Preliminary Water Quality Management Plan (PWQMP)

Project Name:

Tentative Tract Map No. 19298

Prepared for:

The Olson Company

3010 Old Ranch Parkway, Suite 100

Seal Beach, CA 90740

(562) 596-4770

Prepared by:

Advanced Civil Group, Inc.

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3RD REVIEW 3-15-24
NO EXCEPTION TAKEN
Robert Righetti
Land Use Review

Date Prepared: 2/22/2024

Project Owner's Certification

Permit/Application No.		Grading Permit No.	
Tract/Parcel Map No.	TTM No. 19298	Building Permit No.	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract)			090-671-07

This Preliminary Water Quality Management Plan (PWQMP) has been prepared for The Olson Company by Advanced Civil Group, Inc.. The PWQMP is intended to comply with the requirements of the local NPDES Stormwater Program requiring the preparation of the plan and the requirements of the California Environmental Quality Act (CEQA) to assess impacts and propose appropriate mitigation during the entitlement process.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of the final plan and will ensure that the final 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 Final Water Quality Management Plan (WQMP). An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

Each Project WQMP will be stored within the City's files, and will continue with the property after the completion of the construction phase, and the City will require that the terms, conditions and requirements be recorded with the County Recorder's office by the property owner or any successive owner as authorized by the Water Quality Ordinance. The City will also require the Project Final WQMP to include a Notice of Transfer Responsibility Form, which serves to notify the City that a change in ownership has occurred and notify the new owner of its responsibility to continue implementing the Project Final WQMP.

The final Project WQMP must include calculations to support the structural integrity of the selected LID or treatment control BMP as appropriate and be prepared by or under the direction of a California Registered Civil Engineer and affixed with their stamp.

Owner:			
Title	VP, Operational Planning		
Company	The Olson Company		
Address	3010 Old Ranch Parkway, Suite 100 Seal Beach, CA 90740		
Email	tmoore@theolsonco.com		
Telephone #	(562) 596-4770		
Signature		Date	

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Attachments

Section I Discretionary Permit(s) and Water Quality Conditions

Provide discretionary permit and water quality information. *Refer to Section 2.1 in the Technical Guidance Document (TGD) available from the Orange County Stormwater Program (ocwatersheds.com).*

Project Infomation			
Permit/Application No.		Tract/Parcel Map No.	TTM No. 19298
Additional Information/ Comments:	This Preliminary Water Quality Management Plan (PWQMP) is prepared to satisfy the requirements of the current Orange County Drainage Area Management Plan (DAMP) and the requirements of the California Environmental Quality Act (CEQA) for the entitlement processing of the project to determine impacts of the project and recommend mitigation to address the impacts during entitlement review. Approval of this preliminary plan does not imply final approval of the Final Project Water Quality Management Plan, nor the associated final grading plan for the project.		
Water Quality Conditions			
Water Quality Conditions (list verbatim)	A geotechnical study prepared by a registered geotechnical engineer is required. The report shall analyze the liquefaction potential of the site and make recommendations. The report shall analyze sub-surface issues related to the past uses of the site, including sub-surface tanks and basement and septic facilities. Any soil or groundwater contamination shall be remediated prior to the issuance of a building permit in a manner meeting the approval of the City Engineer in concert with the Orange County Health Department. The report shall make recommendations for pavement design the interior streets and parking spaces. The report shall also test and analyze soil conditions for LID (Low Impact Development) principles and implementations, including potential infiltration alternatives, soil compaction, saturation, permeability and groundwater levels. a. WQMP i. Prior to the issuance of any grading or building permits or prior to recordation upon subdivision of land if determined applicable by the City Building Official, the applicant shall submit to the City for review and approval a Water Quality Management Plan that:		

	Addresses Site Design BMPs such as minimizing impervious areas, maximizing permeability, minimizing directly connected impervious areas, creating reduced or "zero discharge" areas, and conserving natural areas Incorporates the applicable Routine Source Control BMPs as defined in the DAMP Incorporates structural and Treatment Control BMPs as defined in the DAMP • Generally describes the long-term operation and maintenance requirements for the Treatment Control BMPs Identifies the entity that will be responsible for long-term operation and maintenance of the Treatment Control BMPs Describes the mechanism for funding the long-term operation and maintenance of the Treatment Control BMPs. 2. Prior to grading or building permit closeout and/or the issuance of a certificate of use or a certificate of occupancy, the applicant shall: Demonstrate that all structural best management practices (BMPs)described in the Project WQMP have been constructed and installed in conformance with approved plans and specifications Demonstrate that applicant is prepared to implement all non-structural BMPs described in the Project WQMP Demonstrate that an adequate number of copies of the approved Project WQMP are available onsite Submit for review and approval by the City an Operations and Maintenance (O&M) Plan for all structural BMPs
Watershed-Based Plan Conditions	
Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS.	There is currently no approved WIHMP for the project area watershed. 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 of the Permittees.

Section II Project Description

II.1 Project Description

Description of Proposed Project		
Development Category (Verbatim from WQMP):	Priority Project All significant redevelopment projects, where significant redevelopment is defined as the addition or replacement of 5,000 or more square feet of impervious surface on an already developed site. Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of the facility, or emergency redevelopment activity required to protect public health and safety. If the redevelopment results in the addition or replacement of less than 50 percent of the impervious area on-site and the existing development was not subject to WQMP requirement, the numeric sizing criteria discussed in Section 7.II-2.0 only applies to the addition or replacement area. If the addition or replacement accounts for 50 percent or more of the impervious area, the Project WQMP requirements apply to the entire development.	
Project Area (ft^2): 38,422	Number of Dwelling Units: 15	SIC Code: Not Applicable
Narrative Project Description:	Under proposed conditions, the site will be developed for residential use and plans to consist of 15 detached residential townhomes. Associated interior driveways and private drive, common area landscaping, surface parking spaces along the private drive, perimeter walls, and underground utilities are proposed. Landscaped areas are both common – open space maintained by HOA – and private yards maintained by homeowner. There will not be any residential features that are of particular water quality concern proposed for the project, such as swimming pools, trash enclosures, outdoor storage areas, or recreational facilities of note. The project will not have any of the items listed above. The proposed project does not include any right-of-ways that will incorporate green street design to address water quality, as the LID BMPs proposed for the project site meet or exceed the benefits of what green streets would otherwise achieve.	

Project Area	Pervious		Impervious	
	Area (acres or sq ft)	Percentage	Area (acres or sq ft)	Percentage
Pre-Project Conditions	24,829 sq ft	64.8%	13,593 sq ft	35.2%
Post-Project Conditions	8,276 sq ft	21.6%	30,146 sq ft	78.4%
Drainage Patterns/Connections	The site is relatively flat with elevations ranging from EL 93 to EL 97 above Mean Sea Level. Drainage is directed as sheet flow to the west and into Newhope Street. Runoff then flows as curb and gutter flows along Newhope Street south about 500 feet to a catch basin. The MS4 then flows south into a storm drain channel just north of the 22 Highway (OCFCD CO5S10). The channel drains southeast and confluences with a larger channel, East Garden Grove Wintersburg Channel draining south and southwest (OCFCD CO5) to the Anaheim Bay / Huntington Harbor and ultimately to the Pacific Ocean.			

II.2 Potential Stormwater Pollutants

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

II.3 Hydrologic Conditions of Concern

☒ No – Show map

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

The project is not susceptible to hydromodification impacts because all downstream receiving waters, are considered stabilized. See map provided below, where the project site is clearly outside of the area of susceptibility shaded in blue. Therefore, there area no HCOC's for the project.

The proposed project is not within a hydrologic condition of concern area and will have a very minor increase in runoff (less than 1 cfs in the 100 year event) in the developed condition. For these reasons, the proposed project runoff will not negatively impact properties downstream and will not negatively impact the downstream drainage system.

II.4 Post Development Drainage Characteristics

Describe post development drainage characteristics. Refer *to Section 2.2.4 in the TGD.*

In the post-development condition, the proposed project will maintain existing drainage patterns. The site's runoff is collected in drive gutters and area drains and conveyed in a westerly direction towards the project entrance. On-site storm drain inlets with grates and Full Trash Capture certified inserts (to ensure trash does not enter system and to meet requirements of the Statewide Trash Amendment, Full Capture System definition, part b (P. E-9)) collect the runoff and convey LID flows to an underground storage system and deep infiltration dry well for infiltration below the surface parking on the south side of the entrance. High flows continue west in a new storm drain connection to the existing storm drain in Newhope Street. There are no negative impacts to downstream properties or downstream drainage systems. All trash generated by the project will be placed in private trash cans with lids that are to be stored in the private unit garages. There is no planned common trash enclosure.

II.5 Property Ownership/Management

Describe property ownership/management. *Refer to Section 2.2.5 in the TGD.*

A Homeowners Association (HOA) will be formed upon project completion. The HOA will be responsible for inspecting and maintaining all BMPs prescribed for Tentative Tract No. 19298 at 12828 Newhope Street. Until an HOA is formally established, The Olson Company shall assume all BMP maintenance and inspection responsibilities for the proposed project. Inspection and maintenance responsibilities are outlined in Section V of this report. No infrastructure will be transferred to any public agencies.

Section III Site Description

III.1 Physical Setting

Fill out table with relevant information. *Refer to Section 2.3.1 in the TGD.*

Planning Area/ Community Name	Tentative Tract No. 19298
Location/Address	12828 Newhope Street
	Garden Grove, CA
Land Use	Medium Density Residential
Zoning	
Acreage	0.88 acres / 38,422 sq ft
Predominant Soil Type	The site geotechnical report prepared by Albus and Associates on June 6, 2023 found the predominant soils to be coarse-grained material consisting of sands with variable amounts of silt and clay, and sandy clay. The Natural Resources Conservation Service (NRCS) identifies the site as having Hydrologic Soil Type B.

III.2 Site Characteristics

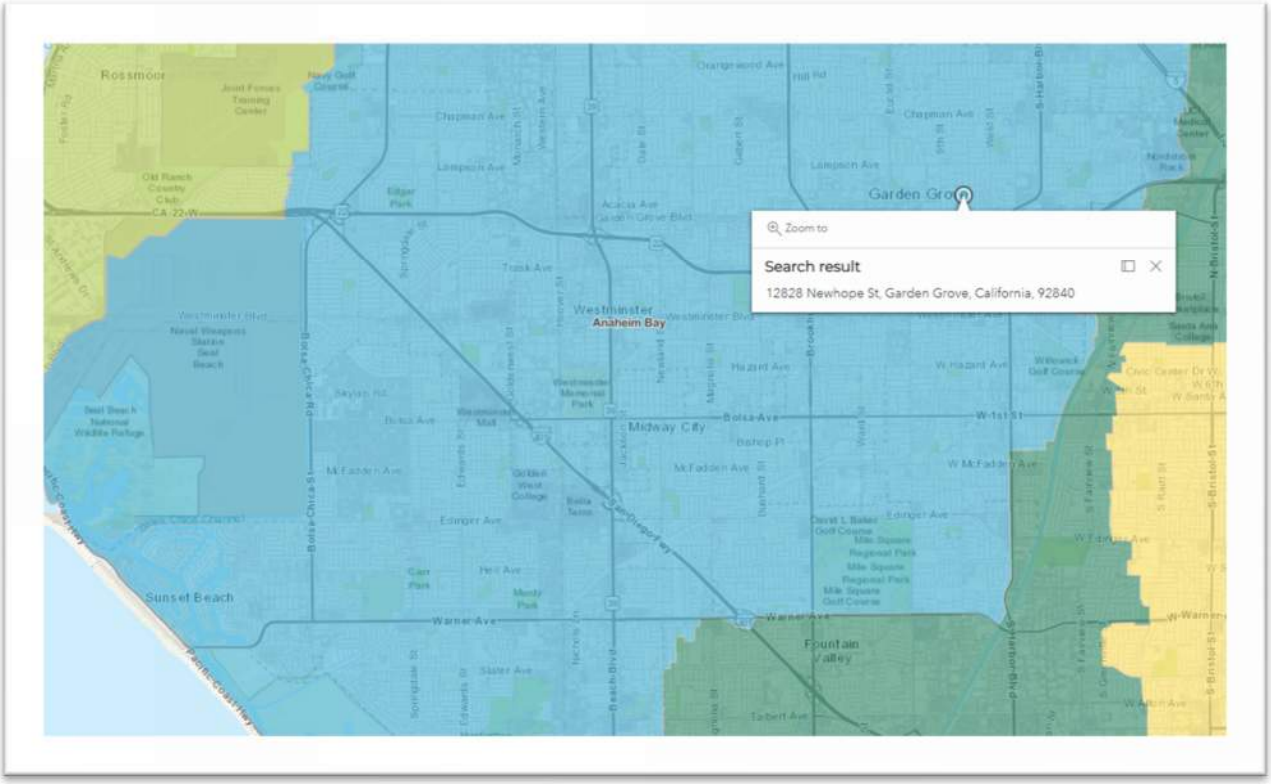
Precipitation Zone	0.78 inches
Topography	Relatively flat terrain with a slight grade to the west. Outside of any significant topography and not located within a potential landslide area.
Drainage Patterns/Connections	In the post-development condition, the proposed project will maintain existing drainage patterns. The site's runoff is collected in drive gutters and area drains and conveyed in a westerly direction towards the project entrance. On-site storm drain inlets collect the runoff and convey LID flows to an underground storage system and deep infiltration well for infiltration below the surface parking on the south side of the entrance. High flows continue west in a new storm drain connection to the existing storm drain in Newhope Street.
Soil Type, Geology, and Infiltration Properties	Artificial fill material was observed in soil borings and are anticipated to be generally 2 feet deep. Deeper portions of artificial fill may be encountered in localized areas. A retaining wall exists along all sides of the property lines and retains approximately 2 feet at the northwest and southwest corners before tapering off heading south and east. The artificial fill materials observed onsite are typically silty sands that are damp to very moist, loose to medium dense, and gray. Young alluvial fan deposits (Qyfa) were encountered below the fill materials to the maximum depths explored of 51.5 feet. The materials were typically interbedded with a predominance of coarse-grained materials. Deeper portions of the alluvial fan deposits were observed to be cohesive. The materials consisted of sands with variable amounts of silt and clay, and sandy clay, which were very moist and loose to dense and very stiff to hard. Soils located within the upper 35 feet are primarily sandy in nature with relatively high infiltration rates.

Site Characteristics (continued)	
Hydrogeologic (Groundwater) Conditions	Groundwater was encountered at 37 feet below the existing grade during subsurface exploration to a depth of 51.5 feet. The CDMG Special Report 003 suggests that historic high groundwater for the subject site is about 10 feet below the ground surface. The geotechnical engineer researched online groundwater well data in the California Department of Water Resources database and found three wells located around the site (north, east, and west). The locations of the three wells are depicted in Figure 2. Data from these wells spans from 1970 to 2023. The recorded depths to groundwater from these wells are plotted in in the Geotech report. All three wells indicate that groundwater has remained below a depth of 45 feet since 1970, except for one measurement on May 1, 1979. This measurement may be an error considering other data. Except for this measurement, all measured groundwater depths are deeper than 45 feet. Based on the data from these wells, the water encountered in our borings is likely a shallower perched condition that is hydraulically separate from a deeper aquifer being measured by the local wells. A zone of finer-grained interlayers are present below a depth of 35 feet which may be impeding flow of water downward to a deeper aquifer.
Geotechnical Conditions (relevant to infiltration)	Groundwater was encountered at 37 feet below the ground surface at the time of our investigation although literature indicates historical levels as shallow as 10 feet. As with most areas in southern California, ground water levels have generally been dropping due to water extraction and historical shallow levels are unlikely to occur in the future. Given the unusually high rainfall this past season, the current groundwater levels likely represent a relatively shallow condition over the last few decades. We estimate that future groundwater levels during the life of the project are unlikely to be shallower than 35 feet. Soils located within the upper 35 feet are primarily sandy in nature with relatively high infiltration rates. Below a depth of 35 feet, materials encountered were predominately interbedded coarse-grained and fine grained soils that will tend to impede groundwater infiltration. Based on this condition, dry wells are feasible for use in infiltrating storm water. However, wells will need to be limited to a depth of 25 feet. Please note that a proposed dry well may be required to be registered with the EPA as a Class V injection well. Please see Attachment E - Dry Wells (Uses, Regulations, & Guidelines in California & Elsewhere)
Off-Site Drainage	No off-site drainage enters the project site.
Utility and Infrastructure Information	There are no existing subsurface utilities that will impact the location of LIDBMPs on-site. Any existing utilities will be removed and/or replaced

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 TGD.*

Receiving Waters	- Anaheim Bay
303(d) Listed Impairments	- Anaheim Bay: Nickel, Toxicity, PCBs
Applicable TMDLs	- Anaheim Bay: Copper, Bacteria
Pollutants of Concern for the Project	Expected pollutants from attached residential developments include sediment, nutrients, pathogens, pesticides, oil & grease, and trash. Based on the 303(d) listed impairments and TMDLs for the project's receiving waters, the pollutants of concern are pathogens.
Environmentally Sensitive and Special Biological Significant Areas	There are no ESA's or ASBS within the projects vicinity.



Section IV Best Management Practices (BMPs)

IV. 1 Project Performance Criteria

(NOC Permit Area only) Is there an approved WIHMP or equivalent for the project area that includes more stringent LID feasibility criteria or if there are opportunities identified for implementing LID on regional or sub-regional basis?		YES ☐	NO ☒
If yes, describe WIHMP feasibility criteria or regional/sub-regional LID opportunities.	Not Applicable		

Project Performance Criteria (continued)	
If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	As explained in Section II.3 of this report, the proposed project is not located within an area that is hydromodification susceptible. All downstream receiving waters are considered stabilized. Therefore, HCOCs do not exist for the proposed project.
List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP)	Infiltrate, harvest and use, evapotranspire, or biotreat/biofilter, the 85th percentile, 24-hour storm event (Design Capture Volume). LID BMPs must be designed to retain, on-site, (infiltrate, harvest and use, or evapotranspire) storm water runoff up to 80 percent average annual capture efficiency. The proposed project will infiltrate the entire DCV via underground infiltration in a deep well.
List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP)	If it is not feasible to meet LID performance criteria through retention and/or biotreatment provided on-site or at a sub-regional/regional scale, then treatment control BMPs shall be provided on-site or offsite prior to discharge to waters of the US. Sizing of treatment control BMP(s) shall be based on either the unmet volume after claiming applicable water quality credits, if appropriate. Treatment control BMPs are not required, since the DCV will be biotreated.
Calculate LID design storm capture volume for Project.	$DCV = C \times d \times A \times 43560\ sf/ac \times 1/12\ in/ft$ Where: DCV = runoff volume during the design storm event, cu-ft C = runoff coefficient = $(0.75 \times imp + 0.15)$ imp = impervious fraction of drainage area (ranges from 0 to 1) d = storm depth (inches) A = tributary area (acres) DCV = 0.74 x 0.78 in x 0.88 acres x 43560 sf/ac × 1/12 in/ft DCV = $\underline{2{,}095\ ft^3}$

IV.2. SITE DESIGN AND DRAINAGE PLAN

Minimize Impervious Area

Hardscape is minimized on the property where imperviousness is 82.1%. Also, infiltration BMPs will be implemented for the project to offset the site's imperviousness.

Preserve Existing Drainage Patterns

Existing drainage patterns will be preserved as indicated. The site will drain in a westerly direction as in existing conditions.

Disconnect Impervious Areas

Area drain inlets are located within landscape areas. As such, building roof drains will drain to landscaping before collecting into the area drains.

Landscape Design

Drought tolerant plants will be utilized in the project's landscape design.

The design capture volumes (DCV) for each DMA are summarized in the table below. These have been derived utilizing the "Simple Design Capture Volume Sizing Method" in accordance with the TGD. Actual BMP sizing requirements, drawdown, depths, and other design details specific to subsurface infiltration are provided in Section IV.3.2 below. Locations of DMAs and associated LID and treatment BMPs are identified on the exhibits in Section VI. Additional calculations and TGD Worksheets are provided in Attachment A.

DRAINAGE MANAGEMENT AREAS (DMA's)					
DMA ID	Tributary Drainage Area (ac)	% Imp.	Design Storm Depth (in.)	Design Capture Volume (ft^3)	Tributary LID BMP's
1	0.88 ac	78%	0.78	2,095 ft^3	Infiltration Dry Well Volume = 2,095 ft3

IV.3 LID BMP SELECTION AND PROJECT CONFORMANCE ANALYSIS

Low Impact Development (LID) BMPs are required in addition to site design measures and source controls to reduce pollutants in storm water discharges. LID BMPs are engineered facilities that are designed to retain or biotreat runoff on the project site. The 4th Term MS4 Storm Water Permit (Order R9-2009-0009) requires the evaluation and use of LID features using the following hierarchy of treatment: infiltration, evapotranspiration, harvest/reuse, and biotreatment.

It has been determined that infiltration is feasible for the proposed project due to measured infiltration rates being greater than 0.3 inches per hour. The measured rate was 1.4 in/hr. Therefore, infiltration BMPs will be used to treat the project's DCV. Specific details are provided in the following sub-sections.

IV.3.1 Hydrologic Source Controls

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	☐
Impervious area dispersion (e.g. roof top disconnection)	☐
Street trees (canopy interception)	☐
Residential rain barrels (not actively managed)	☐
Green roofs/Brown roofs	☐
Blue roofs	☐
Impervious area reduction (e.g. permeable pavers, site design)	☐
Other:	☐

No HSCs are proposed for the project site. The DCV will be addressed through infiltration, as discussed below.

IV.3.2 Infiltration BMPs

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

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

Preliminary analyses indicate that a dry well could likely provide a peak measured infiltration flow of approximately 0.038 cfs and the chamber empties within approximately 2.5 hours. The typical dry well is estimated to be 25 feet deep. The estimated Design Capture Volume (DCV) will be about 2,500 cu ft. Assuming a factor of safety of 3.0 applied to our estimated flow rate of the dry well, we estimate the DCV can be treated within the required 72 hours using one dry well. We also estimate the system will require an additional retention storage of about 2,200 cubic feet placed upstream of the dry well. This retention storage can be accommodated by pipe or vault systems. Further percolation testing and/or evaluation may be necessary based on review of preliminary WQMP design plans.

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	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Residential Site
N6	Local Industrial Permit Compliance	☐	☒	Residential Site
N7	Spill Contingency Plan	☐	☒	Residential Site
N8	Underground Storage Tank Compliance	☐	☒	No USTs proposed
N9	Hazardous Materials Disclosure Compliance	☐	☒	No Hazardous Wastes
N10	Uniform Fire Code Implementation	☐	☒	No Hazardous Wastes
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	No loading docks proposed
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	No RGOs proposed.

N1, Education for Property Owners, Tenants and Occupants

Educational materials related to urban runoff can be provided to homeowners (via project owner or HOA) and employees to reduce pollutants from reaching the storm drain system. Examples of environmental awareness materials include, but are not limited to: guidelines for landscaping and gardening, tips for pet care, vehicle cleaning, and proper disposal of household hazardous waste.

N2, Activity Restrictions

Activity restrictions can be developed to restrict activities that have the potential to create adverse impacts on water quality. Activities include but are not limited to: the handling and disposal of contaminants, trash management and litter control, irrigation and landscaping practices, vehicle and equipment cleaning, fertilizer applications and household waste management practices.

N3, Common Area Landscape Management

Common area landscape management will include minimizing fertilizer and pesticide application, use of slow-release fertilizers, maintenance activities, providing education to homeowners (via project owner and/or HOA), and providing education and training for employees on management of landscape materials and storm water management. Maintenance shall be conducted on a monthly basis at a minimum.

N4, BMP Maintenance

In accordance with the City LIP and OC DAMP, the project owners and/or HOA of the site will be responsible for the implementation and maintenance of each applicable non-structural BMP, as well as scheduling inspections and maintenance of all applicable structural BMP facilities through its landscape contractor and any other necessary maintenance contractors for the project site. In addition, the project owner will be required to verify treatment control BMP implementation and ongoing maintenance through inspection, self-certification, or other equally effective measure. The certification shall verify that, at a minimum, the inspection and maintenance of all structural BMPs has occurred prior to the start of the rainy season, and in accordance with frequencies outlined in the PWQMP prepared for the project. Maintenance frequencies are identified in Section V and shall be implemented upon completion of the project.

N11, Common Area Litter Control

Regular litter control for the entire project area shall be performed including trash pick-up on a weekly basis, and sweeping of littered common areas, as performed by the maintenance crew. In addition, pet waste receptacles will be provided throughout the project site where applicable. Proper signage regarding litter will be posted on or near trash receptacles and trash bins will have lids if not covered by canopy.

N12, Employee Training

Employees of the owner and/or HOA, as well as any contractors of the aforementioned entities will require training to ensure that employees are aware of activities that may result in pollutants reaching the storm drain. Training shall be conducted on an annual basis to ensure proper maintenance activities and daily activities are occurring.

N14, Common Area Catch Basin Inspection

Employees of the owner and/or HOA, as well as any contractors of the aforementioned entities will require training to ensure that employees are aware of activities that may result in pollutants reaching the storm drain. Training shall be conducted on an annual basis to ensure proper maintenance activities and daily activities are occurring.

N15, Street Sweeping Private Streets and Parking Lots

Street sweeping of all impervious streets and parking lots performed at a frequency that reduces or prevents sediment and debris from entering receiving waters, monthly at a minimum, and prior to the rainy season.

IV.3.9 Structural Source Control BMPs

The table below indicates all BMPs to be incorporated in the project. For those designated as not applicable (N/A), a brief explanation why is provided.

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

S1/SD-13, Provide storm drain system stenciling and signage

Storm drain stenciling or signage on all catch basins with the highly visible source control message "No Dumping Drains to Ocean". This includes catch basins and grate inlets near pedestrian areas or drive aisles. Stencils shall be inspected annually and replaced as needed.

S4/SD-12, Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control

Installing and maintaining efficient irrigation systems designed to minimize water by eliminating overspray to hardscape areas, and setting irrigation timing and cycle lengths in accordance with water demands, given time of year, weather, and day and night temperatures. Where feasible, includes incorporation of native tolerant species for landscaping, protection of slopes and efficient irrigation. May be used in conjunction with educational materials to homeowners as well as activity restrictions.

IV.4 ALTERNATIVE COMPLIANCE PLAN (IF APPLICABLE)

IV.4.1 Water Quality Credits

Not applicable, water quality credits do not apply to this project. LID BMPs will be utilized for water quality treatment on-site in accordance with the MS4 Permit hierarchy identified at the beginning of this Section.

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

IV.4.2 Alternative Compliance Plan Information

Not applicable. LID BMPs will be utilized for water quality treatment on-site in accordance with the MS4 Permit hierarchy identified at the beginning of this Section.

Section V Inspection/Maintenance Responsibility for BMPs

It has been determined that The Olson Company shall assume all BMP inspection and maintenance responsibilities for the Tentative Tract No. 19298 project.

Contact Name:	Tom Moore
Title:	VP, Operational Planning
Company:	The Olson Company
Address:	3010 Old Ranch Parkway, Suite 100 Seal Beach, CA 90740
Phone:	(562) 682-7422
Email:	Tmoore@theolsonco.com

Should the maintenance responsibility be transferred at any time during the operational life of Tentative Tract No. 19298, such as when an HOA or POA is formed for a project, a formal notice of transfer shall be submitted to the City of Garden Grove at the time responsibility of the property subject to this PWQMP is transferred. The transfer of responsibility shall be incorporated into this PWQMP as an amendment.

The Owner shall verify BMP implementation and ongoing maintenance through inspection, self-certification, survey, or other equally effective measure. The certification shall verify that, at a minimum, the inspection and maintenance of all structural BMPs including inspection and performance of any required maintenance in the late summer / early fall, prior to the start of the rainy season. A form that may be used to record implementation, maintenance, and inspection of BMPs is included in Attachment C. The O&M Plan will be recorded in the Orange County Clerk-Recorder's Office prior to close-out of grading/building permits.

The City of Garden Grove may conduct verifications to assure that implementation and appropriate maintenance of structural and non-structural BMPs prescribed within this PWQMP is taking place at the project site. The Owner shall retain operations, inspections and maintenance records of these BMPs and they will be made available to the City upon request. All records must be maintained for at least five (5) years after the recorded inspection date for the lifetime of the project.
Long term funding for operations and maintenance of BMPs will be generated through HOA fees. Until an HOA is established, the Owner will provide funding for O&M. CC&Rs specifying BMP maintenance requirements of the HOA and annual HOA BMP Inspection and Maintenance budget will be finalized and submitted to the City for final review.

