0200	0.23	Q				V	
22+30	1.0216	0.23	Q				V	
22+35	1.0231	0.22	Q				V	

22+40	1.0246	0.22	Q				V
22+45	1.0262	0.22	Q				V
22+50	1.0277	0.22	Q				V
22+55	1.0292	0.22	Q				V
23+ 0	1.0306	0.21	Q				V
23+ 5	1.0321	0.21	Q				V
23+10	1.0336	0.21	Q				V
23+15	1.0350	0.21	Q				V
23+20	1.0364	0.21	Q				V
23+25	1.0379	0.21	Q				V
23+30	1.0393	0.21	Q				V
23+35	1.0407	0.20	Q				V
23+40	1.0421	0.20	Q				V
23+45	1.0435	0.20	Q				V
23+50	1.0448	0.20	Q				V
23+55	1.0462	0.20	Q				V
24+ 0	1.0476	0.20	Q				V