BMP Inspection/Maintenance

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
INFILTRATION BMPs			
R-Tank underground storage	Owner/ HOA	See Attachment C for manufacturer's O&M Manual. Inspect as required. If sediment is at or above 3 inches (lower row of sidewall holes), clean out using JetVac process.	Every 6 months in the first year, then Annually thereafter. Per Manufacturer's Recommendations
NON-STRUCTURAL SOURCE CONTROL BMPs			
Education for Property Owners, Tenants and Occupants	Owner/ HOA	Educational materials will be provided to homeowners upon occupancy (see Attachment B).	Annually
Activity Restrictions	Owner/ HOA	Activity and use restrictions will be developed and enforced by the Owner/ HOA through CC&Rs.	Ongoing

BMP Inspection/Maintenance

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Common Area Landscape Management	Owner/ HOA	Maintenance shall be consistent with City requirements, plus fertilizer and/or pesticide usage shall be consistent with City of Garden Grove LIP Section 5. Maintenance includes mowing, weeding, and debris removal on a weekly basis. Trimming, replanting and replacement of mulch shall be performed on an as-needed basis. Trimmings, clippings, and other waste shall be properly disposed of off-site in accordance with local regulations. Materials temporarily stockpiled during maintenance activities shall be placed away from water courses and drain inlets.	Monthly
BMP Maintenance	Owner/ HOA	Maintenance of BMPs implemented at the project site shall be performed at the frequency prescribed in this PWQMP. Records of inspections and BMP maintenance shall be maintained by the Owner/HOA and documented with the PWQMP, and shall be available for review upon request.	Ongoing
Common Area Litter Control	Owner/ HOA	Litter patrol, violations investigation, reporting and other litter control activities shall be performed in conjunction with maintenance activities. Litter collection and removal shall be performed on a weekly basis.	Weekly

BMP Inspection/Maintenance

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Employee Training	Owner/ HOA	The Owner shall educate all new employees/managers on storm water pollution prevention, particularly good housekeeping practices, prior to the start of the rainy season (October 1). Refresher courses shall be conducted annually. Materials that may be used are attached to this PWQMP.	Annually

Common Area Catch Basin Inspection	Owner/ HOA	Private catch basin inlets, area drains, swales, curb-and-gutter systems and other drainage systems shall be inspected after each storm event and, when debris is present, cleaned prior to the storm season by October 1st each year.	After each storm event and Annuall
Street Sweeping Private Streets and Parking Lots	Owner/ HOA	Private streets and drive aisles must be swept quarterly, including prior to the start of the rainy season (October 1st).	Quarterly
STRUCTURAL SOURCE CONTROL BMPs			
Provide storm drain system stenciling and signage	Owner/ HOA	Private storm drain stencils shall be inspected for legibility, at minimum, once prior to the storm season, no later than October 1st each year. Those determined to be illegible will be re-stenciled as soon as possible.	Annually
ADS Flexstorm Full Trash Capture (FTC) Inserts	Owner/ HOA	Drop Inlets shall be opened, inspected for trash and other debris, and cleaned out.	Monthly
Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	Owner/ HOA	In conjunction with routine maintenance activities, verify that landscape design continues to function properly by adjusting properly to eliminate overspray to hardscape areas, and to verify that irrigation timing and cycle lengths are adjusted in accordance with water demands, given time of year, weather, day or nighttime temperatures based on system specifications and local climate patterns.	Monthly

Any waste generated from maintenance activities will be disposed of properly. Wash water and other waste from maintenance activities is not to be discharged or disposed of into the storm drain system. Clippings from landscape maintenance (i.e. prunings) will be collected and disposed of properly off-site, and will not be washed into the streets, local area drains/conveyances, or catch basin inlets

Section VI Site Plan and Drainage Plan

VI.1 SITE PLAN AND DRAINAGE PLAN

The exhibits provided in this section are to illustrate the post construction BMPs prescribed within this PWQMP. Drainage flow information of the proposed project, such as general surface flow lines, concrete or other surface drainage conveyances, and storm drain facilities are also depicted. All structural source control BMPs are shown as well. Include a site plan and drainage plan sheet set containing the following minimum information:

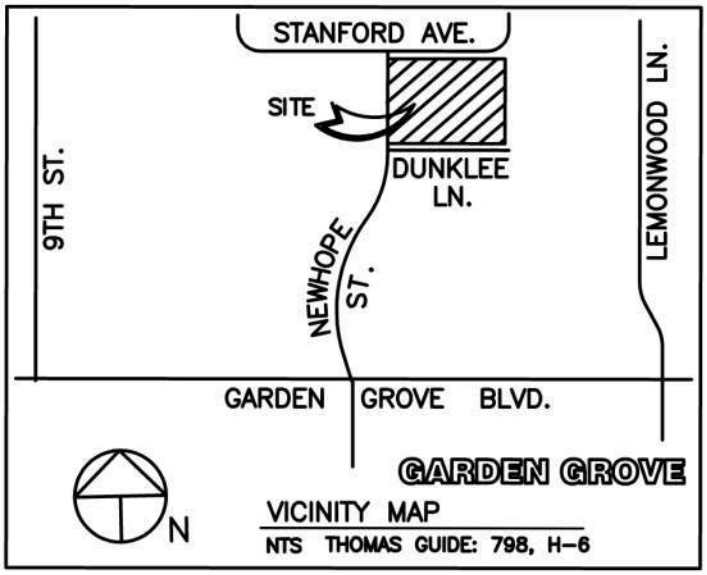
VI.1.1 Vicinity Map

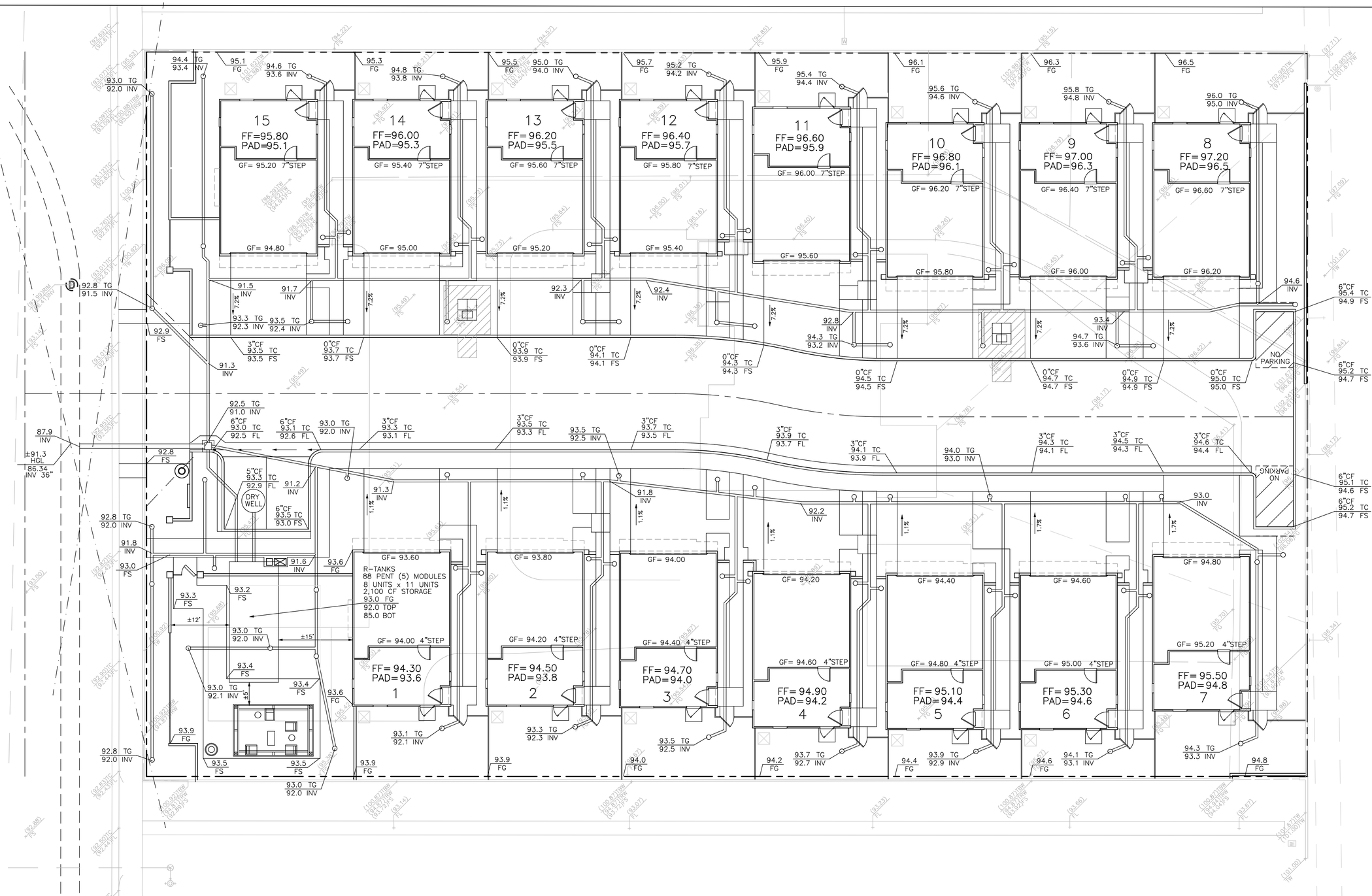
VI.1.2 Concept Grading Plan

VI.1.3 PWQMP Site Plan

VI.1.4 DCV Calculation w/ Existing and Proposed Pervious Exhibits

Vicinity Map





N

10 0 10 20 30

Scale 1" = 10'

PREPARED BY:

REGISTERED PROFESSIONAL ENGINEER
ALAN R. SHORT
No. 30873
EXP. 3/31/24
CIVIL
STATE OF CALIFORNIA

7263 W Galen Drive
Herriman, UT 84096
(949) 586-5200
ALANSHORTPE@GMAIL.COM

ALAN R. SHORT, P.E.

Alan R Short 12/15/23

ALAN R. SHORT, P.E. DATE:
R.C.E. 30873, EXPIRES 3/31/24

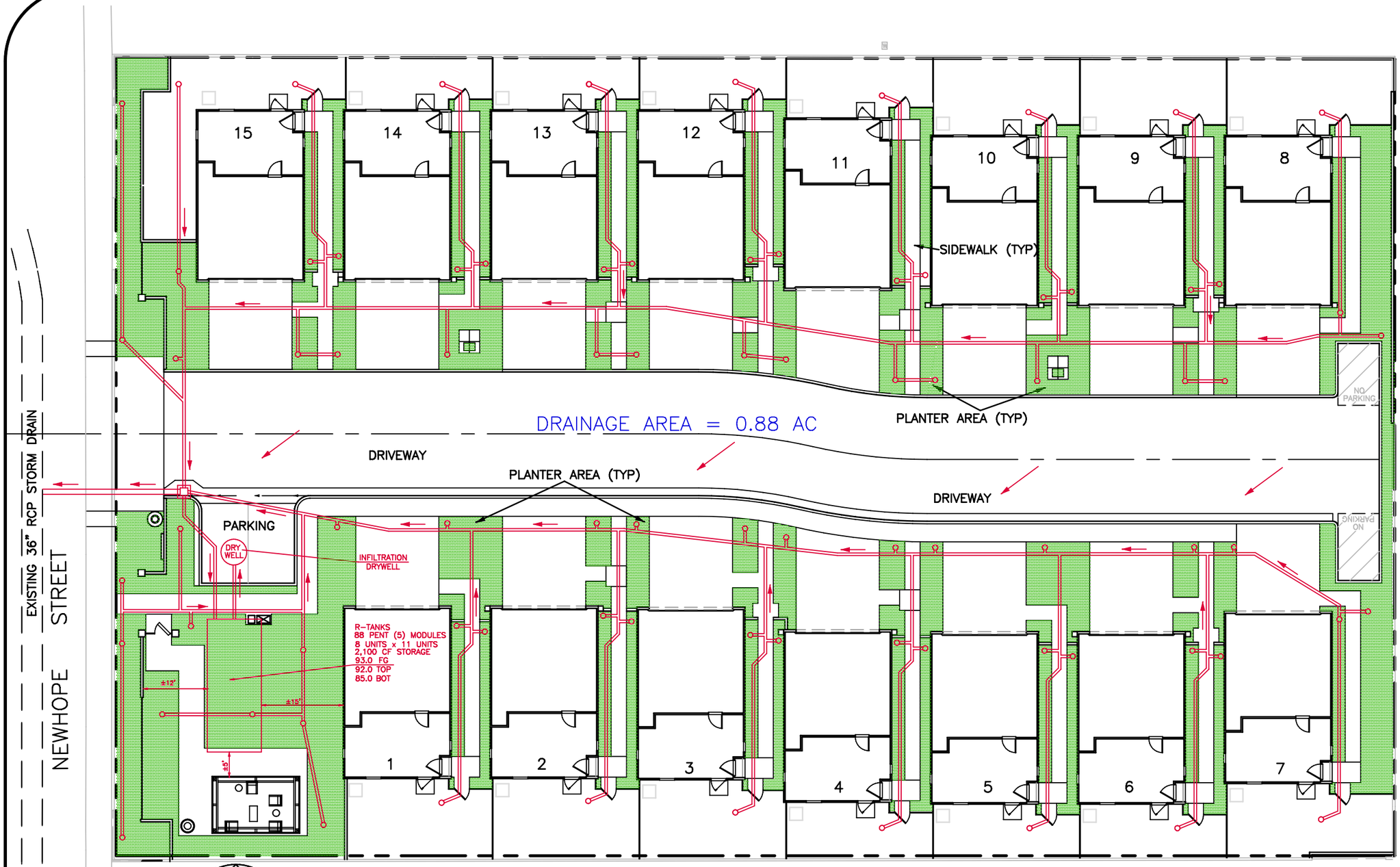
DEVELOPER:

THE OLSON COMPANY
3010 OLD RANCH PARKWAY, SUITE 100
SEAL BEACH, CALIFORNIA 90740-2750
(562) 596-4770
ATTENTION: MR. BRIAN GEIS

CONCEPT GRADING
TT No. 19298
GARDEN GROVE
NEWHOPE ST.

12/15/23

SHEET 1 OF 1



A NO DUMPING STENCIL DETAIL N.T.S.

N

20 0 20 40 60

Scale 1" = 20'

INFILTRATION SUMMARY:

DESIGN CAPTURE VOLUME:	2,095 cf
R-TANK STORAGE PROVIDED:	2,100 cf
PEAK INFILTRATION FLOW:	0.038 cfs
FACTOR OF SAFETY:	3.0
DESIGN INFILTRATION RATE:	0.013 cfs
DRAW DOWN	< 72 hrs

WATER QUALITY MANAGEMENT SITE PLAN TENTATIVE TRACT NO. 19298

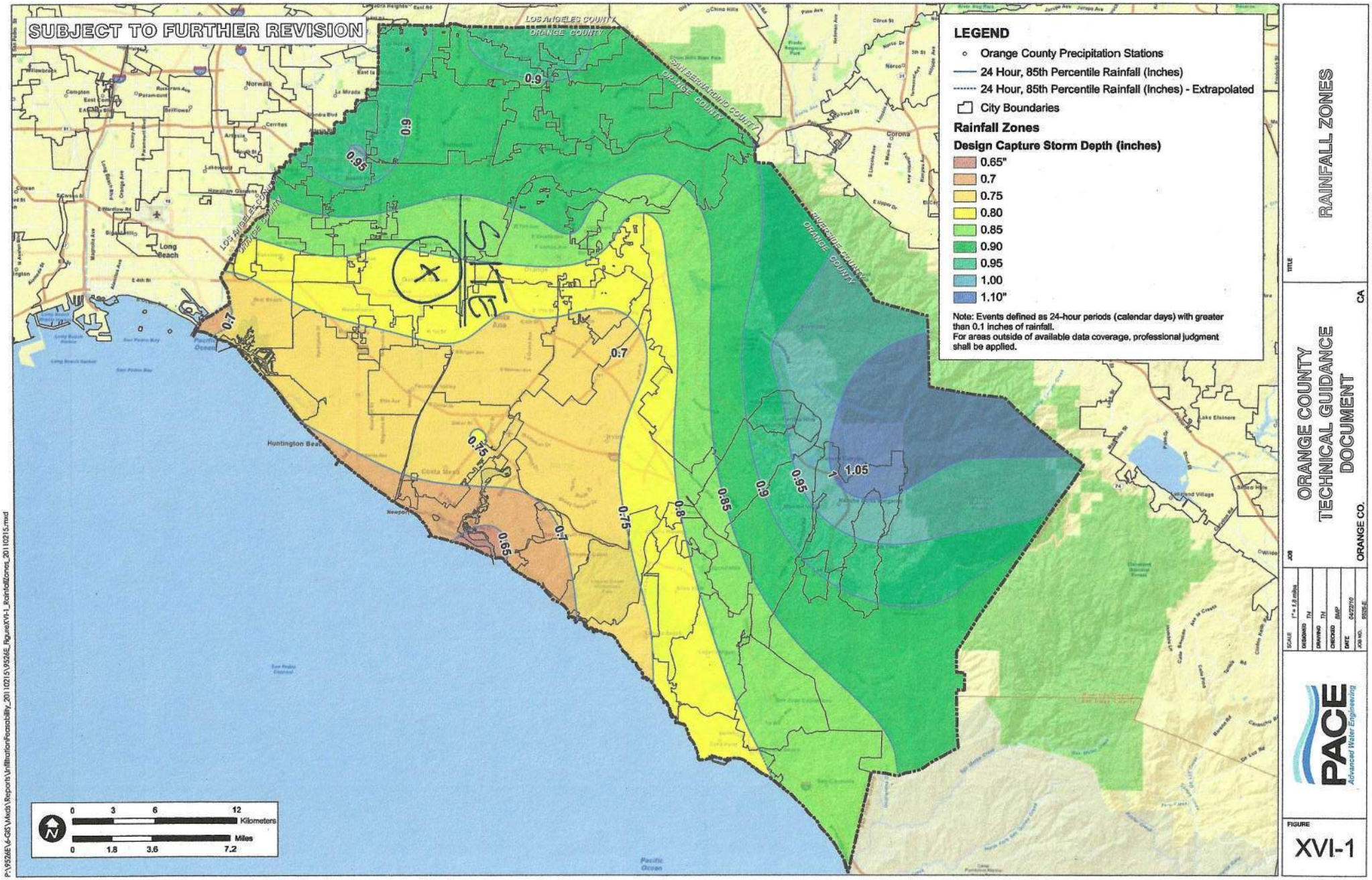
GARDEN GROVE

LATEST REVISION: 1/17/24

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=	0.78	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=		inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=		inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.88	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.78	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.74	
4	Calculate runoff volume, V_{design}= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	2,095	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.



TITLE: RAINFALL ZONES

ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT

JOB: ORANGE CO. CA

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

PACE Advanced Water Engineering

FIGURE XVI-1

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

NEWHOPE STREET

N

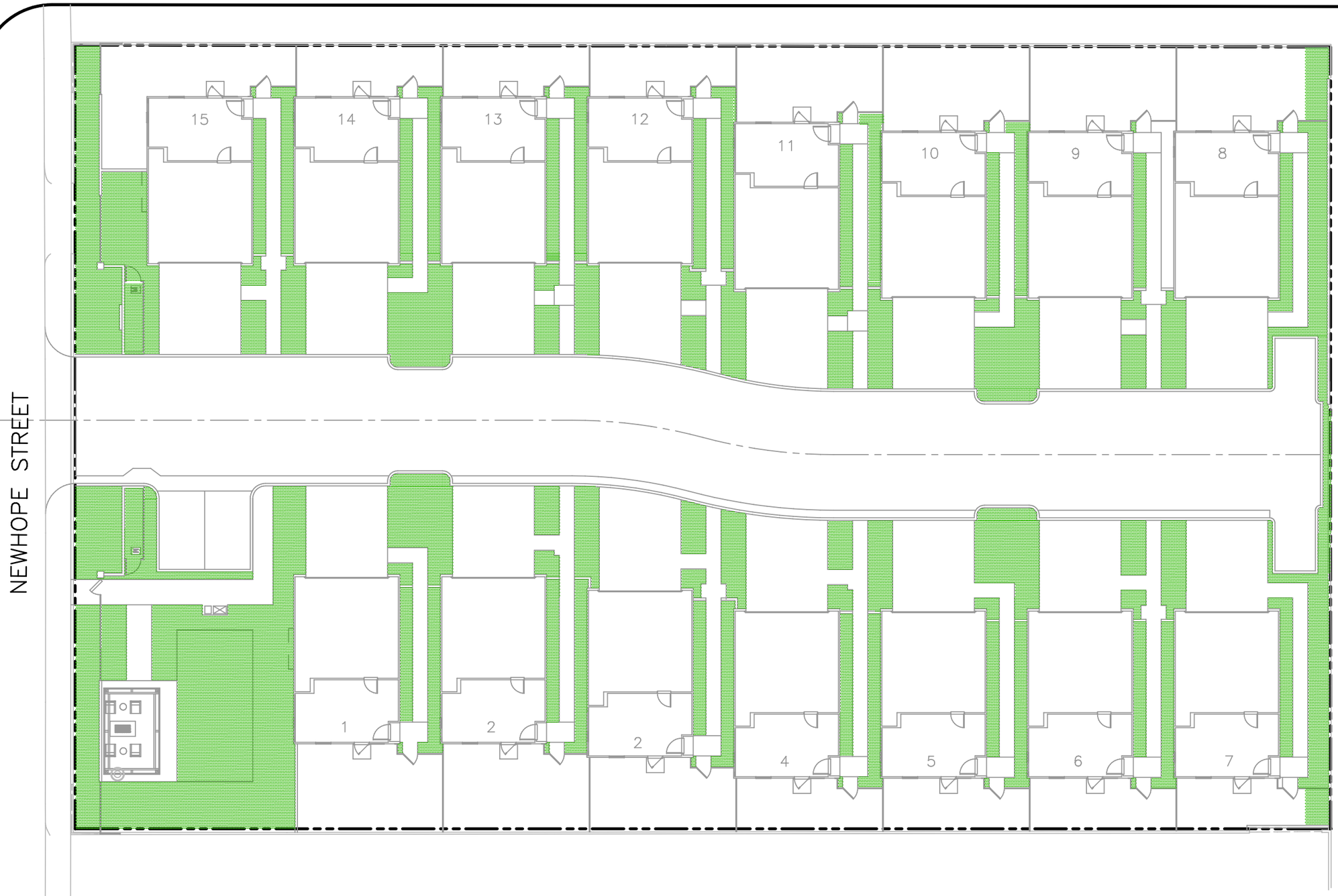
1"=20'

	TOTAL AREA	0.88 AC
	PERVIOUS AREA	0.57 AC
	% PERVIOUS	64.8 %
	% IMPERVIOUS	35.2 %

PERVIOUS AREA
EXISTING CONDITION
TENTATIVE TRACT NO. 84168

LATEST REVISION: 8/8/23

GARDEN GROVE



TOTAL AREA	0.88	AC
PERVIOUS AREA	0.19	AC
% PERVIOUS	21.6	%
% IMPERVIOUS	78.4	%

PERVIOUS AREA
PROPOSED CONDITION
TENTATIVE TRACT NO. 19298
GARDEN GROVE

The educational materials included in this PWQMP are provided to inform people involved in future uses, activities, or ownership of the site about the potential pitfalls associated with careless storm water management. "The Ocean Begins at Your Front Door" provides users with information about storm water that is/will be generated on site, what happens when water enters a storm drain, and its ultimate fate, discharging into the ocean. Also included are activities guidelines to educate anyone who is or will be associated with activities that have a potential to impact storm water runoff quality, and provide a menu of BMPs to effectively reduce the generation of storm water runoff pollutants from a variety of activities. The educational materials that may be used for the proposed project are included in Attachment B of this PWQMP and are listed below.

Education Materials

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

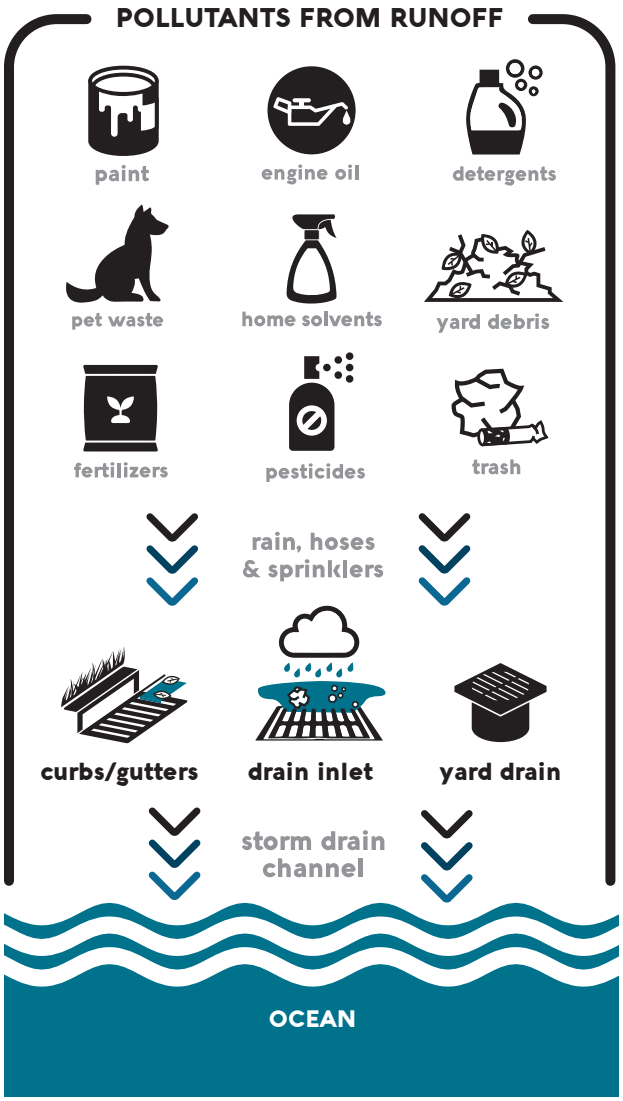
Tips for Residential Pool, Landscape and Hardscape Drains	☐		☐
Tips for Projects Using Paint	☒		☐

Attachment A

Educational Materials

What Common Pollutants are Found in Runoff?

Common runoff pollutants include trash, pet waste, yard debris, fertilizer, pesticides, engine oil, paint, home solvents, and detergents. Continue reading to learn how these pollutants affect our water resources and what you can do to help.



Who is H_2OC?

H_2OC is YOU! H_2OC is also a cooperative stormwater program which includes all 34 cities in Orange County, the County of Orange, and Orange County Flood Control District. Clean and healthy beaches, creeks, rivers, bays, wetlands, and ocean are important to Orange County. H_2OC provides resources to residents and businesses to prevent water pollution and encourage personal action by working with communities to prevent polluted runoff from entering our waterways. Join us at H2OC.org to learn more about how you can protect local waterways and be the solution to runoff pollution!

Visit

H2OC.org to learn more about runoff, water pollution, and what you can do to protect our water resources!

Contact

24-Hour Pollution Reporting Hotline:
(877) 89-SPILL (77455)
24-Hour Reporting Website:
myOCeServices.ocgov.com

*For more information on household hazardous waste centers go to www.oclandfills.com/hazardous or call (714) 834-4000

**UCCE Master Gardeners: ucceocmghotline@ucanr.edu
mgorange.ucanr.edu/Gardening_Hotline/

YOU ARE THE SOLUTION
TO RUNOFF POLLUTION

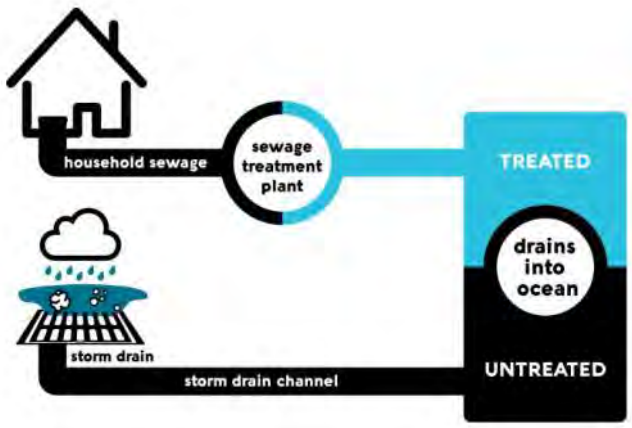
H_2OC STORMWATER PROGRAM

What is Runoff?

Runoff is water from rain and outdoor water use that drains from roofs, driveways, sidewalks, and other surfaces, which does not soak into the ground. As runoff flows over surfaces it will pick up and carry pollutants it encounters, many of which come from waste we produce or mishandle. In Orange County, runoff is captured by storm drains where it flows untreated to the ocean.

Water that flows into storm drains is NOT TREATED

Runoff from homes and businesses may contain pollutants that have harmful effects on downstream creeks, rivers, bays, and ocean. Unlike household sewage, this water is not treated and can negatively impact recreational use, wildlife habitat, and even human health.



TRASH

If trash such as cigarette butts, straws, cups, and other debris enter our waterways, it can create water flow problems and contaminate aquatic habitats. Always properly dispose of waste and recyclables and secure your trash can lid to prevent trash from being released into the environment.

ENGINE OIL

If engine oil enters our waterways, aquatic animals and plants can be negatively affected. It is important to repair leaking vehicles as soon as possible. Clean affected areas utilizing absorbents available at auto and home supply stores. Be sure to follow manufacturer's directions for proper use and disposal of absorbent. Used engine oil can be disposed at a Household Hazardous Waste Center (HHWC*) or where oil was purchased.

PET WASTE

Pet waste is a threat to human and environmental health because it contains harmful bacteria and pathogens. Being a responsible pet owner means picking up after your pet on walks and in your yard, especially before it rains.

YARD DEBRIS

If yard debris reaches local waterways, it can obstruct stormwater flow, clog storm drains, and cause other problems like flooding and erosion. Be sure to collect all debris when doing yard work and properly dispose of it in a green waste bin, or better yet, compost it.

FERTILIZER

If improperly applied, fertilizers can enter our waterways and cause ecological problems. For proper application, follow the manufacturer's instructions and stop applying fertilizers 48 hours before a forecasted rain event.

PESTICIDES

If pesticides, which include herbicides, insecticides, fungicides, and rodenticides, enter our waterways, they can be dangerous to human health and aquatic life. Be sure to limit pesticide use by using nonchemical methods or least-toxic pesticides whenever possible and contact the University of California Cooperative Extension (UCCE) Master Gardeners** with any questions. To properly apply pesticides, follow the manufacturer's instructions and stop applying 48 hours before a forecasted rain event.

PAINT

Paints, and related materials, contain a wide range of chemicals. These products should never be put in storm drains, sewers or septic systems. Instead, dispose of unused paint at your local HHWC*.

DETERGENTS

If phosphorus from detergents enters our waterways, it can cause ecological problems, including fish kills. Additionally, detergents can remove the protective mucous layer from fish, leaving them susceptible to disease. When using detergents for outdoor cleaning projects, do not allow wash water to reach the storm drain system.

HOME SOLVENTS

Many common household cleaning products contain harmful chemicals which are toxic and volatile. If not used and disposed of properly, these chemicals enter our waterways and pose a threat to both human and aquatic life. Always follow the manufacturer's instructions and dispose of the material at your local HHWC*.

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

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

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

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

For emergencies, dial 911.

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

Printed on Recycled Paper

Help Prevent Ocean Pollution: Tips For Protecting Your Watershed

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Protecting Your Watershed

My Watershed. Our Ocean.

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

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

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

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

There are many opportunities to get involved:

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

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

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

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

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

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

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

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

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

For emergencies, dial 911.

RECYCLE USED OIL

Printed on Recycled Paper

Help Prevent Ocean Pollution:

Proper Disposal of Household Hazardous Waste

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

ORANGE COUNTY

Pollution Prevention

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

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

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

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

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

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

Common household hazardous wastes

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

Tips for household hazardous waste

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

The Pollution Solution

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

1 Pesticides and Fertilizer

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

2 Dirt and Sediment

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

3 Metals

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

DID YOU KNOW?

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

4 Pet Waste

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

5 Trash and Debris

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

6 Motor Oil / Vehicle Fluids

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

A TEAM EFFORT

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

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

Thank you for making water protection a priority!

For more information, please visit

Orange County Stormwater Program
www.ocwatersheds.com/publiced/

Municipal Water District of Orange County
www.mwdoc.com

University of California Master Gardeners of Orange County
www.uccemg.com

UC Cooperative Extension OC Water Quality and Water Resources
www.ucanr.org/sites/urbanwatermgmt/

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

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

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

Homeowners Guide for Sustainable Water Use

Low Impact Development, Water Conservation & Pollution Prevention

The Ocean Begins at Your Front Door

RUNOFF, RAINWATER AND REUSE

Where Does Water Runoff Go?

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

Water Conservation

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

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

What is Low Impact Development (LID)?

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

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

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

OPTIONS FOR RAINWATER HARVESTING AND REUSE

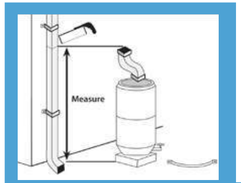
Rainwater harvesting is a great way to save money, prevent pollution and reduce potable water use. To harvest your rainwater, simply redirect the runoff from roofs and downspouts to rain barrels. Rain gardens are another option; these reduce runoff as well as encourage infiltration.

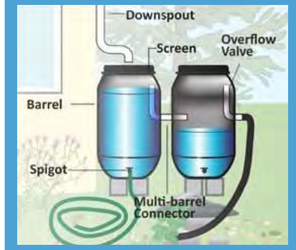
Downspout Disconnection/Redirection

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

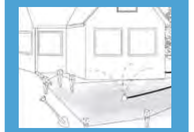
Rain Barrels

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





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



Rain Gardens

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

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

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

OTHER WATER CONSERVATION AND POLLUTION PREVENTION TECHNIQUES

Native Vegetation and Maintenance

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

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

Weed Free Yards

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

Soil Amendments

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

IRRIGATE EFFICIENTLY

Smart Irrigation Controllers

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

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

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

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

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

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

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

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

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

RECYCLE USED OIL

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Help Prevent Ocean Pollution:

Tips for the Home Mechanic

PROJECT Pollution PREVENTION

The Ocean Begins at Your Front Door

Tips for the Home Mechanic

WORK SITE

- Locate the storm drains on or near your property. Do not allow used oil or any materials to flow into these drains.

- Examine your home for sources of pollution.

- Perform automotive projects under cover and in a controlled area to prevent stormwater runoff.

- Sweep or vacuum your automotive workspace regularly

- Use a damp mop to clean work areas. Never hose down surfaces into the street, gutter or storm drain.

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

PREVENT LEAKS AND SPILLS

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

CLEANING SPILLS

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

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

- Report emergencies to 911.

VEHICLE FLUID MANAGEMENT

- Vehicle fluids are hazardous waste and must be stored and disposed of in accordance with all local, state and federal laws.

- Designate an area to drain vehicle fluids away from storm drains and sanitary drains.

- When possible, drain vehicle fluids indoors or within covered areas, and only over floors that are constructed of a non-porous material such as concrete. Asphalt and dirt floors absorb spilled or leaked fluids, making the cleanup extremely difficult.

PROJECT Pollution PREVENTION

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

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

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

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

Please do not mix your oil with other substances!

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

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

RECYCLE USED OIL

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

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Help Prevent Ocean Pollution:

Recycle at Your Local Used Oil Collection Center

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

NORTH COUNTY

Used Oil Collection Centers

Anaheim

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Anaheim Hills

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

Brea

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

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

Buena Park

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

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

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

Cypress

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

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

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

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

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

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

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

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

Fullerton

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

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

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

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

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

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

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

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

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

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

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

Garden Grove

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

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

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

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

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

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

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

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

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

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

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

La Habra

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

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

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

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

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

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

Los Alamitos

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

Midway City

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

Placentia

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

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

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

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

Seal Beach

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

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

Stanton

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

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

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

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

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

Westminster

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

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

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

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

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

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

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

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

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

Yorba Linda

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

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

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

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

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

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

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

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

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

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

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

For emergencies, dial 911.

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

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Help Prevent Ocean Pollution:

Tips for Home Improvement Projects

Tips for Home Improvement Projects

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

General Construction

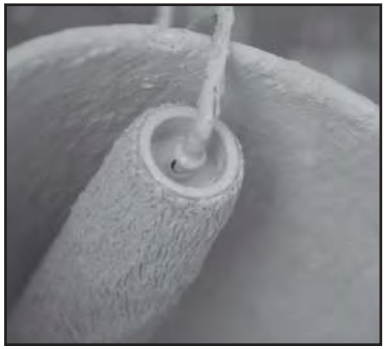
- Schedule projects for dry weather.
- Keep all construction debris away from the street, gutter and storm drain.
- Store materials under cover with temporary roofs or plastic sheets to eliminate or reduce the possibility that rainfall, runoff or wind will carry materials from the project site to the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

Building Materials

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

Paint

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



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

Erosion Control

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

Recycle

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

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

Spills

- Clean up spills immediately by using an absorbent material such as cat litter, then sweep it up and dispose of it in the trash.
- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at **1-877-897-7455** or visit **www.ocwatersheds.com** to fill out an incident reporting form.

PROJECT Pollution PREVENTION

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as 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

Help Prevent Ocean Pollution:

Tips for Projects Using Paint

Tips for Projects Using Paint

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

Purchasing Paint

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

Painting

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

Cleaning

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

Storing Paint

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

Alternatives to Disposal

- Use excess paint to apply another coat, for touch-ups, or to paint a closet, garage, basement or attic.
- Give extra paint to friends or family. Extra paint can also be donated to a local theatre group, low-income housing program or school.
- Take extra paint to an exchange program such as the **"Stop & Swap"** that allows you to drop off or pick up partially used home care products free of charge. **"Stop & Swap"** programs are available at most HHWCCs.
- For HHWCC locations and hours, call **1-877-897-7455** 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 **1-877-897-7455** or visit **www.ocwatersheds.com** to fill out an incident reporting form.

PROJECT Pollution PREVENTION

Sewage Spill Regulatory Requirements

Allowing sewage to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up efforts.

Here are the pertinent codes, fines, and agency contact information that apply.

Orange County Stormwater Program
24 Hour Water Pollution Reporting Hotline
1-877-89-SPILL (1-877-897-7455)

- County and city water quality ordinances prohibit discharges containing pollutants.

Orange County Health Care Agency Environmental Health
(714) 433-6419

California Health and Safety Code, Sections 5410-5416

- No person shall discharge raw or treated sewage or other waste in a manner that results in contamination, pollution or a nuisance.
- Any person who causes or permits a sewage discharge to any state waters:
  - must immediately notify the local health agency of the discharge.
  - shall reimburse the local health agency for services that protect the public's health and safety (water-contact receiving waters).
  - who fails to provide the required notice to the local health agency is guilty of a misdemeanor and shall be punished by a fine (between $500–$1,000) and/or imprisonment for less than one year.

Regional Water Quality Control Board
Santa Ana Region (951) 782-4130
San Diego Region (858) 467-2952

- Requires the prevention, mitigation, response to and reporting of sewage spills.

California Office of Emergency Services
(800) 852-7550

California Water Code, Article 4, Chapter 4, Sections 13268-13271
California Code of Regulations, Title 23, Division 3, Chapter 9.2, Article 2, Sections 2250-2260

- Any person who causes or permits sewage in excess of 1,000 gallons to be discharged to state waters **shall immediately notify the Office of Emergency Services.**
- Any person who fails to provide the notice required by this section is **guilty of a misdemeanor** and shall be punished by a fine (less than $20,000) and/or imprisonment for not more than one year.

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Sewage Spill
Reference Guide

Your Responsibilities as a Private Property Owner

Residences
Businesses
Homeowner/Condominium Associations
Federal and State Complexes
Military Facilities

Orange County Sanitation District

Health Care Agency
Environmental Health

PROJECT Pollution PREVENTION

www.ocwatersheds.com

This brochure was designed courtesy of the Orange County Sanitation District (OCSD). For additional information, call (714) 962-2411, or visit their website at www.ocsd.com

What is a Sewage Spill?

Sewage spills occur when the wastewater being transported via underground pipes overflows through a manhole, cleanout or broken pipe. Sewage spills can cause health hazards, damage to homes and businesses, and threaten the environment, local waterways and beaches.

Common Causes of Sewage Spills

Grease builds up inside and eventually blocks sewer pipes. Grease gets into the sewer from food establishments, household drains, as well as from poorly maintained commercial grease traps and interceptors.

Structure problems caused by tree roots in the lines, broken/cracked pipes, missing or broken cleanout caps or undersized sewers can cause blockages.

Infiltration and inflow (I/I) impacts pipe capacity and is caused when groundwater or rainwater enters the sewer system through pipe defects and illegal connections.

You Are Responsible for a Sewage Spill Caused by a Blockage or Break in Your Sewer Lines!

Time is of the essence in dealing with sewage spills. You are required to **immediately**:

Control and minimize the spill. Keep spills contained on private property and out of gutters, storm drains and public waterways by shutting off or not using the water.

Use sandbags, dirt and/or plastic sheeting to prevent sewage from entering the storm drain system.

Clear the sewer blockage. Always wear gloves and wash your hands. It is recommended that a plumbing professional be called for clearing blockages and making necessary repairs.

Always notify your city sewer/public works department or public sewer district of sewage spills. If the spill enters the storm drains also notify the Health Care Agency. In addition, if it exceeds 1,000 gallons notify the Office of Emergency Services. Refer to the numbers listed in this brochure.

Overflowing cleanout pipe located on private property

You Could Be Liable

Allowing sewage from your home, business or property to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up and enforcement efforts. See Regulatory Codes & Fines section for pertinent codes and fines that apply.

What to Look For

Sewage spills can be a very noticeable gushing of water from a manhole or a slow water leak that may take time to be noticed. Don't dismiss unaccounted-for wet areas.

Look for:

- Drain backups inside the building.
- Wet ground and water leaking around manhole lids onto your street.
- Leaking water from cleanouts or outside drains.
- Unusual odorous wet areas: sidewalks, external walls or ground/landscape around a building.

Caution

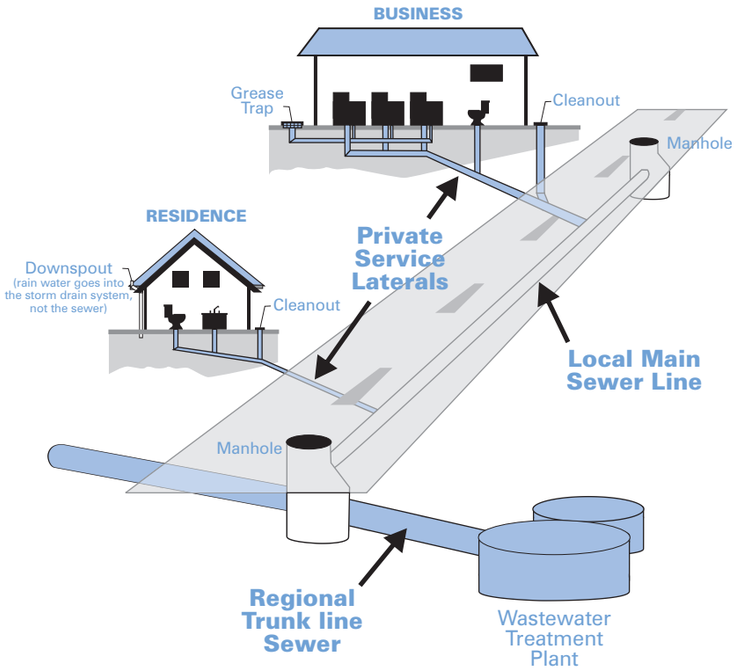
Keep people and pets away from the affected area. Untreated sewage has high levels of disease-causing viruses and bacteria. Call your local health care agency listed on the back for more information.

If You See a Sewage Spill Occurring, Notify Your City Sewer/Public Works Department or Public Sewer District IMMEDIATELY!

How a Sewer System Works

A property owner's sewer pipes are called service laterals and are connected to larger local main and regional trunk lines. Service laterals run from the connection at the home to the connection with the public sewer (including the area under the street). These laterals are the responsibility of the property owner and must be maintained by the property owner. Many city agencies have adopted ordinances requiring maintenance of service laterals. Check with your city sewer/local public works department for more information.

Operation and maintenance of **local and regional sewer lines** are the responsibility of the city sewer/public works departments and public sewer districts.



How You Can Prevent Sewage Spills

1. **Never put grease down garbage disposals, drains or toilets.**
2. **Perform periodic cleaning to eliminate grease, debris and roots in your service laterals.**
3. **Repair any structural problems in your sewer system and eliminate any rainwater infiltration/inflow leaks into your service laterals.**

Preventing Grease Blockages

The drain is not a dump! Recycle or dispose of grease properly and never pour grease down the drain.

Homeowners should mix fats, oils and grease with absorbent waste materials such as paper, coffee grounds, or kitty litter and place it in the trash. Wipe food scraps from plates and pans and dump them in the trash.

Restaurants and commercial food service establishments should always use "Kitchen Best Management Practices." These include:

- Collecting all cooking grease and liquid oil from pots, pans and fryers in covered grease containers for recycling.
- Scraping or dry-wiping excess food and grease from dishes, pots, pans and fryers into the trash.
- Installing drain screens on all kitchen drains.
- Having spill kits readily available for cleaning up spills.
- Properly maintaining grease traps or interceptors by having them serviced regularly. Check your local city codes.

Orange County Agency Responsibilites

- **City Sewer/Public Works Departments—** Responsible for protecting city property and streets, the local storm drain system, sewage collection system and other public areas.
- **Public Sewer/Sanitation District—** Responsible for collecting, treating and disposing of wastewater.
- **County of Orange Health Care Agency—** Responsible for protecting public health by closing ocean/bay waters and may close food-service businesses if a spill poses a threat to public health.
- **Regional Water Quality Control Boards—** Responsible for protecting State waters.
- **Orange County Stormwater Program—** Responsible for preventing harmful pollutants from being discharged or washed by stormwater runoff into the municipal storm drain system, creeks, bays and the ocean.

You Could Be Liable for Not Protecting the Environment

Local and state agencies have legal jurisdiction and enforcement authority to ensure that sewage spills are remedied.

They may respond and assist with containment, relieving pipe blockages, and/or clean-up of the sewage spill, especially if the spill is flowing into storm drains or onto public property.

A property owner may be charged for costs incurred by these agencies responding to spills from private properties.

Report Sewage Spills!

City Sewer/Public Works Departments

Aliso Viejo	(949) 425-2500
Anaheim	(714) 765-6860
Brea	(714) 990-7691
Buena Park	(714) 562-3655
Costa Mesa	(949) 645-8400
Cypress	(714) 229-6760
Dana Point	(949) 248-3562
Fountain Valley	(714) 593-4600
Fullerton	(714) 738-6897
Garden Grove	(714) 741-5375
Huntington Beach	(714) 536-5921
Irvine	(949) 453-5300
Laguna Beach	(949) 497-0765
Laguna Hills	(949) 707-2650
Laguna Niguel	(949) 362-4337
Laguna Woods	(949) 639-0500
La Habra	(562) 905-9792
Lake Forest	(949) 461-3480
La Palma	(714) 690-3310
Los Alamitos	(562) 431-3538
Mission Viejo	(949) 831-2500
Newport Beach	(949) 644-3011
Orange	(714) 532-6480
Orange County	(714) 567-6363
Placentia	(714) 993-8245
Rancho Santa Margarita	(949) 635-1800
San Clemente	(949) 366-1553
San Juan Capistrano	(949) 443-6363
Santa Ana	(714) 647-3380
Seal Beach	(562) 431-2527
Stanton	(714) 379-9222
Tustin	(714) 962-2411
Villa Park	(714) 998-1500
Westminster	(714) 893-3553
Yorba Linda	(714) 961-7170

Public Sewer/Water Districts

Costa Mesa Sanitary District	(714) 393-4433/ (949) 645-8400
El Toro Water District	(949) 837-0660
Emerald Bay Service District	(949) 494-8571
Garden Grove Sanitary District	(714) 741-5375
Irvine Ranch Water District	(949) 453-5300
Los Alamitos/Rossmoor Sewer District	(562) 431-2223
Midway City Sanitary District (Westminster)	(714) 893-3553
Moulton Niguel Water District	(949) 831-2500
Orange County Sanitation District	(714) 962-2411
Santa Margarita Water District	(949) 459-6420
South Coast Water District	(949) 499-4555
South Orange County Wastewater Authority	(949) 234-5400
Sunset Beach Sanitary District	(562) 493-9932
Trabuco Canyon Sanitary District	(949) 858-0277
Yorba Linda Water District	(714) 777-3018

Other Agencies

Orange County Health Care Agency	(714) 433-6419
Office of Emergency Services	(800) 852-7550

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

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

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

UCCE Master Gardener Hotline:
(714) 708-1646

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

For emergencies, dial 911.

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

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Help Prevent Ocean Pollution:

Tips for Landscape & Gardening

Tips for Landscape & Gardening

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

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.
- Plant native vegetation to reduce the amount of water, fertilizers, and pesticide applied to the landscape.

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

Garden & Lawn Maintenance

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro spray systems. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.

- Use slow-release fertilizers to minimize leaching, and use organic fertilizers.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.

- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting. For more information, visit **www.ipm.ucdavis.edu**.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Hazardous Waste Collection Center to be recycled. Locations are provided below.

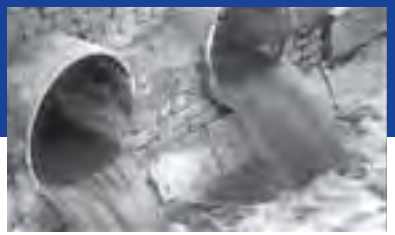
Household Hazardous Waste Collection Centers

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

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

Clean beaches and healthy creeks, rivers, bays and the Pacific Ocean are important to Orange County. However, many common activities can lead to water pollution if we're not careful. Extra water flowing off lawns can carry fertilizer and pesticides as well as other pollutants from our streets and sidewalks into the storm drains. This polluted water then flows untreated directly into our creeks, rivers, bays and ocean.

You would never intentionally put litter, motor oil, pesticides and fertilizer into the ocean, so don't overwater your lawn, which can carry these pollutants into our waterways. Follow these easy tips to help prevent water pollution.



For More Information, please visit the Orange County Stormwater Program website at ww.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 about how you can keep excess runoff from carrying pollutants to the storm drain system. Please visit the Orange County Stormwater Program at www.ocwatersheds.com/Publiced for more resources. Other important resources include:

Municipal Water District of Orange County
www.mwdoc.com

University of California Master Gardeners of Orange County
www.uccemg.com

UC Cooperative Extension / OC Water Quality & Water Resources
www.ucanr.org/sites/urbanwatermgmt/

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Help Prevent Ocean Pollution:

Tips to Prevent Overwatering

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips to Prevent Overwatering

What is Overwatering?

Overwatering is the use of irrigation in exceedance of the water demand of a landscaped area.

In Orange County, 60-70% of water used by residents and businesses goes to irrigation and other outdoor uses. By utilizing water resources more efficiently, more potable water may be available for other uses and will not cause urban runoff.

How Does Overwatering Lead to Pollution?

Even during the hottest summer months, you can often see water runoff going into our storm drains and into our waterways. This runoff is usually the result of overwatering of lawns. The water carries trash, motor oil, pet waste and other pollutants into our storm drains, which flow untreated to the ocean. Water runoff both pollutes our waterways and wastes water.

IT'S THE LAW! If you live in Southern Orange County, runoff from landscape irrigation that enters the street and catch basins is prohibited. Please contact your city for more information about what you can do to prevent overwatering and urban runoff.

Lawn Watering Needs

- During the fall and winter months, your lawn needs far less water than during the summer. Adjust sprinkler controls to water less during winter months.
- If your blades of grass spring up after you step on them, they are adequately watered.
- If your grass is a vibrant green and is not pale, it is receiving enough water. If your lawn becomes less verdant, it may need nutrients and not water. If possible, seek assistance from a gardening professional.
- Overwatering during fall and winter months can saturate soils and lead to lawn disease.

When is the Best Time to Water?

- Watering early in the morning before sunrise will reduce water loss due to evaporation.
- Wind tends to die down in the early morning, so the water will get to the lawn as intended.

How do I Irrigate Most Efficiently?

- Adjust the direction of your sprinkler heads so water does not spray on sidewalks, driveways or roads. By simply adjusting the direction of your sprinklers you can save water, prevent water pollution from runoff and keep your lawn healthy.
- Use an irrigation timer to minimize runoff and maximize water absorption. Water districts often provide irrigation schedules to determine the best water scheme for your yard (e.g. Irvine Ranch Water District Always Water Smart weekly irrigation schedules).
- Consider using 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.
- Consider replacing your sprinkler heads with rotating sprinkler nozzles. Rotating nozzles water more uniformly and efficiently, reducing your outdoor water use by up to 30%.
- Check with your local water agency for available rebates on irrigation controllers and other water efficient devices.
- 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 carries pollutants into our waterways and wastes water.

- Fix leaks. Nationwide, households waste one trillion gallons of water a year to leaks. If your garden hose is leaking, replace the nylon or rubber hose washer and ensure a tight connection. Fix broken sprinklers immediately.

Be Careful With Pesticides and Fertilizer

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

- Utilize least toxic alternatives to pesticides to manage lawn and garden pests where possible. Pesticides are transported via runoff to waterways and can be harmful to aquatic organisms. Visit www.ipm.ucdavis.edu for more information about pest management practices.

Native Vegetation and Maintenance

- "California Friendly" plants or native vegetation can significantly reduce water use. These plants often require far less fertilizers and pesticides, w hich 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.

PROJECT Pollution PREVENTION

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

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

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

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

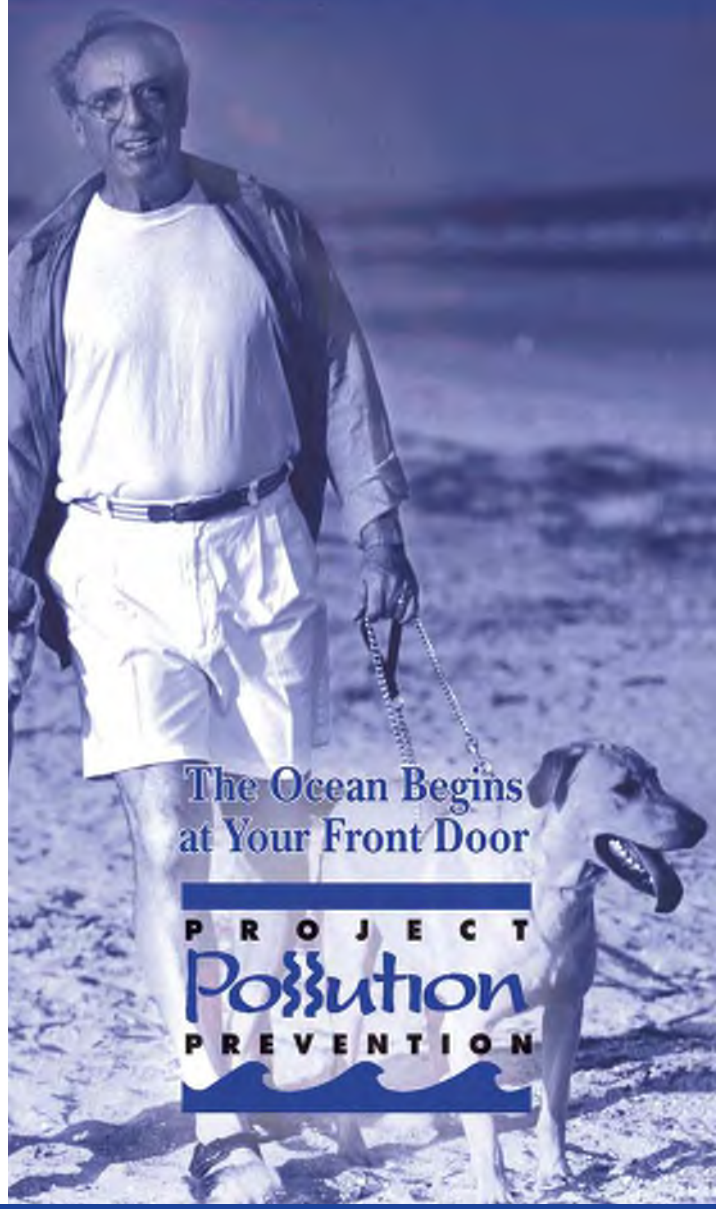
For emergencies, dial 911.

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

Printed on Recycled Paper

Help Prevent Ocean Pollution:

Tips for Pet Care



Tips for Pet Care

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

Washing Your Pets

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

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

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

Flea Control

- Consider using oral or topical flea control products.

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

Why You Should Pick Up After Your Pet

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

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

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

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

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

PROJECT Pollution PREVENTION

Attachment B

Geotechnical Report
and
Percolation Study

ALBUS & ASSOCIATES
formerly Albus-Keefe & Associates, Inc.

June 6, 2023
J.N.: 3157.00

Mr. Brian Geis
The Olson Company
3010 Old Ranch Parkway, Suite 100
Seal Beach, California 90740

Subject: **Geotechnical Due-Diligence Investigation, Proposed Multi-Family Residential Development, 12828 Newhope Street, Garden Grove, California**

Dear Mr. Geis,

Albus & Associates, Inc. is pleased to present to you our geotechnical due-diligence report for the proposed multi-family residential development at the subject site. This report presents a summary of our literature review, subsurface exploration, laboratory testing, and engineering analyses. Conclusions relevant to the feasibility of the proposed site development are also presented herein based on the findings of our work.

We appreciate this opportunity to be of service to you. If you should have any questions regarding the contents of this report, please do not hesitate to call our office.

Sincerely,

ALBUS & ASSOCIATES, INC.

Paul Kim
Associate Engineer

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of our work is to evaluate the feasibility of the proposed site development in order to assist you in your land acquisition evaluation and due-diligence review. The scope of our work for this investigation was focused primarily on the geotechnical issues that we expect could have significant fiscal impacts on future site development. While this report is comprehensive for feasibility purposes, it is not intended for final design purposes. As such, additional geotechnical studies may be warranted based on our review of future rough grading plans and foundation plans. The scope of our work for this investigation included the following:

- Review of published geologic and seismic data for the site and surrounding area
- Exploratory drilling and soil sampling
- Laboratory testing of select soil samples
- Engineering analyses of data obtained from our review, exploration, and laboratory testing
- Evaluate site seismicity, liquefaction potential, and settlement potential
- Preparation of this report

1.2 SITE LOCATION AND DESCRIPTION

The site is located at the address of 12828 Newhope Street within the city of Garden Grove, California. The site is bordered by Newhope Street to the west, Zeta Street to the north, residential properties to the east, and Dunklee Lane to the south. The location of the site and its relationship to the surrounding areas are shown in Figure 1, Site Location Map.

The site consists of 0.9 acres of land and is presently developed with a single-family residence. The building pad is situated approximately 2 feet above the grade of the street. The remaining portions of the site are covered in asphalt associated with the interior driveway and vegetation. Vegetation onsite consists of medium to large-sized trees and grass.

Drainage on site appears to be primarily sheet flow and directed south and west towards the roadways.

Walls are present along all sides of the property lines. Except for the eastern perimeter wall, other walls are retaining walls. The retaining walls are about 6 feet high, retaining up to approximately 2 feet. The elevation of the project site is typically higher than the northern, western, and southern roads but similar to eastern neighborhood houses.

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FIGURE 1-SITE LOCATION MAP

Proposed Multi-Family Residential Development
12828 Newhope Street, Garden Grove, California

NOT TO SCALE

1.3 PROPOSED DEVELOPMENT

We understand that the site will be redeveloped for residential use. We anticipate the proposed site development will consist of attached three-story townhomes and associated interior driveways, perimeter/retaining walls, underground utilities, and a stormwater infiltration system.

No grading or structural plans were available in preparing this report. However, we anticipate some minor to moderate cut and filling of the site will be required to achieve future surface configuration and we expect future foundation loads will be relatively light.

2.0 INVESTIGATION

2.1 RESEARCH

We have reviewed the referenced geologic publications, maps, and historical aerial photos of the vicinity. Data from these sources were utilized to the development of some of our findings and conclusions presented in this report.

Research of aerial photographs indicates that in 1953, the site appeared to be entirely used for citrus groves, and the east adjacent properties were developed with houses. At this time, a single-family residence was constructed. By 1967, the single family residence was expanded to the north while the remaining portions of the site were still used for citrus groves. The residence is roughly in the same location as the existing residence. By 1972, the area was cleared of citrus groves and additional trees were planted on the site. By 1987, the surrounding areas also had been developed. The site appears to have remained relatively unchanged since.

2.2 SUBSURFACE EXPLORATION

Subsurface exploration for this investigation was conducted on May 23, 2023 and consisted of drilling three (3) soil borings to a maximum depth of approximately 51.5 feet below the existing ground surface (bgs). The borings were drilled using a truck-mounted, continuous-flight, hollow-stem-auger drill rig. Representatives of *Albus & Associates, Inc*. logged the exploratory borings. Visual and tactile identifications were made of the materials encountered, and their descriptions are presented on the Exploration Logs in Appendix A. The approximate locations of the borings are shown on the enclosed Geotechnical Map, Plate 1.

Bulk, relatively undisturbed and Standard Penetration Test (SPT) samples were obtained at selected depths for subsequent laboratory testing. Relatively undisturbed samples were obtained using a 3-inch O.D., 2.5-inch I.D., California split-spoon soil sampler lined with brass rings. SPT samples were obtained using a standard SPT soil sampler. During each sampling interval, the samplers were driven 18 inches with successive drops of a 140-pound automatic hammer falling 30 inches. The number of blows required to advance the sampler was recorded for each six inches of advancement. The total blow count for the lower 12 inches of advancement per soil sample is recorded on the exploration log. Samples were placed in sealed containers or plastic bags and transported to our laboratory for analyses and testing. The borings were backfilled with soil cuttings upon completion of drilling.

Two percolation test wells (P-1 and P-2) were drilled adjacent to exploratory boring B-1 for subsequent percolation testing.

2.3 LABORATORY TESTING

Selected samples of representative earth materials from the borings were tested in our laboratory. Tests consisted of in-situ moisture and dry density, maximum dry density and optimum moisture content, soluble sulfate content, grain size analysis, percent passing No. 200 sieve, consolidation/collapse potential, Atterberg limits, direct shear, and corrosivity. Descriptions of

laboratory testing and a summary of the test results are presented in Appendix B and on the exploration log in Appendix A.

3.0 SUBSURFACE CONDITIONS

3.1 SOIL CONDITIONS

Artificial fill material was observed in our soil borings and are anticipated to be generally 2 feet deep. Deeper portions of artificial fill may be encountered in localized areas. A retaining wall exists along all sides of the property lines and retains approximately 2 feet at the northwest and southwest corners before tapering off heading south and east. The artificial fill materials observed onsite are typically silty sands that are damp to very moist, loose to medium dense, and gray.

Young alluvial fan deposits (Qyfa) were encountered below the fill materials to the maximum depths explored of 51.5 feet. The materials were typically interbedded with a predominance of coarse-grained materials. Deeper portions of the alluvial fan deposits were observed to be cohesive. The materials consisted of sands with variable amounts of silt and clay, and sandy clay, which were very moist and loose to dense and very stiff to hard.

A more detailed description of the interpreted soil profile at each of the boring locations, based upon the borehole cuttings and soil samples, are presented in Appendix A. The stratigraphic descriptions in the logs represent the predominant materials encountered and relatively thin, often discontinuous layers of different material may occur within the major divisions.

3.2 GROUNDWATER

Groundwater was encountered at 37 feet below the existing grade during this firm's subsurface exploration to a depth of 51.5 feet. The CDMG Special Report 003 suggests that historic high groundwater for the subject site is about 10 feet below the ground surface. We researched online groundwater well data in the California Department of Water Resources database and found three wells located around the site (north, east, and west). The locations of the three wells are depicted in Figure 2. Data from these wells spans from 1970 to 2023. The recorded depths to groundwater from these wells are plotted in Figure 3.

As indicated by Figure 3, all three wells indicate that groundwater has remained below a depth of 45 feet since 1970, except for one measurement on May 1, 1979. This measurement may be an error considering other data. Except for this measurement, all measured groundwater depths are deeper than 45 feet. Based on the data from these wells, the water encountered in our borings is likely a shallower perched condition that is hydraulically separate from a deeper aquifer being measured by the local wells. A zone of finer-grained interlayers are present below a depth of 35 feet which may be impeding flow of water downward to a deeper aquifer.

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FIGURE 2 - Groundwater Well Location Map

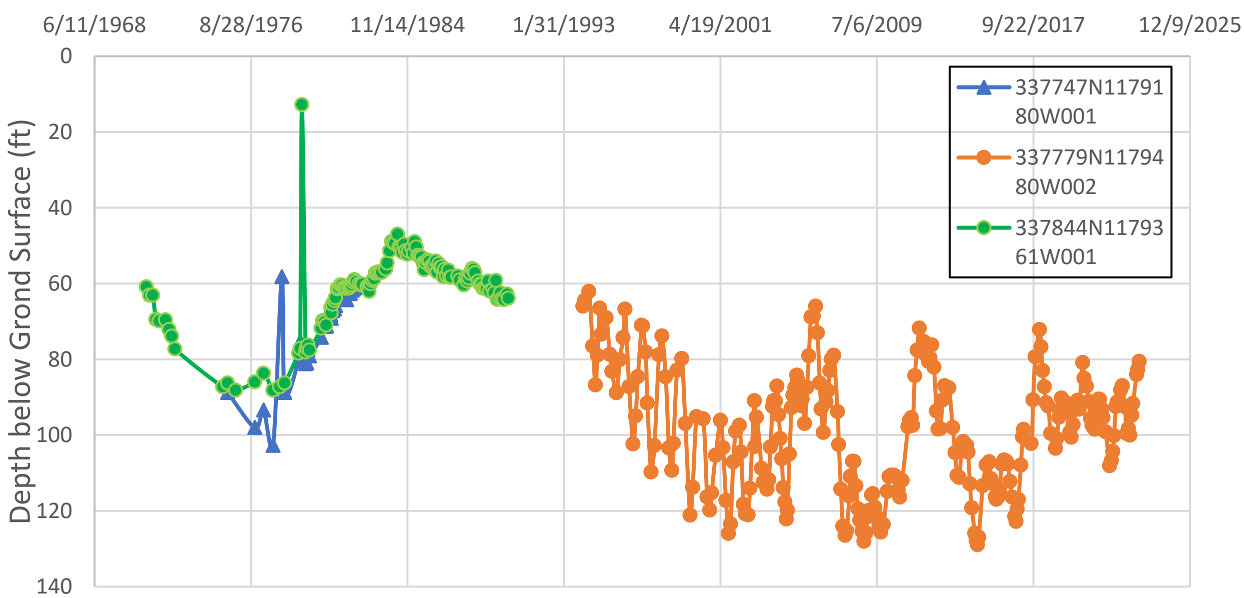

FIGURE 3 - Ground Water Data

3.3 ACTIVE FAULTS

Based on our review of the referenced publications and seismic data, no active faults are known to project through or immediately adjacent the subject sites and the sites do not lie within an "Earthquake Fault Zone" as defined by the State of California in Earthquake Fault Zoning Act. Table 3.1 presents a summary of known seismically active faults within 10 miles of the sites based on the 2008 USGS National Seismic Hazard Maps.

TABLE 3.1
Summary of Active Faults

Name	Distance (miles)	Slip Rate (mm/yr.)	Preferred Dip (degrees)	Slip Sense	Rupture Top (km)	Fault Length (km)
San Joaquin Hills	5.64	0.5	23	thrust	2	27
Puente Hills (Coyote Hills)	6.53	0.7	26	thrust	2.8	17
Newport Inglewood Connected alt 2	7.84	1.3	90	strike slip	0	208
Newport Inglewood Connected alt 1	7.94	1	88	strike slip	0	65
Newport-Inglewood, alt 1	7.94	1.3	89	strike slip	0	208

4.0 ANALYSES

4.1 SEISMICITY

Following ASCE7-16, Section 21.5.3, the mapped Maximum Considered Earthquake Geometric Mean (MCE_G) peak ground acceleration is PGA_M = 0.639g. Additional evaluation will be necessary to determine the site-specific value to be used for evaluation of liquefaction, lateral spreading, seismic settlements, and other soil-related issues. Based on the results of deaggregation analysis performed using USGS Unified Hazard Tool, the mean event associated with a probability of exceedance equal to 2% over 50 years has a moment magnitude of 6.68 and the mean distance to the seismic source is 8.1 miles.

4.2 STATIC SETTLEMENT

Analyses were performed to estimate settlement of footings for the anticipated loading conditions and configurations. Loading conditions for the proposed foundations are not known at this time. Based on previous experience, we have assumed the maximum load will not exceed 3 kips/ft. for continuous footing loads and 75 kips per column loads.

Based on the anticipated foundation loads and provided the existing surficial materials are removed and recompacted to provide a uniform layer of engineered compacted fill, the total and differential

static settlements are not anticipated to exceed 1 inch and ½-inch over 30 feet, respectively, for the proposed residential structures.

4.3 LIQUEFACTION

Engineering research of soil liquefaction potential (Youd, et al., 2001) indicates that generally three basic factors must exist concurrently in order for liquefaction to occur. These factors include:

- A source of ground shaking, such as an earthquake, capable of generating soil mass distortions.
- A relatively loose silty and/or sandy soil.
- A relative shallow groundwater table (within approximately 50 feet below ground surface) or completely saturated soil conditions that will allow positive pore pressure generation.

The site is located within a State-designated zone of potentially liquefiable soils. Additionally, historic groundwater is about 10 feet below ground surface. The site is also predominately underlain by coarse grained materials which are susceptible to liquefaction. Groundwater was encountered at 37 feet below the existing grade during this firm's subsurface exploration although review of groundwater data from three nearby wells suggests that groundwater has not risen above 45 feet since 1979 and has predominantly been below a depth of 60 feet.

Our analysis indicates that liquefaction may occur below the site during periods of strong ground motion. Our analyses indicate liquefaction could lead to a total seismic settlement (saturated and dry) of the ground surface of up to approximately 3.7 inches due to seismic consolidation during liquefaction. Given this condition, differential settlement due to seismic settlement would likely be on the order of ½ of the total seismic settlement or approximately 1.9 inches over 30 feet.

If hazards from liquefaction were likely, these hazards can be mitigated to the extent required to reduce seismic risk to "acceptable levels." The use of well-reinforced foundations, such as post-tensioned slabs, grade beams with structural slabs, or mat foundations, has been proven to adequately provide basal support for similar structures during comparable liquefaction events.

5.0 CONCLUSIONS

5.1 FEASIBILITY OF PROPOSED DEVELOPMENT

From a geotechnical point of view, the proposed site development is considered feasible. Furthermore, it is also our opinion that the proposed development will not adversely impact the stability of adjoining properties. The adequacy and sufficiency of the preliminary findings and conclusions provided herein should be assessed based upon the final grading and structural plans. A supplemental geotechnical investigation report will be required for design, permitting and construction.

5.2 GEOLOGIC HAZARDS

5.2.1 Ground Rupture

From a geotechnical point of view, the proposed site development is considered feasible. Furthermore, it is also our opinion that the proposed development will not adversely impact the stability of adjoining properties. The adequacy and sufficiency of the preliminary findings and conclusions provided herein should be assessed based upon the final grading and structural plans. A supplemental geotechnical investigation report will be required for design, permitting and construction.

5.2.2 Ground Shaking

The site is situated in a seismically active area that has historically been affected by generally moderate to occasionally high levels of ground motion. The site lies in relatively close proximity to several seismically active faults; therefore, during the life of the proposed structures, the property will probably experience similar moderate to occasionally high ground shaking from these fault zones, as well as some background shaking from other seismically active areas of the Southern California region. Potential ground accelerations have been estimated for the site and are presented in Section 4.1 of this report. Design and construction in accordance with the current California Building Code (CBC 2022) requirements is anticipated to adequately address potential ground shaking.

5.2.3 Liquefaction

The site is mapped with a historical high groundwater level of approximately 10 feet. We have performed an evaluation of liquefaction potential. Based on our analyses, liquefaction may occur below the site during periods of strong ground motion using historic high groundwater. Our analyses indicate liquefaction could lead to a total seismic settlement (saturated and dry) of the ground surface of up to approximately 3.7 inches due to seismic consolidation during liquefaction. Given this condition, differential settlement due to seismic settlement would likely be on the order of ½ of the total seismic settlement or approximately 1.9 inches over 30 feet.

5.3 STATIC SETTLEMENT

Our exploration and laboratory testing indicated that portions of the underlying soils are relatively loose. However, provided the existing artificial fill soils are removed and recompacted, total and differential static settlement can likely be limited to a maximum of 1 inch and ½-inch over 30 feet, respectively. These estimated magnitudes of static settlements are considered within tolerable limits for the proposed residential structures.

5.4 EARTHWORK AND MATERIAL CHARACTERISTICS

In general, the existing fill materials are considered unsuitable in their existing condition to support proposed structural fills and site development. This condition can be mitigated by removal and recompaction of unsuitable soils. The anticipated depth of removal to mitigate structural load-induced settlement below the proposed residential buildings, retaining walls, and pavement is on the order of 2 feet below the existing ground surface. As mentioned previously, some localized areas of deeper artificial fills may be present onsite. A minimum of 2 feet of engineered fill should be placed to support the proposed buildings and retaining walls.

Temporary construction slopes and trench excavations can likely be cut vertically up to a height of 3 feet within the onsite materials provided that no surcharging of the excavations is present. Temporary excavations greater than 3 feet in height will likely require side laybacks to 1:1 (H:V) or flatter to mitigate the potential for sloughing. Vertical excavations exposing sandy materials will likely have no tolerance for a vertical cut and require laybacks at a 1.5:1 gradient (H:V). Site materials may be prone to sloughing and possible caving if allowed to dry. The sandy materials will limit vertical excavations along the property line.

Demolition of the existing site improvements will generate a concrete debris. Significant portions of concrete debris can likely be reduced in size to less than 4 inches and incorporated within fill soils during earthwork operations.

Onsite disposal systems, clarifiers and other underground improvements may be present beneath the site. If encountered during future rough grading, these improvements will require proper abandonment or removal.

Existing walls are present along all sides of the property lines. These walls are estimated to be retaining up to 2 feet within the northwest and southwest corner. If the proposed buildings are close to the existing walls, special considerations may be required in order to excavate along this wall. Additionally, any structures proposed near the wall will need to be supported such that surcharge loads are not applied to the existing wall.

Off-site improvements exist near the property lines. The presence of the existing off-site improvements may limit removals of unsuitable materials adjacent to the property lines. Therefore, construction of perimeter site walls may require deepened footings and/or additional reinforcement and additional control joints, where removals are restricted by property boundaries. The proposed perimeter walls may require A-B-C slot construction, in areas of sandy materials or where wall heights exceed 4 feet.

Subsurface soils are anticipated to be relatively easy to excavate with conventional heavy earthmoving equipment. Removal and recompaction of the site materials will result in some minor shrinkage and subsidence. Design of site grading will require consideration of this loss when evaluating earthwork balance issues.

The site soils encountered during our investigation were generally below or near optimum moisture content and will require the addition of water to achieve proper compaction.

5.5 SHRINKAGE AND BULKAGE

Volumetric changes in earth quantities will occur when excavated onsite soil materials are replaced as properly compacted fill. We estimate the existing upper earth materials will shrink approximately 10 to 15 percent due to the varying densities throughout the site. Subsidence of removal bottoms is estimated to be on the order of 0.15 feet. The estimates of shrinkage are intended as an aid for project engineers in determining earthwork quantities. However, these estimates should be used with some caution since they are not absolute values. Contingencies should be made for balancing earthwork quantities based on actual swelling and bulkage that occurs during the grading process.

5.6 SOIL EXPANSION

Based on USCS visual manual classification, the near-surface sandy soils within the site are generally anticipated to possess a **Very Low** expansion potential. Additional testing for soil expansion will be required subsequent to rough grading and prior to construction of foundations and other concrete work to confirm these conditions.

5.7 FOUNDATIONS

Conventional shallow spread and continuous footings may be utilized to support the proposed residential buildings and wall structures at the site. However, if liquefaction potential is considered to be a hazard, post-tensioned foundations may be used. Considering the **Very Low** expansion potential, the foundations for the proposed structures and other site improvements, such as retaining walls, screen walls, and flatwork, will likely require only nominal reinforcement and depths.

5.8 CONCRETE MIX DESIGN

Laboratory testing of onsite soil indicates negligible soluble sulfate content. Concrete designed to follow the procedures provided in ACI 318, Section 4.3, Table 4.3.1 for **negligible** sulfate exposure are anticipated to be adequate for mitigation of sulfate attack on concrete. Upon completion of rough grading, an evaluation of as-graded conditions and further laboratory testing will be required for the site to confirm or modify the conclusions provided in this section.

5.9 CORROSION POTENTIAL

Laboratory testing of onsite soil indicates indicate a minimum resistivity of 10,000 ohm-cm, chloride content of 65 ppm, and a pH of 7. Based on laboratory test results, site soils are **Slightly Corrosive** to metals. Structures fabricated from metals should have appropriate corrosion protection if they will be in direct contact with site soils. Under such conditions, a corrosion specialist should provide specific recommendations.

5.10 PAVEMENT SECTIONS

Existing near-surface sandy soils are anticipated to have a moderate R-value. Based on the assumed R-value of 35 and a traffic index of 5, a preliminary pavement structural section of 3 inches asphaltic concrete over 5 inches of aggregate base, may be used for planning and estimating purpose. R-value testing will be required subsequent to rough grading and prior to construction of interior driveways to confirm these conditions.

5.11 PERCOLATION CHARACTERISTICS

Groundwater was encountered at 37 feet below the ground surface at the time of our investigation although literature indicates historical levels as shallow as 10 feet. As with most areas in southern California, ground water levels have generally been dropping due to water extraction and historical shallow levels are unlikely to occur in the future. Given the unusually high rainfall this past season,

the current groundwater levels likely represent a relatively shallow condition over the last few decades. We estimate that future groundwater levels during the life of the project are unlikely to be shallower than 35 feet.

Soils located within the upper 35 feet are primarily sandy in nature with relatively high infiltration rates. Below a depth of 35 feet, materials encountered were predominately interbedded coarse-grained and fine grained soils that will tend to impede groundwater infiltration. Based on this condition, dry wells are feasible for use in infiltrating storm water. However, wells will need to be limited to a depth of 25 feet.

Preliminary analyses indicate that a dry well could likely provide a peak measured infiltration flow of approximately 0.038 cfs and the chamber empties within approximately 2.5 hours. The typical dry well is estimated to be 25 feet deep. We estimate the Design Capture Volume (DCV) will be about 2,500 ft^3. Assuming a factor of safety of 3.0 applied to our estimated flow rate of the dry well, we estimate the DCV can be treated within the required 72 hours using one dry well. We also estimate the system will require an additional retention storage of about 2,200 cubic feet placed upstream of the dry well. This retention storage can be accommodated by pipe or vault systems. Further percolation testing and/or evaluation may be necessary based on review of preliminary WQMP design plans.

6.0 LIMITATIONS

This report is based on the proposed development and geotechnical data as described herein. The materials described herein and in other literature are believed representative of the total project area, and the conclusions contained in this report are presented on that basis. However, soil materials can vary in characteristics between points of exploration, both laterally and vertically, and those variations could affect the conclusions and recommendations contained herein. As such, observation and testing by a geotechnical consultant prior to and during the grading and construction phases of the project are essential to confirming the basis of this report.

This report summarizes several geotechnical topics that should be beneficial for project planning and budgetary evaluations. *The information presented herein is intended only for a preliminary feasibility evaluation and **is not** intended to satisfy the requirements of a site specific and detailed geotechnical investigation required for further planning and permitting.*

This report has been prepared consistent with that level of care being provided by other professionals providing similar services at the same locale and time period. The contents of this report are professional opinions and as such, are not to be considered a guaranty or warranty.

This report should be reviewed and updated after a period of one year or if the site ownership or project concept changes from that described herein.

This report has been prepared for the exclusive use of **The Olson Company** to assist the project consultants in determining the feasibility of the proposed development. This report has not been prepared for use by parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

Respectfully submitted,

ALBUS & ASSOCIATES, INC.

Eung Jin Jeon, Ph.D.
Associate Engineer
G.E. 3096

Reviewed by:

Paul Hyun Jin Kim
Associate Engineer
G.E. 3106

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0 15 30 60

APPROX SCALE : 1" = 30'

EXPLANATION

(Locations Approximate)

- Exploratory Boring
- Percolation Test Boring

ALBUS ASSOCIATES

GEOTECHNICAL MAP

Job No.: 3157.00	Date: 12/06/2022	Plate: 1

APPENDIX A

EXPLORATION LOGS

Field Identification Sheet

Light gray

Gray

Dark gray

Gray Brown

Light brown

Brown

Dark Brown

Olive brown

Olive

Yellow

Yellowish brown

Yellowish red

Red

Reddish Brown

Tan

Description Order:

Description, Color, Moisture, Density, Grain Size, Additional Description

Description	%	Example
	0-5	Sand
trace	5-15	Sand trace Silt
with	15-30	Sand with Silt
	30+	Silty Sand

More Examples

Sand with Silt trace Clay

Sand trace Silt and Clay

Sand with Silt and Clay

Gravelly Sand with Silt trace Clay

Silty Clay with Sand trace Gravel

Moisture

Dry	absence of water
Damp	below optimum
Moist	near optimum
Very Moist	above optimum
Wet	free water visible

Density (Navfac)

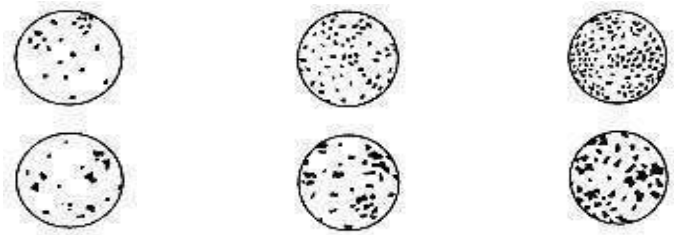
Coarse grained soils	SPT	CA
Very Loose	0-3	0-5
Loose	3-8	5-13
Medium Dense	8-14	13-22
Dense	14-25	22-40
Very Dense	25>	40>
Fine grained soils		
Very Soft	2<	0-3
Soft	2-4	3-6
Medium Stiff	4-8	6-13
Stiff	8-15	13-24
Very Stiff	15-30	24-48
Hard	30>	48>

Grain Size

Description		Sieve Size	Approx. Size
Boulders		>12"	Larger than basketball
Cobbles		3-12"	Fist to basketball
Gravel	coarse	3/4-3"	Thumb to Fist
	fine	#4-3/4"	Pea to Thumb
Sand	coarse	#10-4	Rock Salt to Pea
	medium	#40-10	Sugar to Rock Salt
	fine	#200-40	Flour to Sugar
Fines		Pass #200	Smaller than Flour

Additional Description (ie. roots, pinhole pores, debris, etc.)

Trace 5% Moderate 15% Abundant 30%



EXPLORATION LOG

Project:		Location:
Address:		Elevation:
Job Number:	Client:	Date:
Drill Method:	Driving Weight:	Logged By:

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		EXPLANATION							
		Solid lines separate geologic units and/or material types.							
		Dashed lines indicate unknown depth of geologic unit change or material type change.							
5		**Solid black rectangle** in Core column represents California Split Spoon sampler (2.5in ID, 3in OD).							
		Double triangle in core column represents SPT sampler.							
10		**Vertical Lines** in core column represents Shelby sampler.							
		Solid black rectangle in Bulk column respresents large bag sample.							
		Other Laboratory Tests:							
15		Max = Maximum Dry Density/Optimum Moisture Content							
		EI = Expansion Index							
		SO4 = Soluble Sulfate Content							
		DSR = Direct Shear, Remolded							
		DS = Direct Shear, Undisturbed							
		SA = Sieve Analysis (1" through #200 sieve)							
		Hydro = Particle Size Analysis (SA with Hydrometer)							
20		200 = Percent Passing #200 Sieve							
		Consol = Consolidation							
		SE = Sand Equivalent							
		Rval = R-Value							
		ATT = Atterberg Limits							

EXPLORATION LOG B-1

JOB NO.	CLIENT/PROJECT	DAY	DATE
3157.00	The Olson Company	Tuesday	2023-05-23

LOCATION	LATITUDE	LONGITUDE	ELEVATION
12828 Newhope Street, Garden Grove	33.77704	-117.92861	94.7

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
ddalbus	2R Drilling	Hollow-Stem Auger	140 lbs / 30 in

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		Asphalt							
2		**Artificial Fill (Af)** Sand trace Silt (SP): gray, moist, loose, fine to medium grained				13	19.5	99.7	
3									
4		**Alluvial Fan Deposits (Qyfa)** Sand trace Silt (SP): gray, moist, loose, fine to medium grained, trace pinhole pores				12	8.8	103.3	consol
5									
6		@ 4 ft, trace pinhole pores				14	11.2	103	
7		@ 6 ft, medium dense, trace pinhole pores							
8									
9									
10		Sand (SP): light gray, dry, medium dense, fine to coarse grained sand				27	2	101.4	
11									
12									
13									
14									
15		Silty Sand (SM): gray, moist, medium dense, fine grained sand				12			200
16									
17									
18									
19									
20		Sand (SP): light gray, dry to damp, dense, fine to coarse grained				27			200
21									
22									
23									
24									
25		Silty Sand (SM): gray, moist, dense, fine grained				18			
26									
27									
28									
29									

EXPLORATION LOG B-1

JOB NO.	CLIENT/PROJECT	DAY	DATE
3157.00	The Olson Company	Tuesday	2023-05-23

LOCATION	LATITUDE	LONGITUDE	ELEVATION
12828 Newhope Street, Garden Grove	33.77704	-117.92861	94.7

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
ddalbus	2R Drilling	Hollow-Stem Auger	140 lbs / 30 in

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
31		Sand (SP): light gray, dry to damp, dense, fine grained				20			
35		Sandy Clay (CL): gray, moist to very moist, loose, fine grained				4	23.7		200 att
40		Sand trace Silt (SP): gray, wet, medium dense, fine to medium grained				10			
41		Sandy Clay (CL): gray, very moist, very stiff, fine grained							
45		Sand (SP): gray, wet, medium dense, fine to coarse grained				10			
46		Sandy Clay (CL): gray, very moist, very stiff, fine grained							
50		Sandy Clay (CL): gray, very moist to wet, hard, fine grained				23			
51		Total Depth 51.5 feet Groundwater 37 feet Boring backfilled with soil cuttings							

EXPLORATION LOG B-2

JOB NO.	CLIENT/PROJECT	DAY	DATE
3157.00	The Olson Company	Tuesday	2023-05-23

LOCATION	LATITUDE	LONGITUDE	ELEVATION
12828 Newhope Street, Garden Grove	33.77701	-117.92846	95.2

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
ddalbus	2R Drilling	Hollow-Stem Auger	140 lbs / 30 in

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
0		Asphalt							max so4 ph resist ch
1		**Artificial Fill (Af)** Sand trace Silt (SP): gray, moist, loose, fine grained							
2		**Alluvial Fan Deposits (Qyfa)** Sand trace Silt (SP): gray, moist, loose, fine grained, trace pinhole pores and roots				13	7.2	94.7	
3									
4		@ 4 ft, medium dense, trace pinhole pores				14	8.2	101	
5									
6		Sand with Silt (SP): gray, moist, loose, fine grained, trace pinhole pores				12	8	95.8	consol
7									
8									
9									
10		Sand trace Silt (SP): gray, very moist, medium dense, fine grained, trace pinhole pores and roots				20	4.3	103.3	
11									
12		Total Depth 11.5 feet No Groundwater Boring backfilled with soil cuttings							
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									

EXPLORATION LOG B-3

JOB NO.	CLIENT/PROJECT	DAY	DATE
3157.00	The Olson Company	Tuesday	2023-05-23

LOCATION	LATITUDE	LONGITUDE	ELEVATION
12828 Newhope Street, Garden Grove	33.77701	-117.92808	93.9

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
ddalbus	2R Drilling	Hollow-Stem Auger	140 lbs / 30 in

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		Asphalt							
2		**Artificial Fill (Af)** Silty Sand trace Clay (SM): gray, very moist, medium dense, fine grained				19	16.7	107.4	
3		**Alluvial Fan Deposits (Qyfa)** Silty Sand trace Clay (SM): gray, very moist, medium dense, fine grained, trace pinhole pores and roots				12	5.7	99.7	consol
4		Sand (SP): gray, moist, loose, fine to medium grained							
5									
6		@ 6 ft, medium dense, fine to coarse grained				18	4.5	100.6	
7									
8									
9									
10		@ 10 ft, more coarse grained sand				21	2.2	99.3	
11									
12		Total Depth 11.5 feet No Groundwater Boring backfilled with soil cuttings							
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									

APPENDIX B

LABORATORY TEST PROGRAM

LABORATORY TESTING PROGRAM

Soil Classification

Soils encountered within the exploratory borings were initially classified in the field in general accordance with the visual-manual procedures of the Unified Soil Classification System (ASTM D 2487). The samples were re-examined in the laboratory and classifications reviewed and then revised where appropriate. The assigned group symbols are presented on the Exploration Logs provided in Appendix A.

In Situ Moisture and Density

Moisture content and unit dry density of in-place soil materials were determined in representative strata. Test data are summarized in the Boring Logs, Appendix A.

Maximum Dry Density and Optimum Moisture Content

Maximum dry density and optimum moisture content were performed on representative samples of the site materials obtained from our field explorations. The test was performed in accordance with ASTM D 1557. Pertinent test values are given in Table B.

Soluble Sulfate Content

Chemical analysis is being performed on selected samples to determine soluble sulfate content. The test was performed in accordance with California Test Method No. 417. The test result is still pending.

Atterberg Limits

Atterberg Limits (Liquid Limit, Plastic Limit, and Plasticity Index) were performed in accordance with Test Method ASTM D4318. Pertinent test values are presented in Table B-1.

Consolidation

Consolidation tests were performed for selected soil samples in general conformance with ASTM D 2435. Axial loads were applied in several increments to a laterally restrained 1-inch-high sample. Loads were applied in geometric progression by doubling the previous load, and the resulting deformations were recorded at selected time intervals. Results of the tests are graphically presented on Plates B-1 thru B-3.

Percent Passing the No. 200 Sieve

Percent of material passing the No. 200 sieve was determined on selected samples to verify visual classifications performed in the field. These tests were performed in accordance with ASTM D1140-00. Test results are presented in Table B.

Direct Shear

Direct shear testing was performed for a selected soil sample remolded to 90 percent of the maximum dry density. This test was performed in general accordance with ASTM D3080-04. Three specimens were prepared for the test. The test specimens were artificially saturated, and then sheared under varied normal loads at a constant rate. The results are graphically presented on Plate B-4.

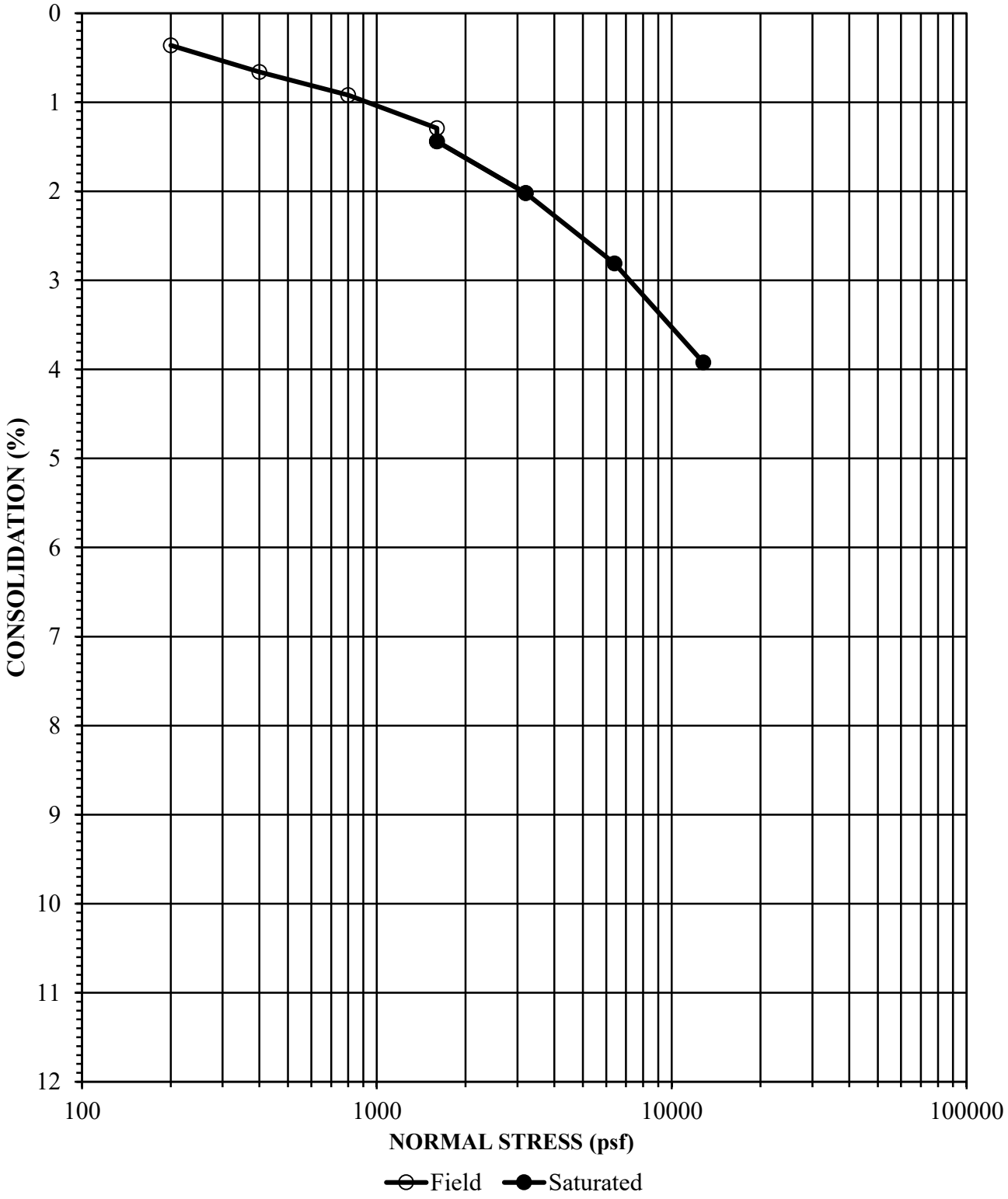
Corrosion

Select samples is being tested for minimum resistivity and pH in accordance with California Test Method 643. Results of these tests are still pending.

TABLE B
SUMMARY OF LABORATORY TEST RESULTS

Boring No.	Sample Depth (ft)	Soil Description	Test Results	
B-1	15	Silty Sand (SM)	Passing #200 Sieve (%):	23
B-1	20	Sand trace Silt (SP)	Passing #200 Sieve (%):	6
B-1	35	Sandy Clay (CL)	Passing #200 Sieve (%): Liquid Limit: Plastic Index:	66.3 33 14
B-2	0-5	Sand with Silt (SP)	Max. Dry Density (pcf): Opt. Moisture Content (%): Soluble Sulfate Content: Sulfate Exposure: Resistivity (ohm-cm): pH: Chloride content (ppm):	123.5 11 0.000 % Negligible 10,000 7 65

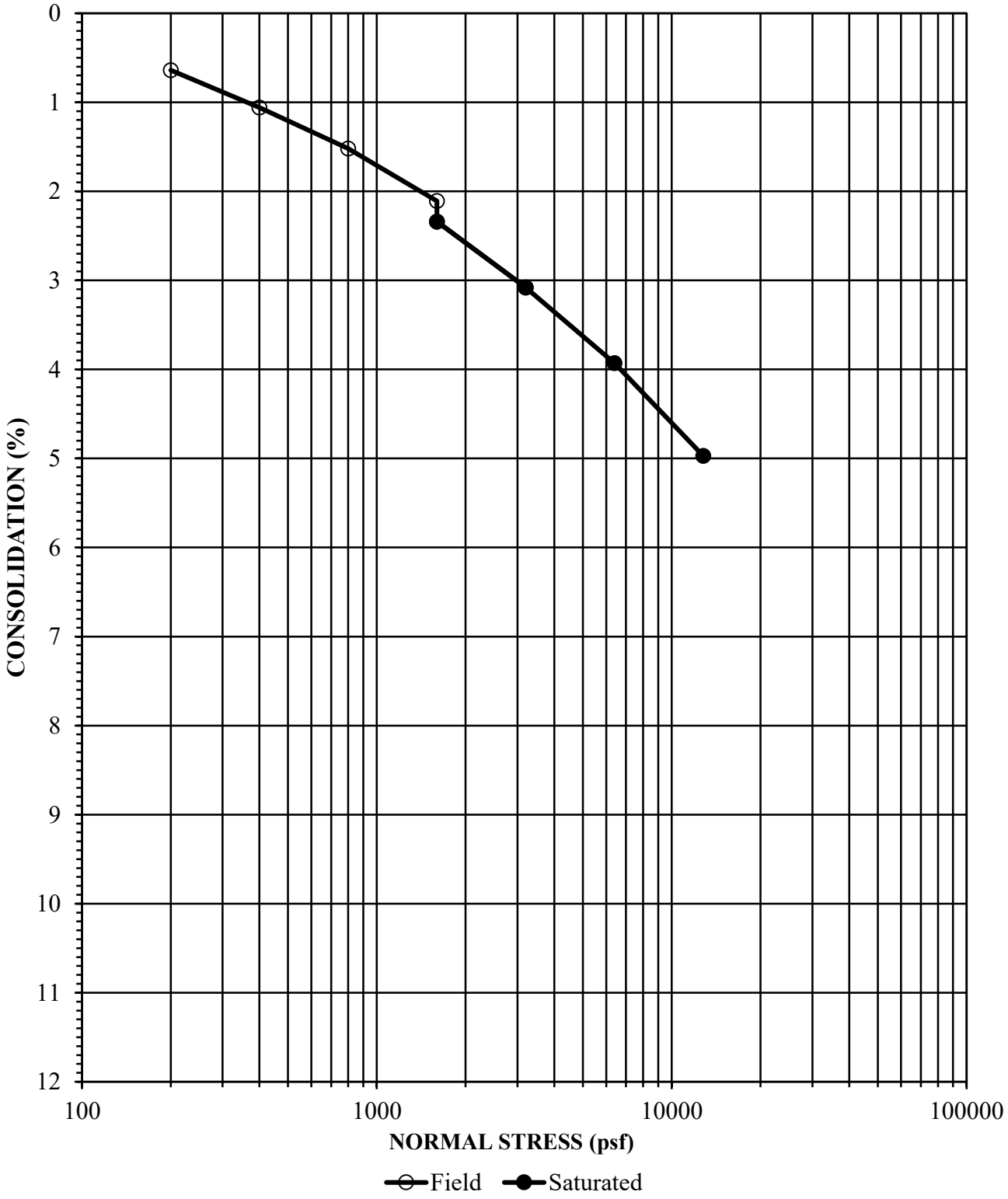
CONSOLIDATION



Job Number	Location	Depth	Description
3157.00	B-1	4	Sand trace Silt (SP)

Initial Dry Density (pcf)	Initial Moisture Content (%)	Final Moisture Concent (%)

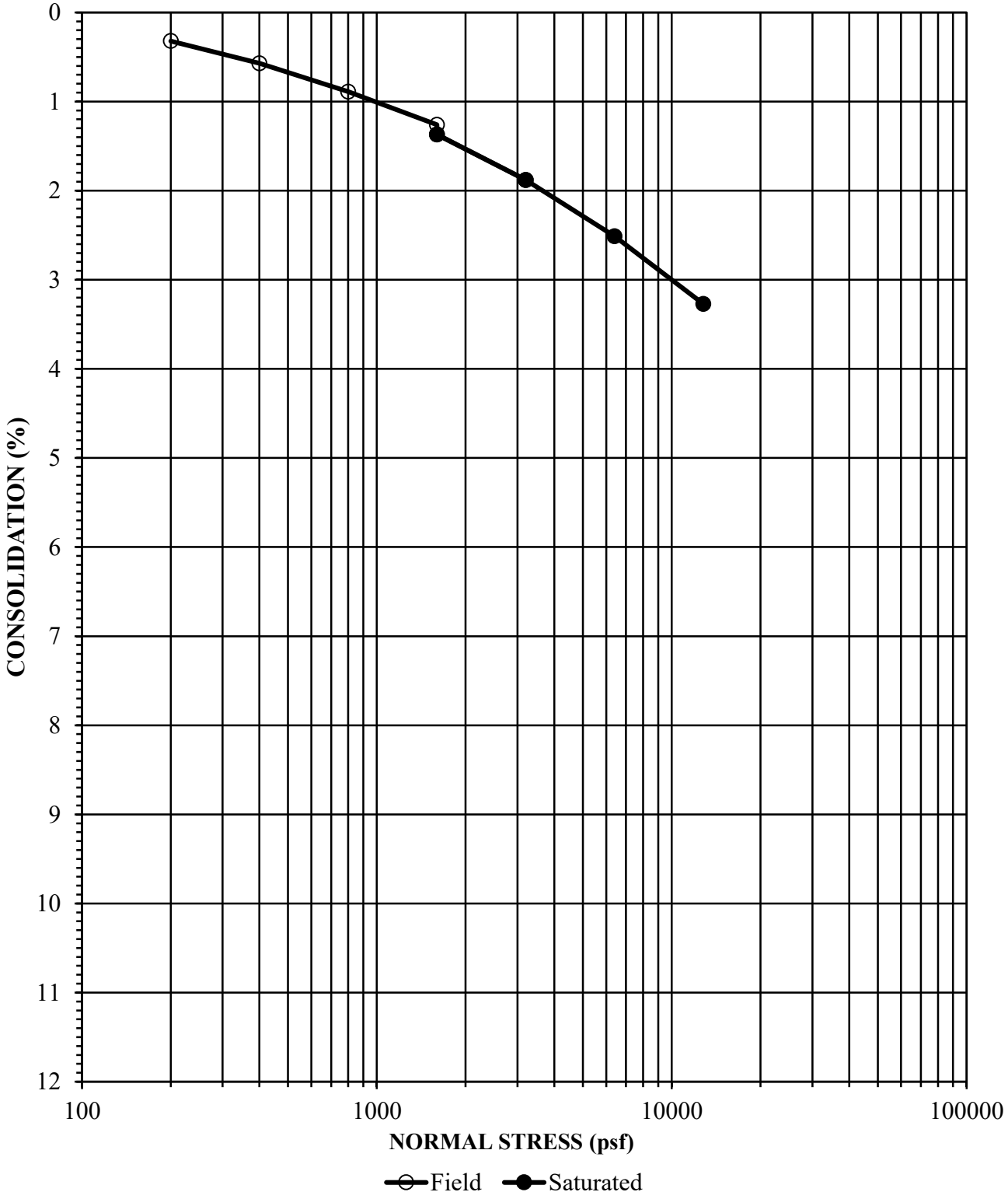
CONSOLIDATION



Job Number	Location	Depth	Description
3157.00	B-2	6	Sand (SP)

Initial Dry Density (pcf)	Initial Moisture Content (%)	Final Moisture Concent (%)

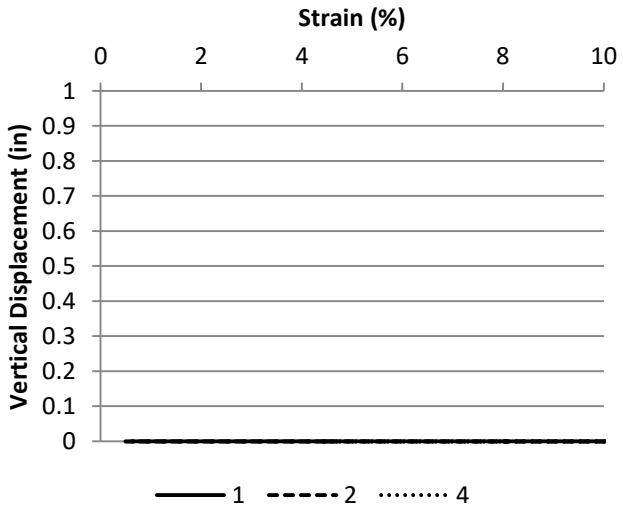
CONSOLIDATION

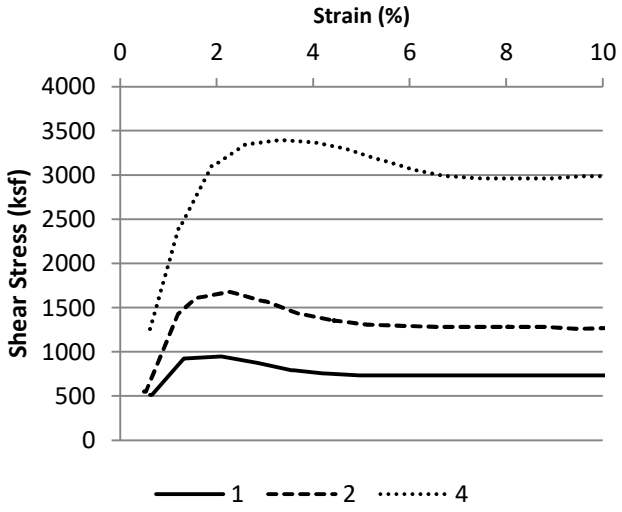


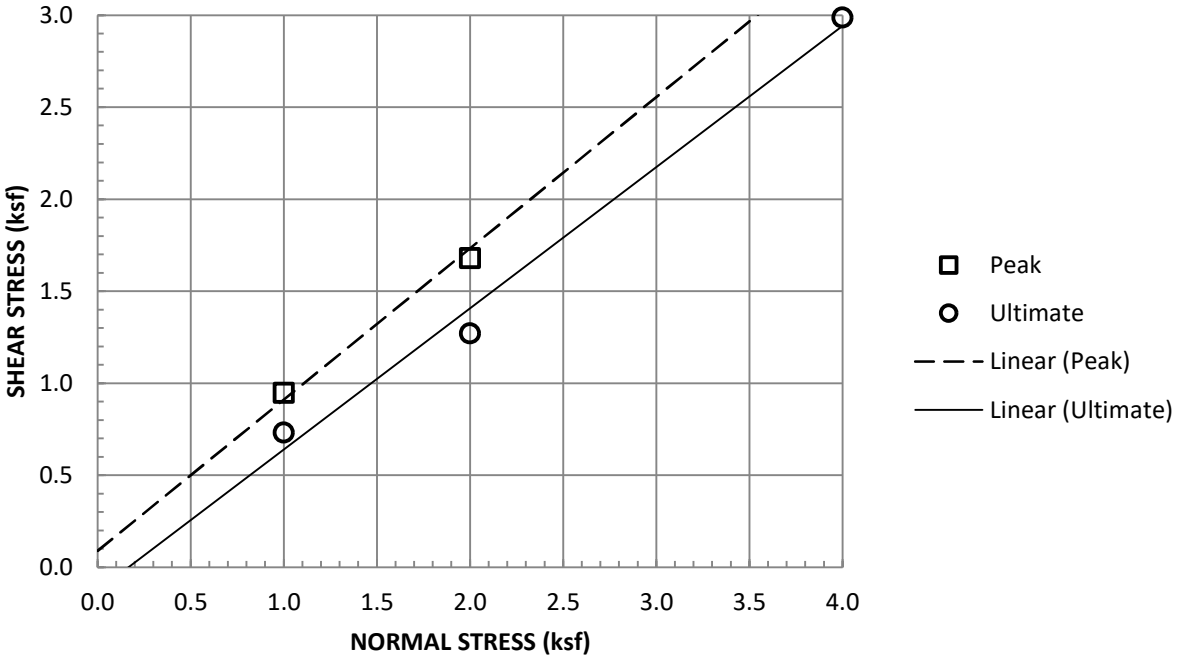
Job Number	Location	Depth	Description
3157.00	B-3	4	Sand (SP)

Initial Dry Density (pcf)	Initial Moisture Content (%)	Final Moisture Concent (%)

DIRECT SHEAR







Sample Type:	Remolded, Saturated		
Normal Stress (ksf)	1	2	4
Peak Shear Stress (ksf)	0.948	1.68	3.396
Peak Displacement (in)	0	0	0
Ultimate Shear Stress (ksf)	0.732	1.272	2.988
Ultimate Displacement (in)	948	1680	3396
Initial Dry Density (pcf)	111.2	111.3	111.3
Initial Moisture Content (%)	11	11	11
Final Moisture Content (%)	17	16.8	16.9
Strain Rate (in/min)	.035		

Job Number	Location	Depth	Description
3157.00	B-2	0-5	Sand with Silt (SP)

APPENDIX C

LIQUEFACTION ANALYSES

TABLE C-1

ANALYSIS OF LIQUEFACTION POTENTIAL
BORING: B-1 (2%PE in 50 yrs; FS=1.3)

Client:
J.N.
Site:

Hammer Type (D,S,A)	A	[Ce= D 0.75, S 0.95, A Hammer Efficiency]			
Boring Diameter, ID (in)	4				
Site Acceleration (g)	0.683	PGAm w/o MSF			
for a Magnitude (Mw) of	6.68	Corresponding to 2%PE in 50 yrs			
and MSF of	1.41		Analysis Type:	General	
Depth to High GW	10.0	ft.	FS for Liquefaction:	1.3	
Depth to GW during invest.	37.0	ft.	FS for Liqu. Settlement:	1.3	
Hammer Efficiency	90.1	%	PI Threshold for Liquefaction:	12	
Sublayer Thickness	1.0	ft.	Min. Moisture Cnt for Liqu. (%LL)	85	
Depth of Analysis	50.0	ft.	Max FS for Plotting:	5.0	

Layer Label (Auto)	Depth Interval (ft) Top	Depth Interval (ft) Bottom	Layer Mid-Depth (ft)	Soil Type (USCS)	Fines <#200 Sieve (%)	LL (%)	PI	M (%)	Field Nf (bls/ft)	Sample Type SPT/CA	Soil Wet Density (pcf)
1	0.0	5.0	2.5	SP	15				12	CA	115
2	5.0	10.0	7.5	SP	15				14	CA	115
3	10.0	15.0	12.5	SP	5				27	CA	105
4	15.0	20.0	17.5	SM	23				12	SPT	105
5	20.0	25.0	22.5	SP	6				27	SPT	105
6	25.0	30.0	27.5	SM	23				18	SPT	105
7	30.0	35.0	32.5	SP	5				20	SPT	105
8	35.0	40.0	37.5	CL	66	33	14	23.7	4	SPT	105
9	40.0	41.0	40.5	SP	5				10	SPT	105
10	41.0	45.0	43.0	CL	60	33	14	24	10	SPT	120
11	45.0	46.0	45.5	SP	5				10	SPT	105
12	46.0	50.0	48.0	CL	60	33	14	24	10	SPT	120
13	50.0	51.5	50.8	CL	60	33	14	24	23	SPT	120
14	51.5										
15	51.6										

TABLE C-2
ANALYSIS OF LIQUEFACTION POTENTIAL
BORING: B-1 (2%PE in 50 yrs; FS=1.3)

Client: 0
J.N. 0
Site: 0

SP

Hammer Type (D,S,A)	A			
Boring Diameter, ID (in)	4			
Site Acceleration (g)	0.683			
for a Magnitude (Mw) of	6.68			
and MSF of	1.41			
Depth to High GW	10	ft.	FS for Liquefaction:	1.3
Depth to GW during invest.	37	ft.	FS for Liqu. Settlement:	1.3
Hammer Efficiency	90.1	%	PI Threshold for Liquefaction:	12
Sublayer Thickness	1	ft.	Moisture Cnt Threshold for Liqu. (%LL)	85
Depth of Boring	50	ft.		

Notes: Underlined numbers are estimated values.
(1) Based on current groundwater conditions at the time of investigation.
(2) Based on assumed/proposed high groundwater conditions.
(3) Kα=1.0

(4) A Layer is located above historically high groundwater
B Factor of Saftey is greater than the specified value of FS=1.3
C The $(N_1)_{60\text{-}cs}$ is greater than 30 blows per foot
D PI > 12 or the in situ moisture content (M%) < 85% LL

Reference: Youd, T.L., et.al., (2001), "Liquefaction Resistance of Soils: Summary Report From The 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils", ASCE Journal of Geotechnical and Geoenvironmental Engineering, Vol.127, No.10, pp.817-833, October, 2001.

Layer Label	Depth Interval (ft) Top	Depth Interval (ft) Bottom	Layer Mid-Depth (ft)	Soil Type (USCS)	Fines <#200 Sieve (%)	LL (%)	PI	M (%)	Field Nf (bls/ft)	Sample Type SPT/CA	Soil Wet Density (pcf)	Total Stress (psf)(1)	Effec. Stress (psf)(1)	C_n	C_e	C_b	C_r	C_L	$(N_1)_{60}$ (lbs/ft)	α	β	$(N_1)_{60\text{-}cs}$ (lbs/ft)	Effec. Stress (psf)(2)	R_d	CRR (M=7.5)	Kσ	CSR	FS (3)	To Liquefy Y/N?	Reason(4) not Liquifiable
																												1.30		
1	0.0	1.0	0.5	SP	15				12	CA	115	58	58	1.7	1.50	1.00	0.75	1.0	12.9	2.5	1.05	16.0	58	1.00	NA	1.00	0.44	NA	N	A
1	1.0	2.0	1.5	SP	15				12	CA	115	173	173	1.7	1.50	1.00	0.75	1.0	12.9	2.5	1.05	16.0	173	1.00	NA	1.00	0.44	NA	N	A
1	2.0	3.0	2.5	SP	15				12	CA	115	288	288	1.6	1.50	1.00	0.75	1.0	12.4	2.5	1.05	15.5	288	0.99	NA	1.00	0.44	NA	N	A
1	3.0	4.0	3.5	SP	15				12	CA	115	403	403	1.6	1.50	1.00	0.75	1.0	12.0	2.5	1.05	15.0	403	0.99	NA	1.00	0.44	NA	N	A
1	4.0	5.0	4.5	SP	15				12	CA	115	518	518	1.5	1.50	1.00	0.75	1.0	11.5	2.5	1.05	14.6	518	0.99	NA	1.00	0.44	NA	N	A
2	5.0	6.0	5.5	SP	15				14	CA	115	633	633	1.5	1.50	1.00	0.75	1.0	12.9	2.5	1.05	16.0	633	0.99	NA	1.00	0.44	NA	N	A
2	6.0	7.0	6.5	SP	15				14	CA	115	748	748	1.4	1.50	1.00	0.80	1.0	13.3	2.5	1.05	16.4	748	0.99	NA	1.00	0.44	NA	N	A
2	7.0	8.0	7.5	SP	15				14	CA	115	863	863	1.4	1.50	1.00	0.80	1.0	12.8	2.5	1.05	16.0	863	0.98	NA	1.00	0.44	NA	N	A
2	8.0	9.0	8.5	SP	15				14	CA	115	978	978	1.3	1.50	1.00	0.80	1.0	12.4	2.5	1.05	15.5	978	0.98	NA	1.00	0.44	NA	N	A
2	9.0	10.0	9.5	SP	15				14	CA	115	1093	1093	1.3	1.50	1.00	0.85	1.0	12.8	2.5	1.05	15.9	1093	0.98	NA	1.00	0.44	NA	N	A
3	10.0	11.0	10.5	SP	5				27	CA	105	1103	1103	1.3	1.50	1.00	0.85	1.0	24.6	0.0	1.00	24.6	1071	0.98	0.28	1.00	0.44	0.91	Y	
3	11.0	12.0	11.5	SP	5				27	CA	105	1208	1208	1.2	1.50	1.00	0.85	1.0	23.9	0.0	1.00	23.9	1114	0.97	0.27	1.00	0.46	0.83	Y	
3	12.0	13.0	12.5	SP	5				27	CA	105	1313	1313	1.2	1.50	1.00	0.85	1.0	23.2	0.0	1.00	23.2	1157	0.97	0.26	1.00	0.48	0.76	Y	
3	13.0	14.0	13.5	SP	5				27	CA	105	1418	1418	1.2	1.50	1.00	0.85	1.0	22.6	0.0	1.00	22.6	1199	0.97	0.25	1.00	0.50	0.71	Y	
3	14.0	15.0	14.5	SP	5				27	CA	105	1523	1523	1.1	1.50	1.00	0.85	1.0	22.0	0.0	1.00	22.0	1242	0.97	0.24	1.00	0.52	0.66	Y	
4	15.0	16.0	15.5	SM	23				12	SPT	105	1628	1628	1.1	1.50	1.00	0.85	1.2	20.4	4.1	1.10	26.5	1284	0.96	0.33	1.00	0.54	0.85	Y	
4	16.0	17.0	16.5	SM	23				12	SPT	105	1733	1733	1.1	1.50	1.00	0.90	1.2	21.1	4.1	1.10	27.3	1327	0.96	0.35	1.00	0.56	0.87	Y	
4	17.0	18.0	17.5	SM	23				12	SPT	105	1838	1838	1.1	1.50	1.00	0.90	1.2	20.6	4.1	1.10	26.7	1370	0.96	0.33	1.00	0.58	0.80	Y	
4	18.0	19.0	18.5	SM	23				12	SPT	105	1943	1943	1.0	1.50	1.00	0.90	1.2	20.1	4.1	1.10	26.2	1412	0.96	0.32	1.00	0.58	0.77	Y	
4	19.0	20.0	19.5	SM	23				12	SPT	105	2048	2048	1.0	1.50	1.00	0.90	1.2	19.6	4.1	1.10	25.7	1455	0.96	0.31	1.01	0.60	0.72	Y	
5	20.0	21.0	20.5	SP	6				27	SPT	105	2153	2153	1.0	1.50	1.00	0.90	1.2	43.2	0.0	1.00	43.4	1497	0.95	NA	1.00	0.60	NA	N	C
5	21.0	22.0	21.5	SP	6				27	SPT	105	2258	2258	1.0	1.50	1.00	0.90	1.2	42.2	0.0	1.00	42.5	1540	0.95	NA	0.99	0.62	NA	N	C
5	22.0	23.0	22.5	SP	6				27	SPT	105	2363	2363	0.9	1.50	1.00	0.95	1.2	43.6	0.0	1.00	43.9	1583	0.95	NA	0.99	0.62	NA	N	C
5	23.0	24.0	23.5	SP	6				27	SPT	105	2468	2468	0.9	1.50	1.00	0.95	1.2	42.7	0.0	1.00	42.9	1625	0.95	NA	0.98	0.64	NA	N	C
5	24.0	25.0	24.5	SP	6				27	SPT	105	2573	2573	0.9	1.50	1.00	0.95	1.2	41.8	0.0	1.00	42.0	1668	0.94	NA	0.97	0.64	NA	N	C
6	25.0	26.0	25.5	SM	23				18	SPT	105	2678	2678	0.9	1.50	1.00	0.95	1.2	27.3	4.1	1.10	34.1	1710	0.94	NA	0.96	0.66	NA	N	C
6	26.0	27.0	26.5	SM	23				18	SPT	105	2783	2783	0.9	1.50	1.00	0.95	1.2	26.8	4.1	1.10	33.5	1753	0.94	NA	0.96	0.66	NA	N	C
6	27.0	28.0	27.5	SM	23				18	SPT	105	2888	2888	0.9	1.50	1.00	0.95	1.2	26.2	4.1	1.10	32.9	1796	0.94	NA	0.95	0.66	NA	N	C
6	28.0	29.0	28.5	SM	23				18	SPT	105	2993	2993	0.8	1.50	1.00	0.95	1.2	25.7	4.1	1.10	32.4	1838	0.93	NA	0.94	0.68	NA	N	C
6	29.0	30.0	29.5	SM	23				18	SPT	105	3098	3098	0.8	1.50	1.00	1.00	1.2	26.6	4.1	1.10	33.3	1881	0.93	NA	0.94	0.68	NA	N	C
7	30.0	31.0	30.5	SP	5				20	SPT	105	3203	3203	0.8	1.50	1.00	1.00	1.2	29.0	0.0	1.00	29.0	1923	0.93	0.41	0.93	0.68	0.79	Y	
7	31.0	32.0	31.5	SP	5				20	SPT	105	3308	3308	0.8	1.50	1.00	1.00	1.2	28.5	0.0	1.00	28.5	1966	0.92	0.39	0.92	0.68	0.74	Y	
7	32.0	33.0	32.5	SP	5				20	SPT	105	3413	3413	0.8	1.50	1.00	1.00	1.2	28.0	0.0	1.00	28.0	2009	0.91	0.37	0.92	0.68	0.70	Y	
7	33.0	34.0	33.5	SP	5				20	SPT	105	3518	3518	0.8	1.50	1.00	1.00	1.2	27.5	0.0	1.00	27.5	2051	0.90	0.35	0.91	0.68	0.66	Y	
7	34.0	35.0	34.5	SP	5				20	SPT	105	3623	3623	0.7	1.50	1.00	1.00	1.2	27.0	0.0	1.00	27.0	2094	0.89	0.34	0.90	0.68	0.63	Y	
8	35.0	36.0	35.5	CL	66	33	14	23.7	4	SPT	105	3728	3728	0.7	1.50	1.00	1.00	1.2	5.3	5.0	1.20	11.4	2136	0.89	NA	0.90	0.68	NA	N	D
8	36.0	37.0	36.5	CL	66	33	14	23.7	4	SPT	105	3833	3833	0.7	1.50	1.00	1.00	1.2	5.2	5.0	1.20	11.3	2179	0.88	NA	0.89	0.68	NA	N	D
8	37.0	38.0	37.5	CL	66	33	14	23.7	4	SPT	105	3938	3906	0.7	1.50	1.00	1.00	1.2	5.2	5.0	1.20	11.2	2222	0.87	NA	0.89	0.68	NA	N	D
8	38.0	39.0	38.5	CL	66	33	14	23.7	4	SPT	105	4043	3949	0.7	1.50	1.00	1.00	1.2	5.1	5.0	1.20	11.2	2264	0.86	NA	0.89	0.68	NA	N	D
8	39.0	40.0	39.5	CL	66	33	14	23.7	4	SPT	105	4148	3992	0.7	1.50	1.00	1.00	1.2	5.1	5.0	1.20	11.1	2307	0.85	NA	0.88	0.68	NA	N	D
9	40.0	41.0	40.5	SP	5				10	SPT	105	4253	4034	0.7	1.50	1.00	1.00	1.2	12.7	0.0	1.00	12.7	2349	0.85	0.14	0.88	0.68	0.25	Y	
10	41.0	42.0	41.5	CL	60	33	14	24	10	SPT	120	4980	4699	0.6	1.50	1.00	1.00	1.2	11.5	5.0	1.20	18.8	3014	0.84	NA	0.85	0.62	NA	N	D
10	42.0	43.0	42.5	CL	60	33	14	24	10	SPT	120	5100	4757	0.6	1.50	1.00	1.00	1.2	11.4	5.0	1.20	18.7	3072	0.83	NA	0.84	0.62	NA	N	D
10	43.0	44.0	43.5	CL	60	33	14	24	10	SPT	120	5220	4814	0.6	1.50	1.00	1.00	1.2	11.3	5.0	1.20	18.6	3130	0.82	NA	0.84	0.60	NA	N	D
10	44.0	45.0	44.5	CL	60	33	14	24	10	SPT	120	5340	4872	0.6	1.50	1.00	1.00	1.2	11.2	5.0	1.20	18.5	3187	0.81	NA	0.84	0.60	NA	N	D
11	45.0	46.0	45.5	SP	5				10	SPT	105	4778	4247	0.7	1.50	1.00	1.00	1.2	12.3	0.0	1.00	12.3	2562	0.81	0.13	0.87	0.66	0.25	Y	
12	46.0	47.0	46.5	CL	60	33	14	24	10	SPT	120	5580	4987	0.6	1.50	1.00	1.00	1.2	11.0	5.0	1.20	18.3	3302	0.80	NA	0.83	0.60	NA	N	D
12	47.0	48.0	47.5	CL	60	33	14	24	10	SPT	120	5700	5045	0.6	1.50	1.00	1.00	1.2	11.0	5.0	1.20	18.2	3360	0.79	NA	0.83	0.60	NA	N	D
12	48.0	49.0	48.5	CL	60	33	14	24	10	SPT	120	5820	5102	0.6	1.50	1.00	1.00	1.2	10.9	5.0	1.20	18.1	3418	0.78	NA	0.83	0.60	NA	N	D
12	49.0	50.0	49.5	CL	60	33	14	24	10	SPT	120	5940	5160	0.6	1.50	1.00	1.00	1.2	10.8	5.0	1.20	18.0	3475	0.77	NA	0.83	0.58	NA	N	D

TABLE C-3
LIQUEFACTION INDUCED SETTLEMENT
BORING B-1 (2%PE in 50 yrs; FS=1.3)

Client: 0

J.N. 0

Site: 0

Notes:

(1) Effective ER=55% normalized standard penetration resistance for clean sands, $(N_1)_{60\text{-}cs}$*1.1 (Seed, 1994).

(2) Volumetric strain (Ishihara and Yoshimine, 1992) using $(N_1)_{55\text{-}cs}$.

(3) Volumetric strain (Tokimatsu and Seed, 1987) using $(N_1)_{60\text{-}cs}$.

									Total δ (in.)	2.34	3.09	2.71
Depth Interval (ft)		Soil layer thickness (ft)	Fines <#200 Sieve (%)	$(N_1)_{60\text{-}cs}$	$(N_1)_{55\text{-}cs}$ (1)	FS	IY Percent ε_v (2)	CSR*	TS Percent ε_v (3)	IY δ (in.)	TS δ (in.)	Ave δ (in.)
Top	Bottom											
0.00	1.00	1.00	15	16.0	17.6	NA	0.00	0.44	NA	NA	NA	0
1.00	2.00	1.00	15	16.0	17.6	NA	0.00	0.44	NA	NA	NA	0
2.00	3.00	1.00	15	15.5	17.1	NA	0.00	0.44	NA	NA	NA	0
3.00	4.00	1.00	15	15.0	16.5	NA	0.00	0.44	NA	NA	NA	0
4.00	5.00	1.00	15	14.6	16.0	NA	0.00	0.44	NA	NA	NA	0
5.00	6.00	1.00	15	16.0	17.7	NA	0.00	0.44	NA	NA	NA	0
6.00	7.00	1.00	15	16.4	18.1	NA	0.00	0.44	NA	NA	NA	0
7.00	8.00	1.00	15	16.0	17.6	NA	0.00	0.44	NA	NA	NA	0
8.00	9.00	1.00	15	15.5	17.1	NA	0.00	0.44	NA	NA	NA	0
9.00	10.00	1.00	15	15.9	17.5	NA	0.00	0.44	NA	NA	NA	0
10.00	11.00	1.00	5	24.6	27.0	0.9	0.78	0.44	1.46	0.09	0.18	0.13
11.00	12.00	1.00	5	23.9	26.3	0.8	1.10	0.46	1.49	0.13	0.18	0.16
12.00	13.00	1.00	5	23.2	25.5	0.8	1.16	0.48	1.52	0.14	0.18	0.16
13.00	14.00	1.00	5	22.6	24.9	0.7	1.47	0.50	1.54	0.18	0.18	0.18
14.00	15.00	1.00	5	22.0	24.2	0.7	1.57	0.52	1.56	0.19	0.19	0.19
15.00	16.00	1.00	23	26.5	29.2	0.8	0.86	0.54	1.40	0.10	0.17	0.14
16.00	17.00	1.00	23	27.3	30.0	0.9	0.60	0.56	1.38	0.07	0.17	0.12
17.00	18.00	1.00	23	26.7	29.4	0.8	0.85	0.58	1.39	0.10	0.17	0.13
18.00	19.00	1.00	23	26.2	28.8	0.8	0.90	0.58	1.41	0.11	0.17	0.14
19.00	20.00	1.00	23	25.7	28.2	0.7	1.13	0.60	1.43	0.14	0.17	0.15
20.00	21.00	1.00	6	43.4	47.8	NA	0.00	0.60	NA	NA	NA	0
21.00	22.00	1.00	6	42.5	46.7	NA	0.00	0.62	NA	NA	NA	0
22.00	23.00	1.00	6	43.9	48.2	NA	0.00	0.62	NA	NA	NA	0
23.00	24.00	1.00	6	42.9	47.2	NA	0.00	0.64	NA	NA	NA	0
24.00	25.00	1.00	6	42.0	46.2	NA	0.00	0.64	NA	NA	NA	0
25.00	26.00	1.00	23	34.1	37.5	NA	0.00	0.66	NA	NA	NA	0
26.00	27.00	1.00	23	33.5	36.9	NA	0.00	0.66	NA	NA	NA	0
27.00	28.00	1.00	23	32.9	36.2	NA	0.00	0.66	NA	NA	NA	0
28.00	29.00	1.00	23	32.4	35.6	NA	0.00	0.68	NA	NA	NA	0
29.00	30.00	1.00	23	33.3	36.7	NA	0.00	0.68	NA	NA	NA	0
30.00	31.00	1.00	5	29.0	31.9	0.8	0.67	0.68	1.33	0.08	0.16	0.12
31.00	32.00	1.00	5	28.5	31.3	0.7	0.83	0.68	1.34	0.10	0.16	0.13
32.00	33.00	1.00	5	28.0	30.8	0.7	0.88	0.68	1.35	0.11	0.16	0.13
33.00	34.00	1.00	5	27.5	30.2	0.7	0.93	0.68	1.37	0.11	0.16	0.14
34.00	35.00	1.00	5	27.0	29.7	0.6	1.18	0.68	1.38	0.14	0.17	0.15
35.00	36.00	1.00	66	11.4	12.5	NA	0.00	0.68	NA	NA	NA	0
36.00	37.00	1.00	66	11.3	12.4	NA	0.00	0.68	NA	NA	NA	0
37.00	38.00	1.00	66	11.2	12.3	NA	0.00	0.68	NA	NA	NA	0
38.00	39.00	1.00	66	11.2	12.3	NA	0.00	0.68	NA	NA	NA	0
39.00	40.00	1.00	66	11.1	12.2	NA	0.00	0.68	NA	NA	NA	0
40.00	41.00	1.00	5	12.7	13.9	0.3	2.22	0.68	2.18	0.27	0.26	0.26
41.00	42.00	1.00	60	18.8	20.7	NA	0.00	0.62	NA	NA	NA	0
42.00	43.00	1.00	60	18.7	20.5	NA	0.00	0.62	NA	NA	NA	0
43.00	44.00	1.00	60	18.6	20.4	NA	0.00	0.60	NA	NA	NA	0
44.00	45.00	1.00	60	18.5	20.3	NA	0.00	0.60	NA	NA	NA	0
45.00	46.00	1.00	5	12.3	13.5	0.2	2.33	0.66	2.22	0.28	0.27	0.27
46.00	47.00	1.00	60	18.3	20.1	NA	0.00	0.60	NA	NA	NA	0
47.00	48.00	1.00	60	18.2	20.0	NA	0.00	0.60	NA	NA	NA	0
48.00	49.00	1.00	60	18.1	19.9	NA	0.00	0.60	NA	NA	NA	0
49.00	50.00	1.00	60	18.0	19.8	NA	0.00	0.58	NA	NA	NA	0

TABLE C-4
ANALYSIS OF DRY SEISMIC SETTLEMENT POTENTIAL
BORING B-1 (2%PE in 50 yrs; FS=1.3)

Client: 0
J.N. 0
Site: 0

GW Depth: 10 feet
EQ Magnitude 6.68
MSF 1.41

Total Seismic Settlement of Unsaturated Soil w/ FS=2.0 (in):	0.96
Subtotal Seismic Settlement of Unsaturated Soil (in)	0.48
Total Thickness of Unsaturated Soil (ft)	10.0

Layer Mid-Depth (ft.)	**Soil Type**	**Eff. Stress σ'_{vo}(tsf)**	**Clean Sand $(N_1)_{60}$**	**CSR**	**(psf) τ_{avg} Avg. Shear Stress**	**(tsf) σ_m' Mean Bulk Stress**	**(tsf) G_{max} Max. Dyn.Shr. Mod.**	**γ_{eff} (G_{eff}/G_{max})**	**Eff. Cyclic Shr.Strain γ_{eff}**	**Eff. Cyclic Shr.Strain γ_{eff} (%)**	**Volume Strain (%)**	**EQ Mag. Factor**	**Layer Thickness (ft.)**	**Estimated Dry Sand Seismic Settlement (in.)**
									Fig.11		Fig.13			
0.5	SP	0.03	16.0	0.44	25.3	0.02	152.6	8.29E-05	1.66E-04	1.66E-02	2.20E-02	1.41	1.0	0.002
1.5	SP	0.09	16.0	0.44	75.9	0.06	264.3	1.44E-04	5.25E-04	5.25E-02	6.96E-02	1.41	1.0	0.006
2.5	SP	0.14	15.5	0.44	126.5	0.09	338.1	1.87E-04	2.07E-03	2.07E-01	2.84E-01	1.41	1.0	0.024
3.5	SP	0.20	15.0	0.44	177.1	0.13	395.6	2.24E-04	8.06E-03	8.06E-01	9.83E-01	1.41	1.0	0.084
4.5	SP	0.26	14.6	0.44	227.7	0.17	443.8	2.57E-04	6.16E-03	6.16E-01	8.44E-01	1.41	1.0	0.072
5.5	SP	0.32	16.0	0.44	278.3	0.21	506.7	2.75E-04	2.62E-03	2.62E-01	3.45E-01	1.41	1.0	0.029
6.5	SP	0.37	16.4	0.44	328.9	0.24	555.3	2.96E-04	4.02E-03	4.02E-01	5.13E-01	1.41	1.0	0.044
7.5	SP	0.43	16.0	0.44	379.5	0.28	590.7	3.21E-04	6.77E-03	6.77E-01	8.19E-01	1.41	1.0	0.070
8.5	SP	0.49	15.5	0.44	430.1	0.32	623.0	3.45E-04	7.38E-03	7.38E-01	8.97E-01	1.41	1.0	0.077
9.5	SP	0.55	15.9	0.44	480.7	0.36	663.8	3.62E-04	6.91E-03	6.91E-01	8.35E-01	1.41	1.0	0.071

March 6, 2024
J.N.: 3157.00

Mr. Brian Geis
The Olson Company
3010 Old Ranch Parkway, Suite 100
Seal Beach, California 90740

Subject: **Preliminary Geotechnical Investigation for Proposed Water Quality Improvements, Proposed Multi-Family Residential Development, 12828 Newhope Street, Garden Grove, California**

Dear Mr. Geis,

Albus & Associates, Inc. has completed a geotechnical investigation of the site for evaluation of the percolation characteristics of the site soils. The scope of this investigation consisted of the following:

- Exploratory drilling, soil sampling and test well installation
- Field percolation testing
- Laboratory testing of selected soil samples
- Engineering analysis of the data
- Preparation of this report

SITE DESCRIPTION AND PROPOSED DEVELOPMENT

Site Location and Description

The site is located at the address of 12828 Newhope Street within the city of Garden Grove, California. The site is bordered by Newhope Street to the west, Zeta Street to the north, residential properties to the east, and Dunklee Lane to the south. The location of the site and its relationship to the surrounding areas are shown in Figure 1, Site Location Map.

The site consists of 0.9 acres of land and is presently developed with a single-family residence. The building pad is situated approximately 2 feet above the grade of the street. The remaining portions of the site are covered in asphalt associated with the interior driveway and vegetation. Vegetation onsite consists of medium- to large-sized trees and grass.

Drainage on site appears to be primarily sheet flow and directed south and west towards the roadways.

Walls are present along all sides of the property lines. Except for the eastern perimeter wall, other walls are retaining walls. The retaining walls are about 6 feet high, retaining up to approximately 2 feet. The elevation of the project site is typically higher than the northern, western, and southern roads but similar to eastern neighborhood houses.

N

FIGURE 1-SITE LOCATION MAP

Proposed Multi-Family Residential Development
12828 Newhope Street, Garden Grove, California

NOT TO SCALE

Proposed Development

Based on review of the Conceptual Grading Plan by Alan Short, dated February 5, 2024, we understand that the site will be redeveloped with fifteen (15) multi-story single-family homes at grade. An interior driveway, decorative hardscape, parking areas and underground utilities are also anticipated.

We anticipate demolition of existing site improvements and some minor cut and filling of the site will be required to achieve future surface configuration and we expect future foundation loads will be moderate. All structures are anticipated to be at grade.

Preliminary hydrology information was provided at the time of this report. Based on the preliminary hydrology information available, the total design capture volume (DCV) that requires treatment will

be about 2,095 cubic feet. The site is anticipated to drain to E. Florence Ave. and therefore, we assume an infiltration system will be located near the Florence entry at the southwest corner of the property.

SUMMARY OF FIELD AND LABORATORY WORK

Subsurface Investigation

Subsurface exploration for this investigation was conducted on May 23, 2023 and consisted of drilling three (3) soil borings to a maximum depth of approximately 51.5 feet below the existing ground surface (bgs). The borings were drilled using a truck-mounted, continuous-flight, hollow-stem-auger drill rig. Representatives of *Albus & Associates, Inc*. logged the exploratory borings. Visual and tactile identifications were made of the materials encountered, and their descriptions are presented on the Exploration Logs in Appendix A. The approximate locations of the borings are shown on the enclosed Geotechnical Map, Plate 1.

Bulk, relatively undisturbed and Standard Penetration Test (SPT) samples were obtained at selected depths for subsequent laboratory testing. Relatively undisturbed samples were obtained using a 3-inch O.D., 2.5-inch I.D., California split-spoon soil sampler lined with brass rings. SPT samples were obtained using a standard SPT soil sampler. During each sampling interval, the samplers were driven 18 inches with successive drops of a 140-pound automatic hammer falling 30 inches. The number of blows required to advance the sampler was recorded for each six inches of advancement. The total blow count for the lower 12 inches of advancement per soil sample is recorded on the exploration log. Samples were placed in sealed containers or plastic bags and transported to our laboratory for analyses and testing. The borings were backfilled with soil cuttings upon completion of drilling.

Two additional borings (P-1 and P-2) were drilled adjacent to boring B-1 for percolation testing. Upon completion of drilling, well materials were installed within P-1 and P-2 for subsequent percolation testing. Construction details for P-1 and P-2 consisted of 17 and 22 feet of well materials. The bottom 5 feet for both wells utilized perforated 3-inch-diameter pipe with the remaining well utilizing solid 3-inch-diameter pipe to the ground surface. The joints between pipes were reinforced with duct tape and the sections of perforated pipe were covered with filter sock. Upon completion of testing, all well materials were removed from the borings and then backfilled with soil cuttings.

Percolation Testing

Percolation testing was performed on May 23, 2023, in general conformance with the constant-head test procedures outlined in the referenced Well Permeameter Method (USBR 7300-89). A water hose attached to a water source on site was connected to an inline flowmeter to measure the water flow. The flowmeter is capable of measuring flow rates up to 10 gallons per minute and as low as 0.06 gallons per minute. A valve was connected in line with the flowmeter to control the flow rate. A filling hose was used to connect the flowmeter and the test wells. Water was introduced by the filling hose near the bottom of the test wells. A water level meter with 1/100-foot divisions was used to measure the depths to water surface from the top of well casings.

Flow to the wells was terminated upon either completion of testing of all the pre-determined water levels or the flow rate exceeded the maximum capacity of the flowmeter. Measurements obtained during the percolation testing are provided in Appendix C on Plates C-1 and C-2.

Laboratory Testing

Selected soil samples of representative earth materials were tested to assist in the formulation of conclusions and recommendations presented in this report. Tests consisted of in-situ moisture contents and dry densities and 200 washes. Results of laboratory testing relevant to percolation characteristics are presented in Appendix B and on the Exploration Logs in Appendix A.

ANALYSIS OF DATA

Subsurface Conditions

Artificial fill material was observed in our soil borings and are anticipated to be generally 2 feet deep. Deeper portions of artificial fill may be encountered in localized areas. A retaining wall exists along all sides of the property lines and retains approximately 2 feet at the northwest and southwest corners before tapering off heading south and east. The artificial fill materials observed onsite are typically silty sands that are damp to very moist, loose to medium dense, and gray.

Young alluvial fan deposits (Qyfa) were encountered below the fill materials to the maximum depths explored of 51.5 feet. Within the upper 35 feet, the alluvial soils consisted of alternating layers of sands (SP) and silty sands (SM). These materials were generally medium dense to dense and dry to moist. Below a depth of 35 feet, the alluvium primarily consisted of sandy clay with occasional interbeds of sand (SP). These materials were generally very stiff to hard and very moist.

A more detailed description of the interpreted soil profile at each of the boring locations, based upon the borehole cuttings and soil samples, are presented in Appendix A. The stratigraphic descriptions in the logs represent the predominant materials encountered and relatively thin, often discontinuous layers of different material may occur within the major divisions.

Groundwater

Groundwater was encountered at 37 feet below the existing grade during this firm's subsurface exploration to a depth of 51.5 feet. The CDMG Special Report 003 suggests that historic high groundwater for the subject site is about 10 feet below the ground surface. We researched online groundwater well data in the California Department of Water Resources database and found three wells located around the site (north, east, and west). The locations of the three wells are depicted in Figure 2. Data from these wells span from 1970 to 2023. The recorded depths to groundwater from these wells are plotted in Figure 3.

As indicated by Figure 3, all three wells indicate that groundwater has remained below a depth of 45 feet since 1970, except for one measurement on May 1, 1979. This measurement may be an error considering other data. The well data also suggests that regional ground water is currently near a depth of 80 feet. Based on the data from these wells, the water encountered in our boring is likely a transient perched condition due to the presence of aquitard layers present starting at a depth of 35 feet. Our boring was drilled following an unusually wet winter season and the current thin perched water is likely a temporary condition due to recent heavy rainfall. Given the exceptional rainfall that occurred just before our field work, a historical shallowest groundwater depth during the next 50 years can reasonably be taken as 35 feet.

FIGURE 2 - Groundwater Well Location Map

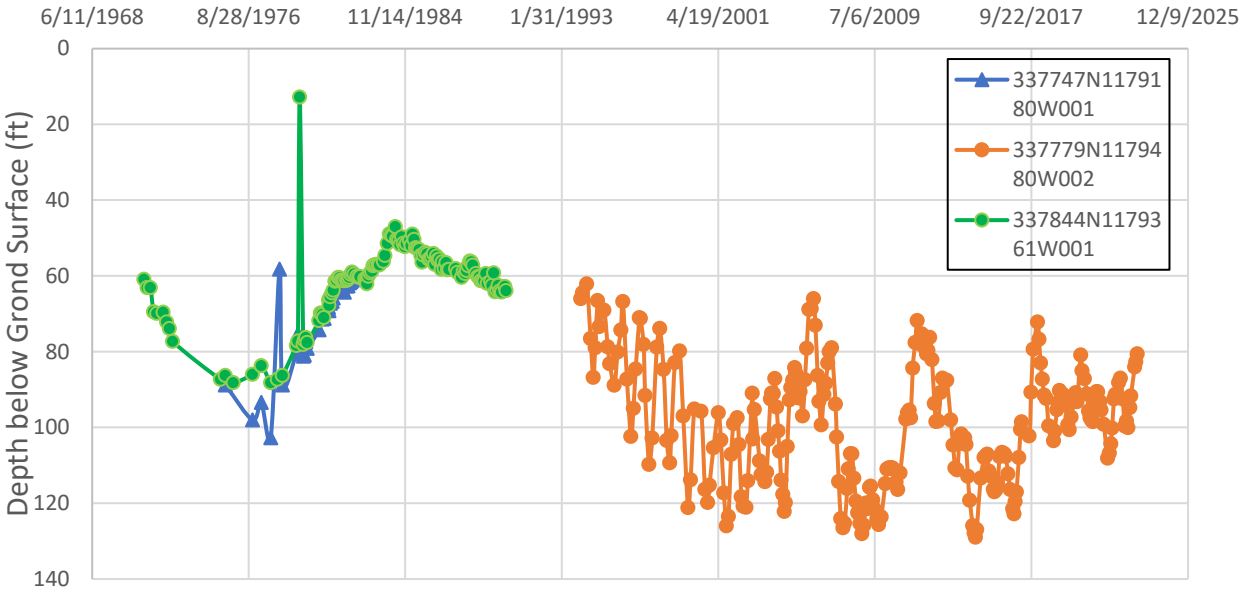


FIGURE 3 - Ground Water Data

Percolation Data

Analyses were performed to evaluate permeability using the flow rate obtained at the end of the constant-head stage of field percolation testing. These analyses were performed in accordance with the procedures provided in the referenced USBR 7300-89. The procedure essentially uses a closed-form solution to the percolation out of a small-diameter well.

Using the USBR method, we calculated a composite permeability value for the head conditions maintained in the wells. The results are summarized in Table 1 below and the supporting analyses are included in Appendix C, Plates C-3 and C-4.

TABLE 1
Summary of Back-Calculated Permeability Coefficient

Test Well	Total Depth of Well (ft)	Depth to Water in Well (ft)	Height of Water in Well (ft)	Static Flow Rate (gal./min.)	Estimated Permeability, k_s (in/hr.)
P-1	16.8	14.6	2.2	0.1	0.53
P-2	21.5	19.35	2.15	0.38	2.09

Design of Dry Well

The ***infiltration rate*** in a dry well is dependent upon several factors including the soil permeabilities of the various soil layers throughout the soil mass, hydraulic gradient of water pressure head in the soil mass, and depth to groundwater. The infiltration rate is related to the permeability by Darcy's equation:

$V = ki$

Where:

V= water velocity (infiltration rate)
k= permeability
i=hydraulic gradient

The presence of differing soil layers with differing permeabilities, the variable head condition in the well shaft, and presence of ground water are factors that make determining the effective infiltration rate of a dry well somewhat complicated. We have performed the Well Permeameter tests in accordance with the test method. This test provides a means to estimate the ***Permeability Rate*** of the soils influencing the dry well, not the infiltration rate. Therefore, the effective infiltration rate must be determined using the relationship between permeability and infiltration rate as expressed by Darcy's equation. Solution of the Darcy equation essentially requires solving a differential mass balance equation. Due to these complications, the infiltration characteristics of the proposed dry well were modeled using a computer program.

Infiltration in a dry well was modeled using the software Seep/W, version 2007, by Geo-Slope International. The program allows for modeling of both partially-saturated and saturated porous medium using a finite element approach to solve Darcy's Law. The program can evaluate both steady-state and transient flow in planar and axisymmetric cases. Boundaries of the model can be identified with various conditions including fix total head, fix pressure head, fix flow rate, and head as a function of flow. Soil permeability properties can be modeled with either Fredlund et al (1994), Green and Corey (1971), Van Genuchten (1980), or Saxton et al. (1986). Only saturated permeabilities were used in our analyses.

A Seep/W model was setup with the bottom of the dry well at a depth of 20 feet below ground surface. The dry well was assumed to consist of a shaft that is 6 feet in diameter and contains a settling chamber having an inside diameter of 4 feet, outside diameter of 4.5 feet, and length of 18 feet. The annular space around the chamber between the depths of 0 and 11 feet was assumed to consist of a cement slurry. Below a depth of 11 feet, the annular space around the chamber and below the chamber is assumed to consist of gravel. A more detailed model of the dry well design can be found on Plate 2.

The model consisted of four types of materials to represent the general soil profile. The saturated permeabilities of materials 2 and 3 which are located in the infiltration zone were selected based on the coefficient of permeabilities estimated from percolation tests as well as laboratory test results. The saturated permeabilities of materials 1 and 4 were estimated based on test results and engineering judgements. The assigned permeability values for the model are summarized in Table 2.

TABLE 2
Summary of Permeability Values

Depth (ft)	Material No.	Material Type	Sat. Perm., Ks (in/hr)
0-8	1	SP/SM	1.0
8-14, 18-24,28-34	2	SP	2.0
14-18,24-28	3	SM	0.5
>34	4	LOAM	0.05

Water in the well was assumed to be at a depth of 7 feet below the ground surface so a fix-head boundary was set with a total head elevation of 93 feet around the edge of the well (ground surface was set to an elevation of 100 feet).

A steady state analysis was performed to estimate the maximum flow that the well can accommodate. Using a well as described above, we obtain a static total flow of 0.034 ft^3/sec. A plot depicting the resulting pressure head contours and flow vectors for the model is provided on Plate C-5. The average infiltration rate can be determined by taking the flow rate divided by the wetted surface area. The surface area is equal to 197.9 square feet which consists of the wetted side area and bottom area of the well shaft. Based on the above flow rate and surface area, the average "measured" infiltration rate across the wetted surface area is 7.49 in/hr.

To evaluate the time required to empty the well once no more water is introduced, the model was reanalyzed with a variable head condition that was dependent upon the volume of water leaving the well. As water infiltrates into the surrounding soil, the volume of water remaining in the well is reduced as well as the resulting water head. A graph of the well head versus exit volume is provided in Figure 2. The function assumes a void ratio of 0.4 within the zones occupied by gravel. If some other well configuration is used, then the analyses will require updating.

The analysis was performed as a transient case over a total time of 2.5 hours. The conditions in the model were evaluated in 10 increments of time over the total duration. From our analyses, the water is evacuated from the chamber in approximately 2.4 hours. Plots depicting the resulting pressure head contours and flow vectors at selected times are provided in Appendix C on Plates C-6 through C-9. A plot of time versus water height in the well is shown on Figure 3.

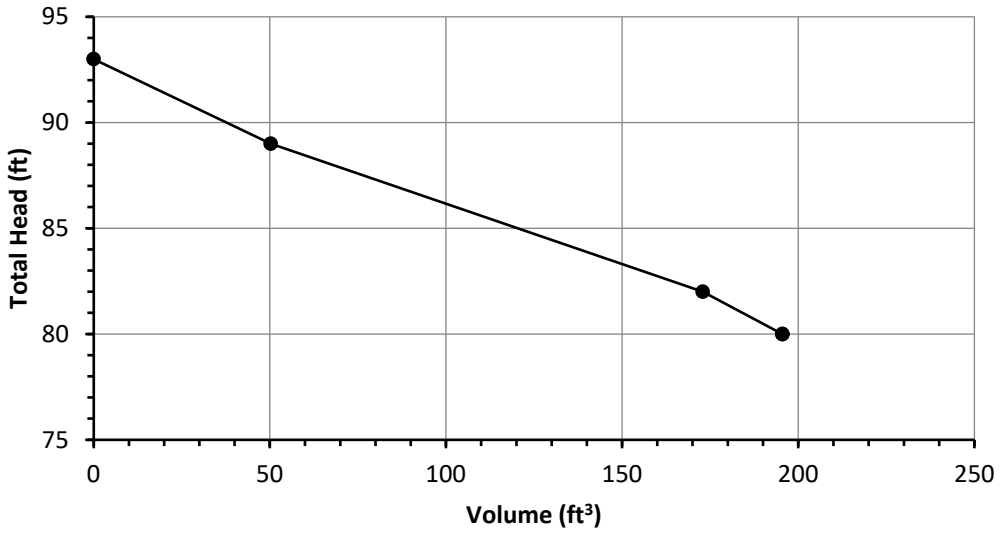


FIGURE 2- Well Head versus Exit Volume

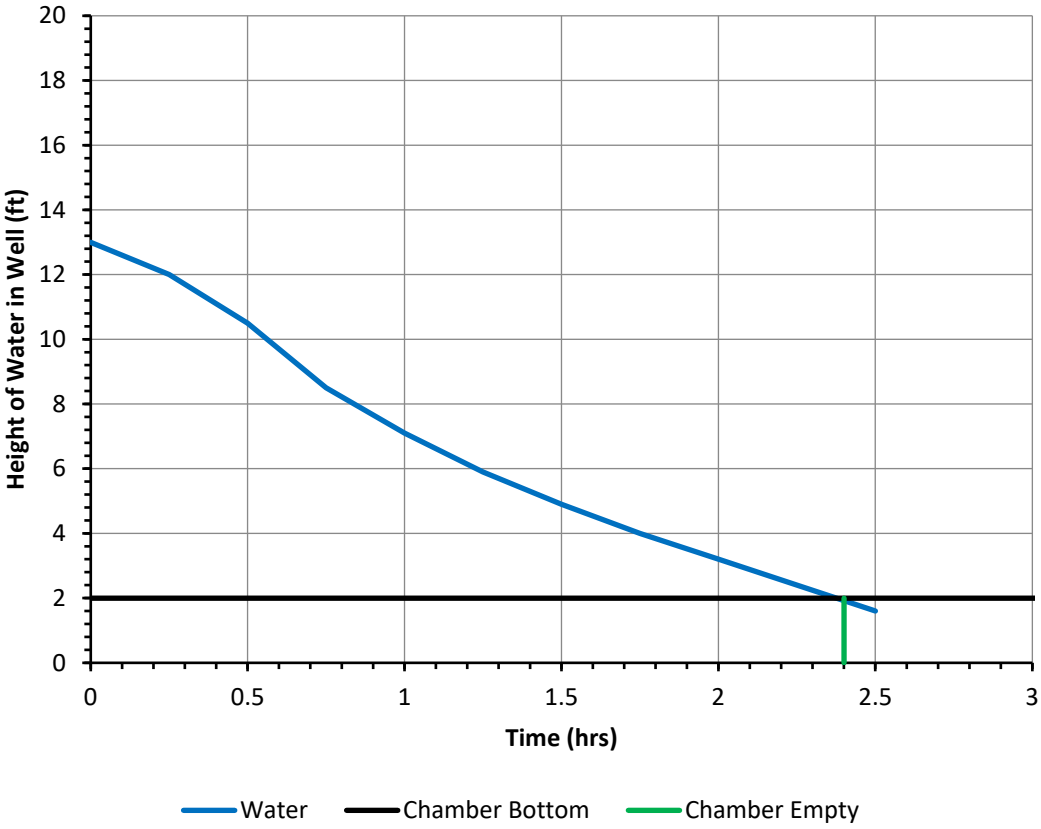


FIGURE 3- Water Head Versus Time

CONCLUSIONS AND RECOMMENDATIONS

Results of our work indicate a storm water disposal system consisting of a dry well is feasible at the site. The use of a dry well is not anticipated to result in worsening any adverse conditions or hazards that may be present for the proposed site development or adjacent properties including subsidence, landsliding, or liquefaction. As discussed above, the historic groundwater level in this area is suggested to be 10 feet, however water was encountered at a depth of 37 feet. Based on the well data summarized above, groundwater is unlikely to rise beyond 35 feet. Therefore, a dry well having a total depth of 20 feet will maintain a clearance above groundwater greater than the minimum required clearance of 10 feet.

Based on the results of percolation testing and analyses, the well configuration as depicted on Plate 2 may utilize a "measured" peak flow rate of 0.034 ft^3/sec. This flow rate corresponds to an average peak infiltration rate of 7.49 in./hr. This flow rate and infiltration rate only apply to the well configuration evaluated and will differ for other configurations. These values are "measured" values and as such, an appropriate factor of safety should be applied to determine the "design" rates.

The "measured" infiltration rates reported above should be adjusted by applying an appropriate factor of safety. Table 3 includes the details of estimating this factor of safety for Factor Category A per

requirements of the Santa Ana Regional Water Quality Control Board. The civil engineer should assign appropriate factor values for Factor Category B to obtain the overall factor of safety.

TABLE 3
Factor Values for Factor Category A

Infiltration Facility Safety Factor Determination Worksheet					
Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w * v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	2	0.5
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5

Once water flow to the well has ceased, we estimate the chamber will require approximately 2.4 hours to empty. As such, the time to empty the dry well should be considered in the overall draw down time of the storm system.

Should you require multiple dry wells across the site, the wells should be spaced at least 120 feet, center to center, to avoid cross influence. The wells should be located at least 10 feet horizontally from any habitable structure or property line.

The actual flow capacity of the dry well could be less or more than the estimated value. As such, provisions should be made to accommodate excess flow quantities in the event the dry well does not infiltrate the anticipated amount. The design also assumes that sediments will be removed from the inflowing water through an upper chamber or other device. Sediments that are allowed to enter the dry well will tend to degrade the flow capacity by plugging up the infiltration surfaces.

In general, the dry well shaft is anticipated to be adequately stable under temporary construction conditions for uncased drilling. However, granular materials are present and may slough during drilling. The contractor should be prepared to install the chamber immediately following the drilling of the shaft as well as have casing on hand if soughing begins to occur. Workers should not enter the shaft unless the excavation is laid back or shored in accordance with OSHA requirements. The placement and compaction of backfill materials, including the gravel and slurry, should be observed by the project geotechnical consultant.

LIMITATIONS

This report is based on the geotechnical data as described herein. The materials encountered in our boring excavations and utilized in our laboratory testing for this investigation are believed representative of the project area, and the conclusions and recommendations contained in this report are presented on that basis. However, soil and bedrock materials can vary in characteristics between points of exploration, both laterally and vertically, and those variations could affect the conclusions and recommendations contained herein. As such, observations by a geotechnical consultant during the construction phase of the storm water infiltration systems are essential to confirming the basis of this report.

This report has been prepared consistent with that level of care being provided by other professionals providing similar services at the same locale and time period. The contents of this report are professional opinions and as such, are not to be considered a guaranty or warranty.

This report should be reviewed and updated after a period of one year or if the site ownership or project concept changes from that described herein.

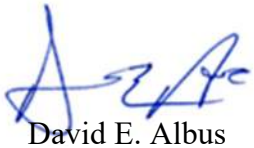
This report has been prepared for the exclusive use of **The Olson Company** to assist the project consultants in the design of the proposed development. This report has not been prepared for use by parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

This report is subject to review by the controlling governmental agency.

We appreciate this opportunity to be of service to you. If you should have any questions regarding the contents of this report, please do not hesitate to call.

Sincerely,

ALBUS & ASSOCIATES, INC.



David E. Albus
Principal Engineer
GE 2455

Enclosures: Plate 1- Geotechnical Map
Plate 2- Dry Well Diagram
Appendix A - Exploratory Logs
Appendix B – Laboratory Testing
Appendix C - Percolation Testing and Analyses

REFERENCES

Publications and Reports

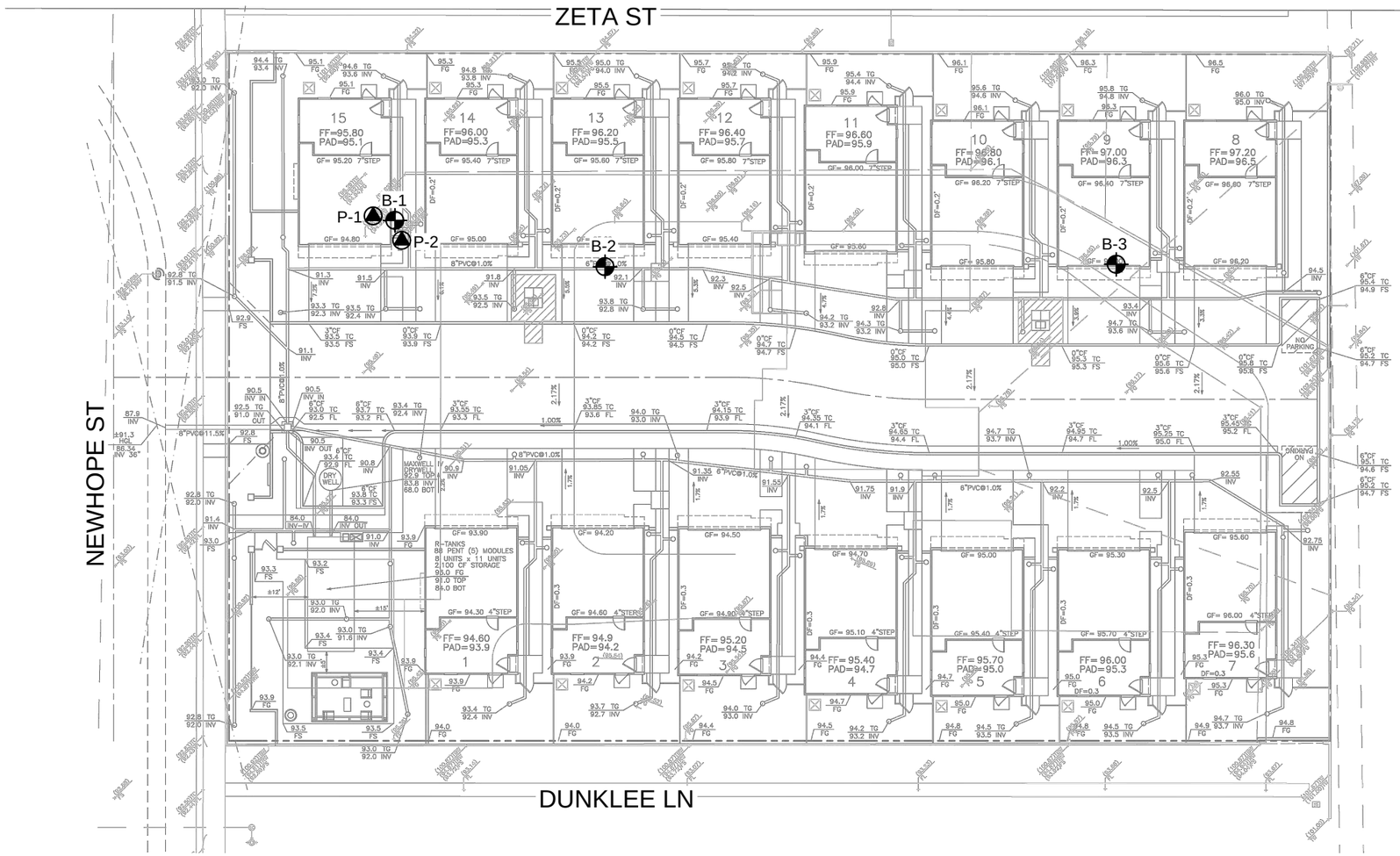
California Department of Conservation Division of Mines and Geology (CDMG), 1997, "Seismic Hazard Zone Report for the Anaheim and Newport Beach 7.5-Minute Quadrangles, Orange County, California," Seismic Hazard Zone Report 034.

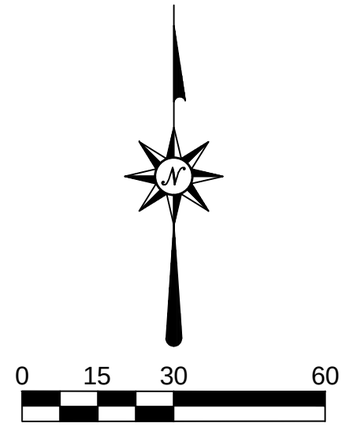
Californian Department of Water Resources Water Data Library (accessed 2023): http://wdl.water.ca.gov/waterdatalibrary/

Procedure for Performing Field Permeability Testing by the Well Permeameter Method, by United States Department of The Interior, Bureau of Reclamation (USBR 7300-89).

Plans

Tentative Tract No. 19298, A Vesting Tentative Tract Map for Condominium Purposes, by Alan Short, dated February 5, 2024.





EXPLANATION

(Locations Approximate)

- Exploratory Boring
- Percolation Test Boring

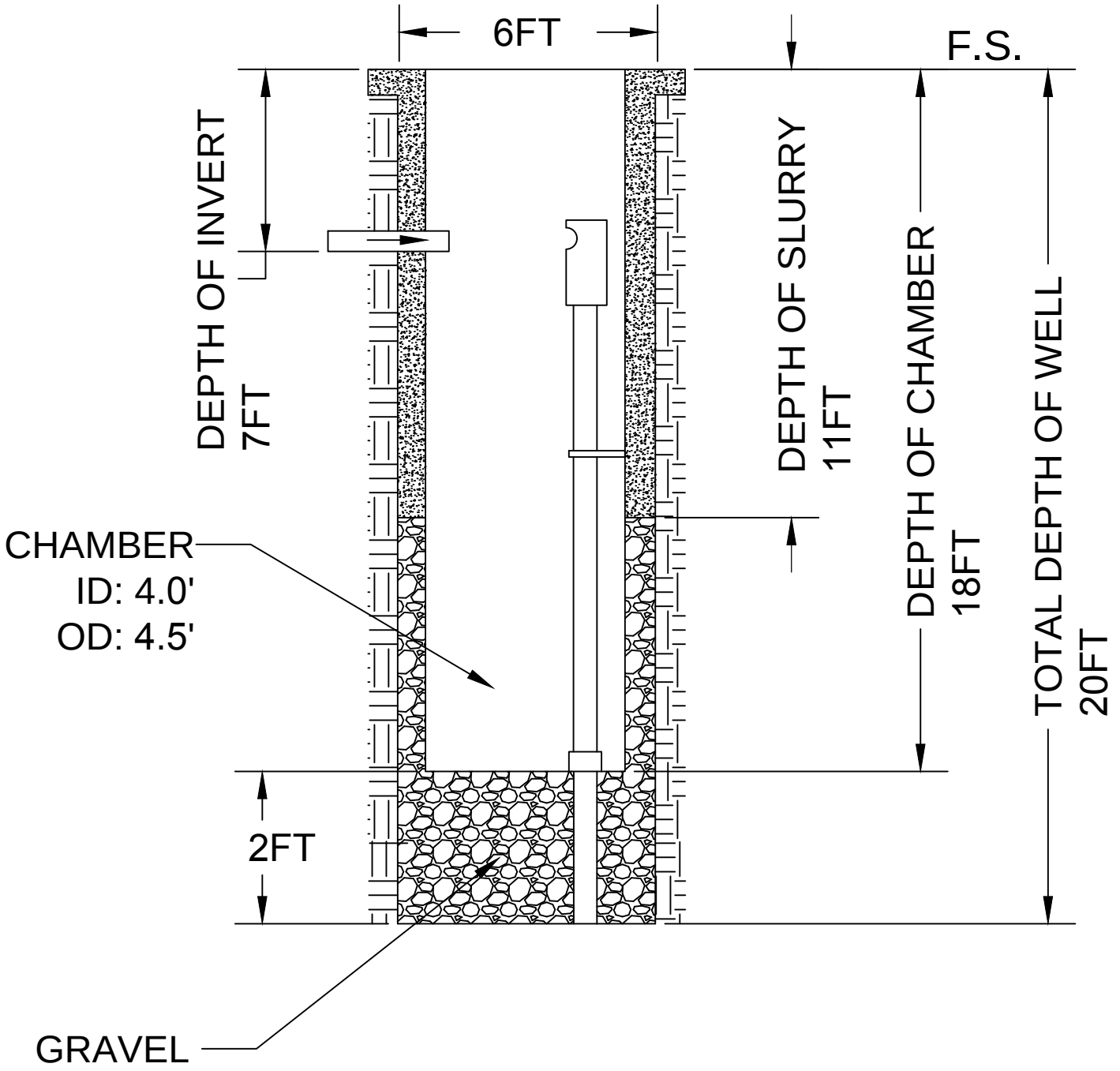
Base Provided By Alan Short

ALBUS ASSOCIATES

GEOTECHNICAL MAP

Job No.: 3157.00	Date: 03/06/2024	Plate: 1

TYPICAL DRY WELL CONSTRUCTION



ALBUS & ASSOCIATES, INC.

PLATE 2

APPENDIX A

EXPLORATORY LOGS

Field Identification Sheet

Light gray

Gray

Dark gray

Gray Brown

Light brown

Brown

Dark Brown

Olive brown

Olive

Yellow

Yellowish brown

Yellowish red

Red

Reddish Brown

Tan

Description Order:

Description, Color, Moisture, Density, Grain Size, Additional Description

Description	%	Example
	0-5	Sand
trace	5-15	Sand trace Silt
with	15-30	Sand with Silt
	30+	Silty Sand

More Examples

Sand with Silt trace Clay

Sand trace Silt and Clay

Sand with Silt and Clay

Gravelly Sand with Silt trace Clay

Silty Clay with Sand trace Gravel

Moisture

Dry	absence of water
Damp	below optimum
Moist	near optimum
Very Moist	above optimum
Wet	free water visible

Density (Navfac)

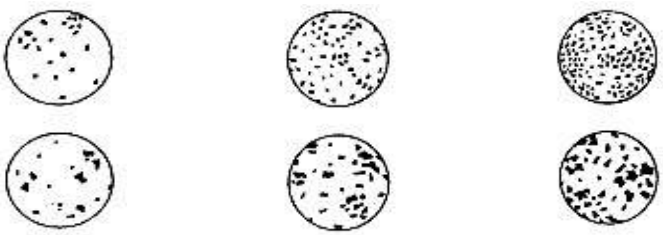
Coarse grained soils	SPT	CA
Very Loose	0-3	0-5
Loose	3-8	5-13
Medium Dense	8-14	13-22
Dense	14-25	22-40
Very Dense	25>	40>
Fine grained soils		
Very Soft	2<	0-3
Soft	2-4	3-6
Medium Stiff	4-8	6-13
Stiff	8-15	13-24
Very Stiff	15-30	24-48
Hard	30>	48>

Grain Size

Description		Sieve Size	Approx. Size
Boulders		>12"	Larger than basketball
Cobbles		3-12"	Fist to basketball
Gravel	coarse	3/4-3"	Thumb to Fist
	fine	#4-3/4"	Pea to Thumb
Sand	coarse	#10-4	Rock Salt to Pea
	medium	#40-10	Sugar to Rock Salt
	fine	#200-40	Flour to Sugar
Fines		Pass #200	Smaller than Flour

Additional Description (ie. roots, pinhole pores, debris, etc.)

Trace 5% Moderate 15% Abundant 30%



EXPLORATION LOG

Project:		Location:
Address:		Elevation:
Job Number:	Client:	Date:
Drill Method:	Driving Weight:	Logged By:

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		EXPLANATION							
		Solid lines separate geologic units and/or material types.							
		Dashed lines indicate unknown depth of geologic unit change or material type change.							
5		**Solid black rectangle** in Core column represents California Split Spoon sampler (2.5in ID, 3in OD).							
		Double triangle in core column represents SPT sampler.							
10		**Vertical Lines** in core column represents Shelby sampler.							
		Solid black rectangle in Bulk column respresents large bag sample.							
		Other Laboratory Tests:							
15		Max = Maximum Dry Density/Optimum Moisture Content							
		EI = Expansion Index							
		SO4 = Soluble Sulfate Content							
		DSR = Direct Shear, Remolded							
		DS = Direct Shear, Undisturbed							
		SA = Sieve Analysis (1" through #200 sieve)							
		Hydro = Particle Size Analysis (SA with Hydrometer)							
20		200 = Percent Passing #200 Sieve							
		Consol = Consolidation							
		SE = Sand Equivalent							
		Rval = R-Value							
		ATT = Atterberg Limits							

EXPLORATION LOG B-1

JOB NO.	CLIENT/PROJECT	DAY	DATE
3157.00	The Olson Company	Tuesday	2023-05-23

LOCATION	LATITUDE	LONGITUDE	ELEVATION
12828 Newhope Street, Garden Grove	33.77704	-117.92861	94.7

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
ddalbus	2R Drilling	Hollow-Stem Auger	140 lbs / 30 in

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		Asphalt							
2		**Artificial Fill (Af)**							
3		Sand trace Silt (SP): gray, moist, loose, fine to medium grained				13	19.5	99.7	
4		**Alluvial Fan Deposits (Qyfa)**							
5		Sand trace Silt (SP): gray, moist, loose, fine to medium grained, trace pinhole pores				12	8.8	103.3	consol
6		@ 4 ft, trace pinhole pores							
7		@ 6 ft, medium dense, trace pinhole pores				14	11.2	103	
8									
9									
10									
11		Sand (SP): light gray, dry, medium dense, fine to coarse grained sand				27	2	101.4	
12									
13									
14									
15		Silty Sand (SM): gray, moist, medium dense, fine grained sand				12			200
16									
17									
18									
19									
20									
21		Sand (SP): light gray, dry to damp, dense, fine to coarse grained				27			200
22									
23									
24									
25									
26		Silty Sand (SM): gray, moist, dense, fine grained				18			
27									
28									
29									

EXPLORATION LOG B-1

JOB NO.	CLIENT/PROJECT	DAY	DATE
3157.00	The Olson Company	Tuesday	2023-05-23

LOCATION	LATITUDE	LONGITUDE	ELEVATION
12828 Newhope Street, Garden Grove	33.77704	-117.92861	94.7

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
ddalbus	2R Drilling	Hollow-Stem Auger	140 lbs / 30 in

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
31		Sand (SP): light gray, dry to damp, dense, fine grained				20			
32									
33									
34									
35									
36		Sandy Clay (CL): gray, moist to very moist, loose, fine grained				4	23.7		200 att
37									
38									
39									
40									
41		Sand trace Silt (SP): gray, wet, medium dense, fine to medium grained				10			
42		Sandy Clay (CL): gray, very moist, very stiff, fine grained							
43									
44									
45									
46		Sand (SP): gray, wet, medium dense, fine to coarse grained				10			
47		Sandy Clay (CL): gray, very moist, very stiff, fine grained							
48									
49									
50									
51		Sandy Clay (CL): gray, very moist to wet, hard, fine grained				23			
52		Total Depth 51.5 feet Groundwater 37 feet Boring backfilled with soil cuttings							
53									
54									
55									
56									
57									
58									
59									

EXPLORATION LOG B-2

JOB NO.	CLIENT/PROJECT	DAY	DATE
3157.00	The Olson Company	Tuesday	2023-05-23

LOCATION	LATITUDE	LONGITUDE	ELEVATION
12828 Newhope Street, Garden Grove	33.77701	-117.92846	95.2

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
ddalbus	2R Drilling	Hollow-Stem Auger	140 lbs / 30 in

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
0		Asphalt							max so4 ph resist ch
1		**Artificial Fill (Af)** Sand trace Silt (SP): gray, moist, loose, fine grained							
2		**Alluvial Fan Deposits (Qyfa)** Sand trace Silt (SP): gray, moist, loose, fine grained, trace pinhole pores and roots				13	7.2	94.7	
3									
4		@ 4 ft, medium dense, trace pinhole pores				14	8.2	101	
5									
6		Sand with Silt (SP): gray, moist, loose, fine grained, trace pinhole pores				12	8	95.8	consol
7									
8									
9									
10		Sand trace Silt (SP): gray, very moist, medium dense, fine grained, trace pinhole pores and roots				20	4.3	103.3	
11									
12		Total Depth 11.5 feet No Groundwater Boring backfilled with soil cuttings							
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									

EXPLORATION LOG B-3

JOB NO.	CLIENT/PROJECT	DAY	DATE
3157.00	The Olson Company	Tuesday	2023-05-23

LOCATION	LATITUDE	LONGITUDE	ELEVATION
12828 Newhope Street, Garden Grove	33.77701	-117.92808	93.9

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
ddalbus	2R Drilling	Hollow-Stem Auger	140 lbs / 30 in

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		Asphalt							
2		**Artificial Fill (Af)** Silty Sand trace Clay (SM): gray, very moist, medium dense, fine grained				19	16.7	107.4	
3		**Alluvial Fan Deposits (Qyfa)** Silty Sand trace Clay (SM): gray, very moist, medium dense, fine grained, trace pinhole pores and roots				12	5.7	99.7	consol
4		Sand (SP): gray, moist, loose, fine to medium grained							
5									
6		@ 6 ft, medium dense, fine to coarse grained				18	4.5	100.6	
7									
8									
9									
10		@ 10 ft, more coarse grained sand				21	2.2	99.3	
11									
12		Total Depth 11.5 feet No Groundwater Boring backfilled with soil cuttings							
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									

APPENDIX B

LABORATORY TEST PROGRAM

LABORATORY TESTING PROGRAM

Soil Classification

Soils encountered within the exploratory borings were initially classified in the field in general accordance with the visual-manual procedures of the Unified Soil Classification System (ASTM D 2487). The samples were re-examined in the laboratory and classifications reviewed and then revised where appropriate. The assigned group symbols are presented on the Exploration Logs provided in Appendix A.

In Situ Moisture and Density

Moisture content and unit dry density of in-place soil materials were determined in representative strata. Test data are summarized in the Boring Logs, Appendix A.

Atterberg Limits

Atterberg Limits (Liquid Limit, Plastic Limit, and Plasticity Index) were performed in accordance with Test Method ASTM D4318. Pertinent test values are presented in Table B.

Percent Passing the No. 200 Sieve

Percent of material passing the No. 200 sieve was determined on selected samples to verify visual classifications performed in the field. These tests were performed in accordance with ASTM D1140-00. Test results are presented in Table B.

TABLE B
SUMMARY OF LABORATORY TEST RESULTS

Boring No.	Sample Depth (ft)	Soil Description	Test Results	
B-1	15	Silty Sand (SM)	Passing #200 Sieve (%):	23
B-1	20	Sand trace Silt (SP)	Passing #200 Sieve (%):	6
B-1	35	Sandy Clay (CL)	Passing #200 Sieve (%): Liquid Limit: Plastic Index:	66.3 33 14

Field Percolation Testing - Constant Head

Client: The Olson Company

Job. No.: 3157.01

Date Tested: 5/23/2023

Test by: ddalbus

Location: P-1

Top of Casing to Bottom of Well (ft): 16.8

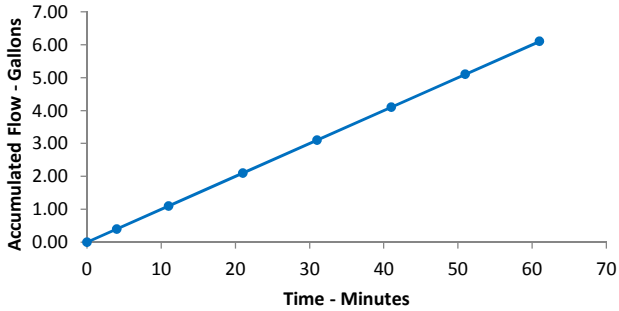
Elev. of Ground Surface (ft):

Diam. of Test Hole (in): 8

Diam. of Casing (in): 3

Ht. to Top of Casing (ft): 0

Water Tempurature (C°):



Constant Head

Elapsed Time (minutes)	Time	Depth to H2O (ft)	Flow Rate (gal./min.)	Total H_2O used (gal)
0	9:09	14.8	0.10	0.00
4	9:13	14.9	0.10	0.40
11	9:20	14.8	0.10	1.10
21	9:30	14.6	0.10	2.10
31	9:40	14.6	0.10	3.10
41	9:50	14.6	0.10	4.10
51	10:00	14.6	0.10	5.10
61	10:10	14.6	0.10	6.10

Field Percolation Testing - Constant Head

Client: The Olson Company

Job. No.: 3157.01

Date Tested: 5/23/2023

Test by: ddalbus

Location: P-2

Top of Casing to Bottom of Well (ft): 22

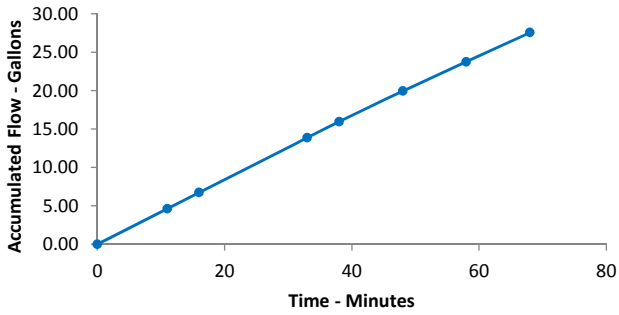
Elev. of Ground Surface (ft):

Diam. of Test Hole (in): 8

Diam. of Casing (in): 3

Ht. to Top of Casing (ft): 0.5

Water Tempurature (C°):



Constant Head

Elapsed Time (minutes)	Time	Depth to H2O (ft)	Flow Rate (gal./min.)	Total H_2O used (gal)
0	10:22	20	0.42	0.00
11	10:33	20.2	0.42	4.62
16	10:38	20.15	0.42	6.72
33	10:55	19.9	0.42	13.86
38	11:00	19.85	0.38	15.96
48	11:10	19.85	0.38	19.96
58	11:20	19.85	0.38	23.76
68	11:30	19.85	0.38	27.56

INFILTRATION WELL DESIGN

Constant Head
USBR 7300-89 Method
J.N.: 3157.00
Client: The Olson Company
Well No.: P-1

Low Water Table	Condition 1	
High Water Table & Water Below Bottom of Well	Condition 2	
High water Table with Water Above the Well Bottom	Condition 3	
		Units:
Enter Condition (1, 2 or 3):	1	
Ground Surface to Bottom of Well (**h_1**):	16.8	feet
Depth to Water (**h_2**):	14.6	feet
Height of Water in the Well (h_1-h_2=**h**):	2.2	feet
Radius of Well (**r**):	4.0	Inches
Minimum Volume Required:	234.0	Gal.
Discharge Rate of Water Into Well for Steady-State Condition (**q**):	0.1	Gal/min.
Temperature (**T**):	21	Celsius
(Viscosity of Water @ Temp. T) / (Viscosity of water @ 20° C) (**V**):	0.9647	ft^3/min.
Unsaturated Distance Between the Water Surface in the Well and the Water table (**T_u**):		Ignore T_u
Factor of Safety:	1	
Coefficient of Permeability @ 20° C (**k_{20}**):	7.40E-04	ft/min.
Design k_{20}:	0.53	in./hr.

The presence or absence of a water table or impervious soil layer within a distance of less than three times that of the water depth in the well (measured from the water surface) will enable the water table to be classified as **Condition I**, **Condition II**, **Condtion III**.

Low Water Table-When the distance from the water surface in the test well to the ground water table, or to an impervious soil layer which is considered for test puposes to be equivalent to a water table, is greater than three times the depth of water in the well, classify as **Condition I**.

High Water Table-When the distance from the water surface in the test well to the ground water table or to an impervious layer is less than three times the depth of water in the well, a high water table condition exists. Use **Condition II** when the water table or impervious layer is below the well bottom. Use **Condition III** when the water table or impervious layer is above the well bottom.

INFILTRATION WELL DESIGN

Constant Head
USBR 7300-89 Method
J.N.: 3157.00
Client: The Olson Company
Well No.: P-2

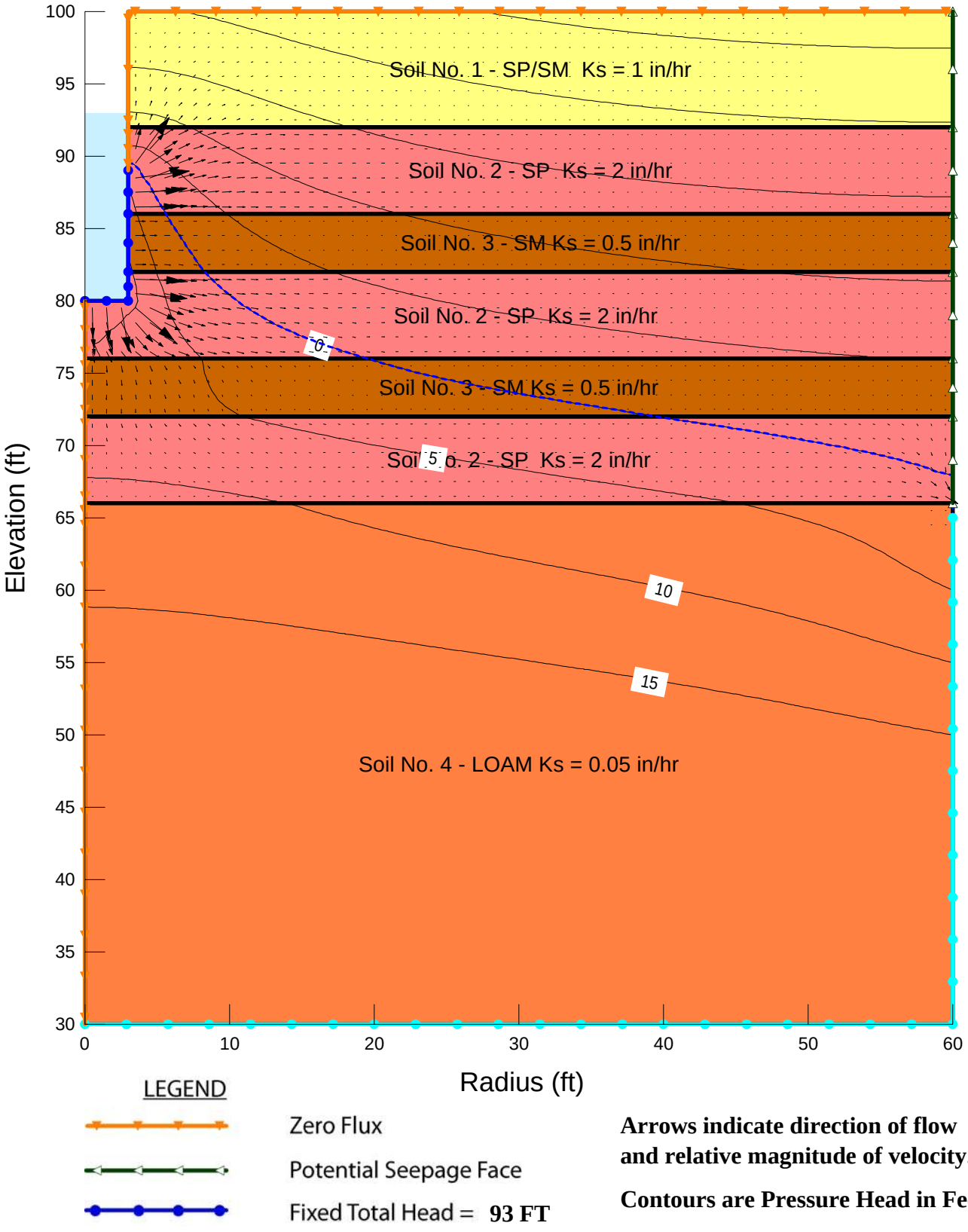
Low Water Table	Condition 1	
High Water Table & Water Below Bottom of Well	Condition 2	
High water Table with Water Above the Well Bottom	Condition 3	
		Units:
Enter Condition (1, 2 or 3):	1	
Ground Surface to Bottom of Well (h_1):	21.5	feet
Depth to Water (h_2):	19.35	feet
Height of Water in the Well (h_1-h_2=**h**):	2.15	feet
Radius of Well (**r**):	4.0	Inches
Minimum Volume Required:	223.2	Gal.
Discharge Rate of Water Into Well for Steady-State Condition (**q**):	0.38	Gal/min.
Temperature (**T**):	21	Celsius
(Viscosity of Water @ Temp. T) / (Viscosity of water @ 20° C) (**V**):	0.9647	ft^3/min.
Unsaturated Distance Between the Water Surface in the Well and the Water table (T_u):		Ignore T_u
Factor of Safety:	1	
Coefficient of Permeability @ 20° C (k_{20}):	2.91E-03	ft/min.
Design k_{20}:	2.09	in./hr.

The presence or absence of a water table or impervious soil layer within a distance of less than three times that of the water depth in the well (measured from the water surface) will enable the water table to be classified as **Condition I**, **Condition II**, **Condtion III**.

Low Water Table-When the distance from the water surface in the test well to the ground water table, or to an impervious soil layer which is considered for test puposes to be equivalent to a water table, is greater than three times the depth of water in the well, classify as **Condition I**.

High Water Table-When the distance from the water surface in the test well to the ground water table or to an impervious layer is less than three times the depth of water in the well, a high water table condition exists. Use **Condition II** when the water table or impervious layer is below the well bottom. Use **Condition III** when the water table or impervious layer is above the well bottom.

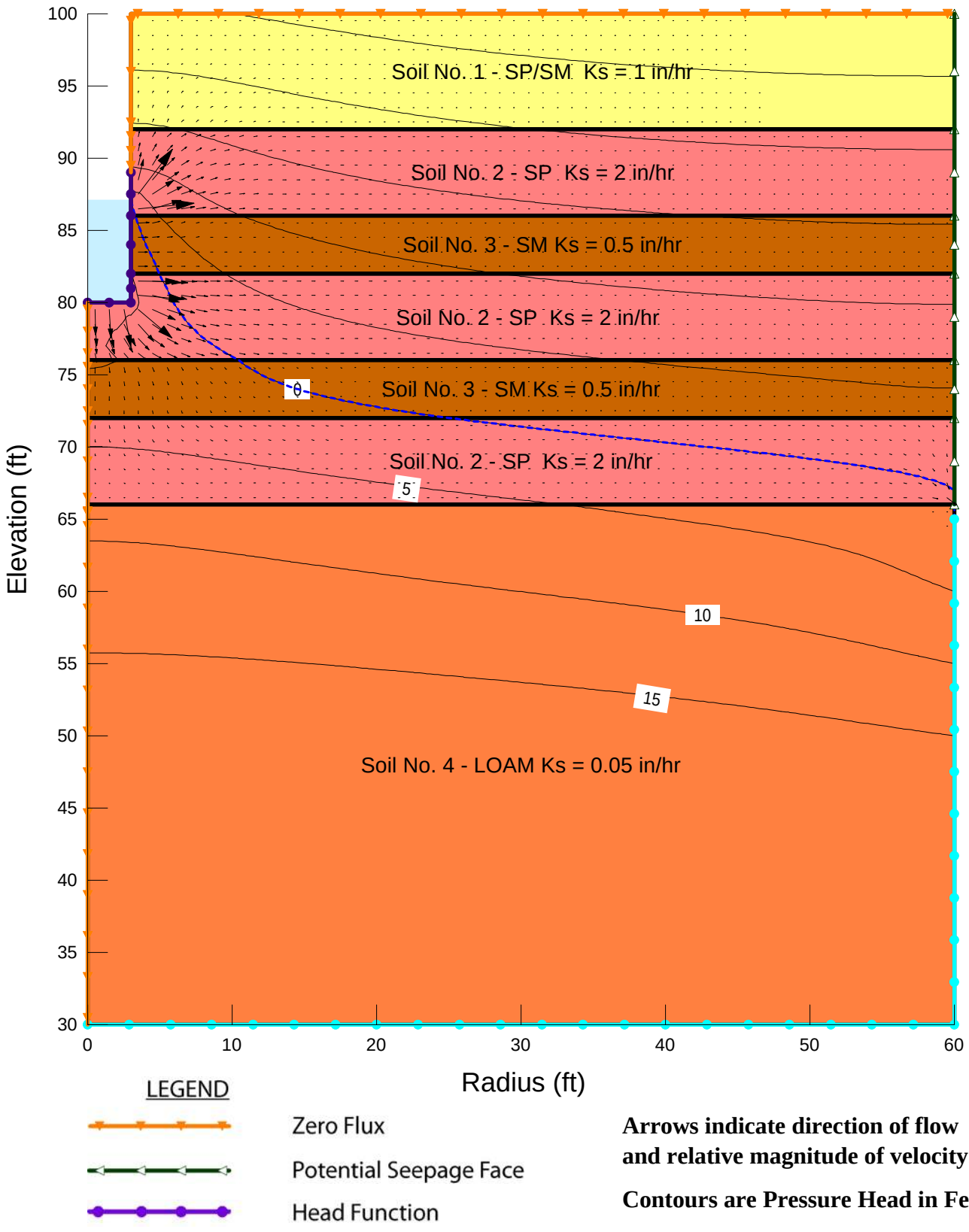
STEADY STATE



Arrows indicate direction of flow and relative magnitude of velocity.

Contours are Pressure Head in Feet.

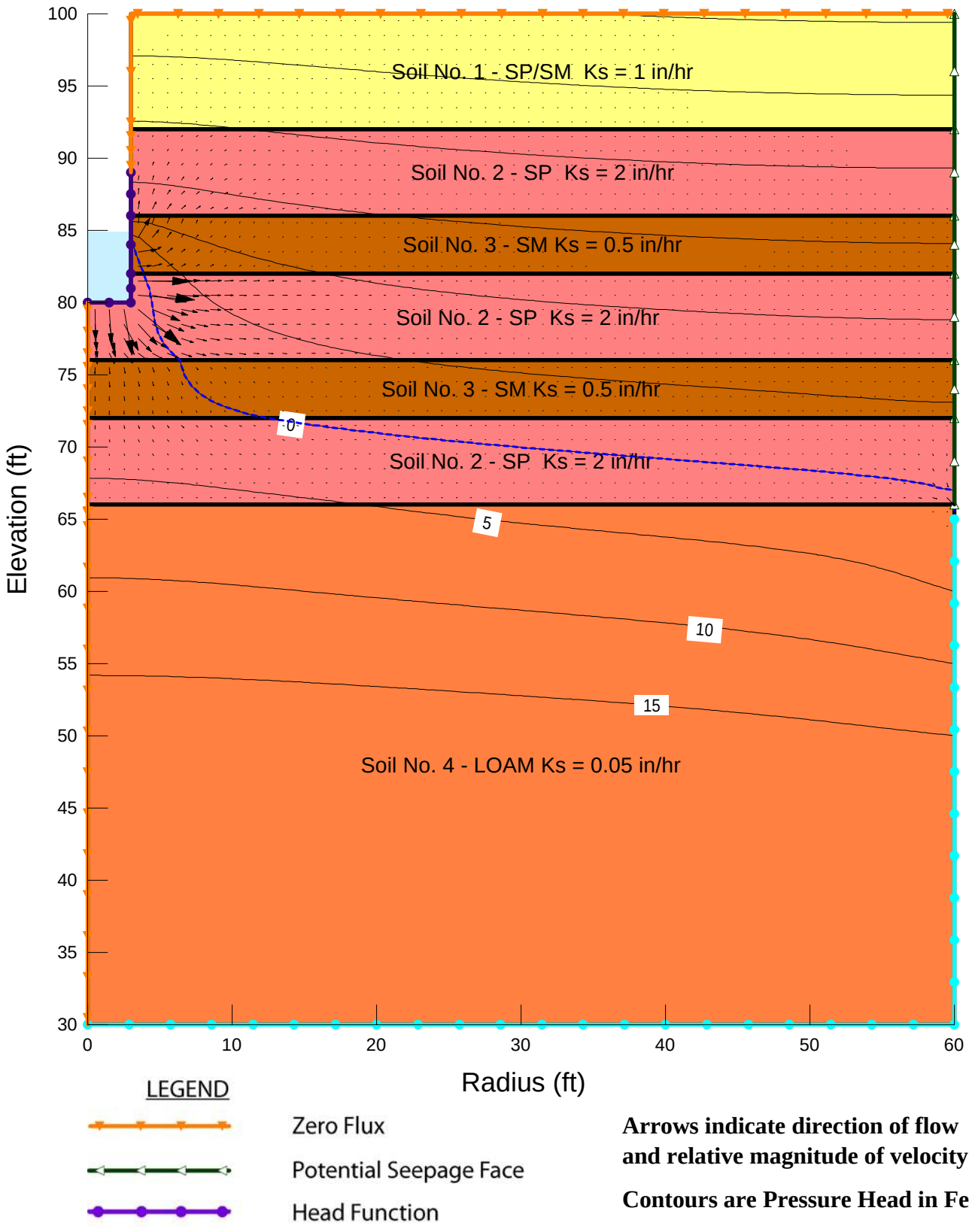
TRANSIENT 1 hr



Arrows indicate direction of flow and relative magnitude of velocity.

Contours are Pressure Head in Feet.

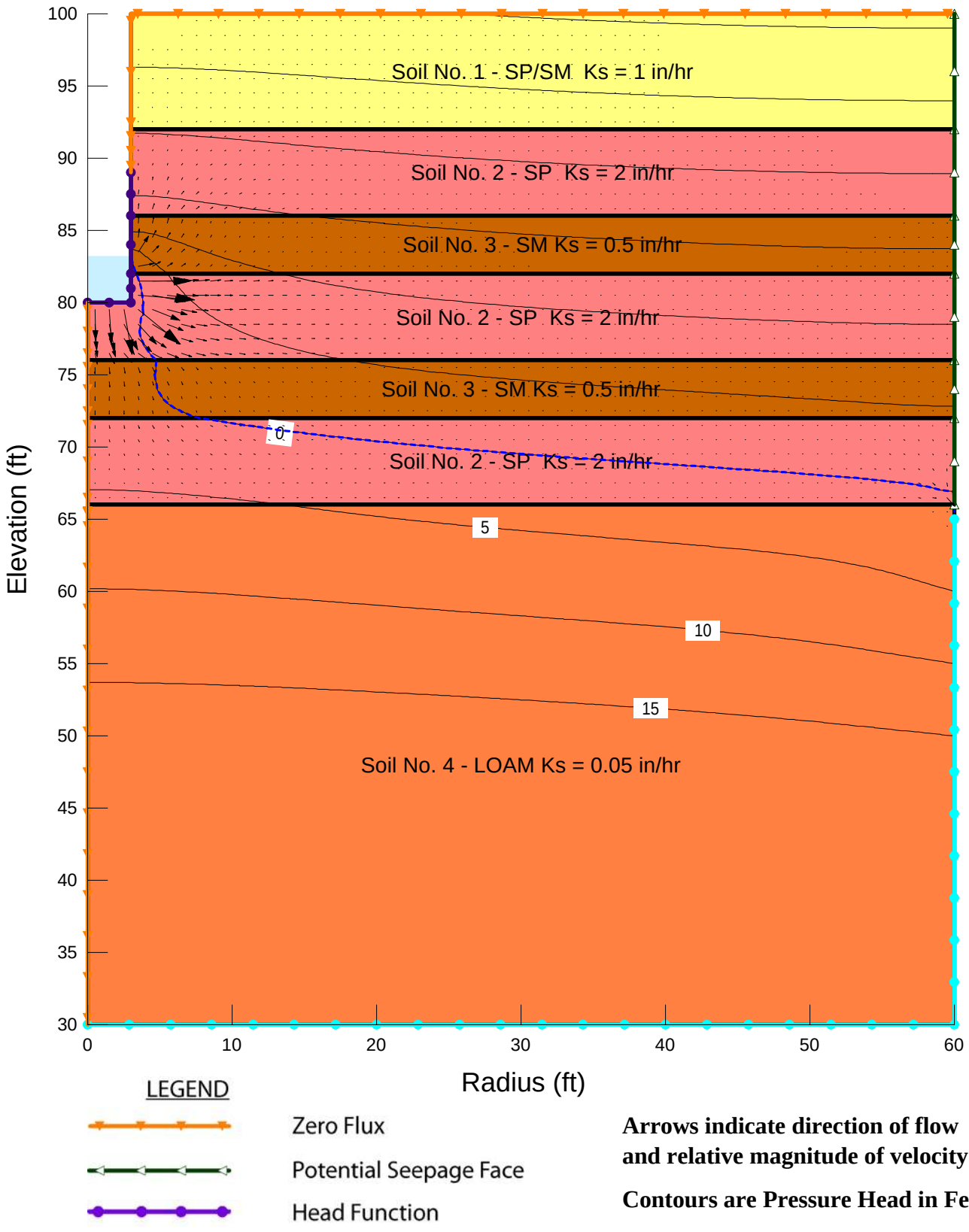
TRANSIENT 1.5 hrs



Arrows indicate direction of flow and relative magnitude of velocity.

Contours are Pressure Head in Feet.

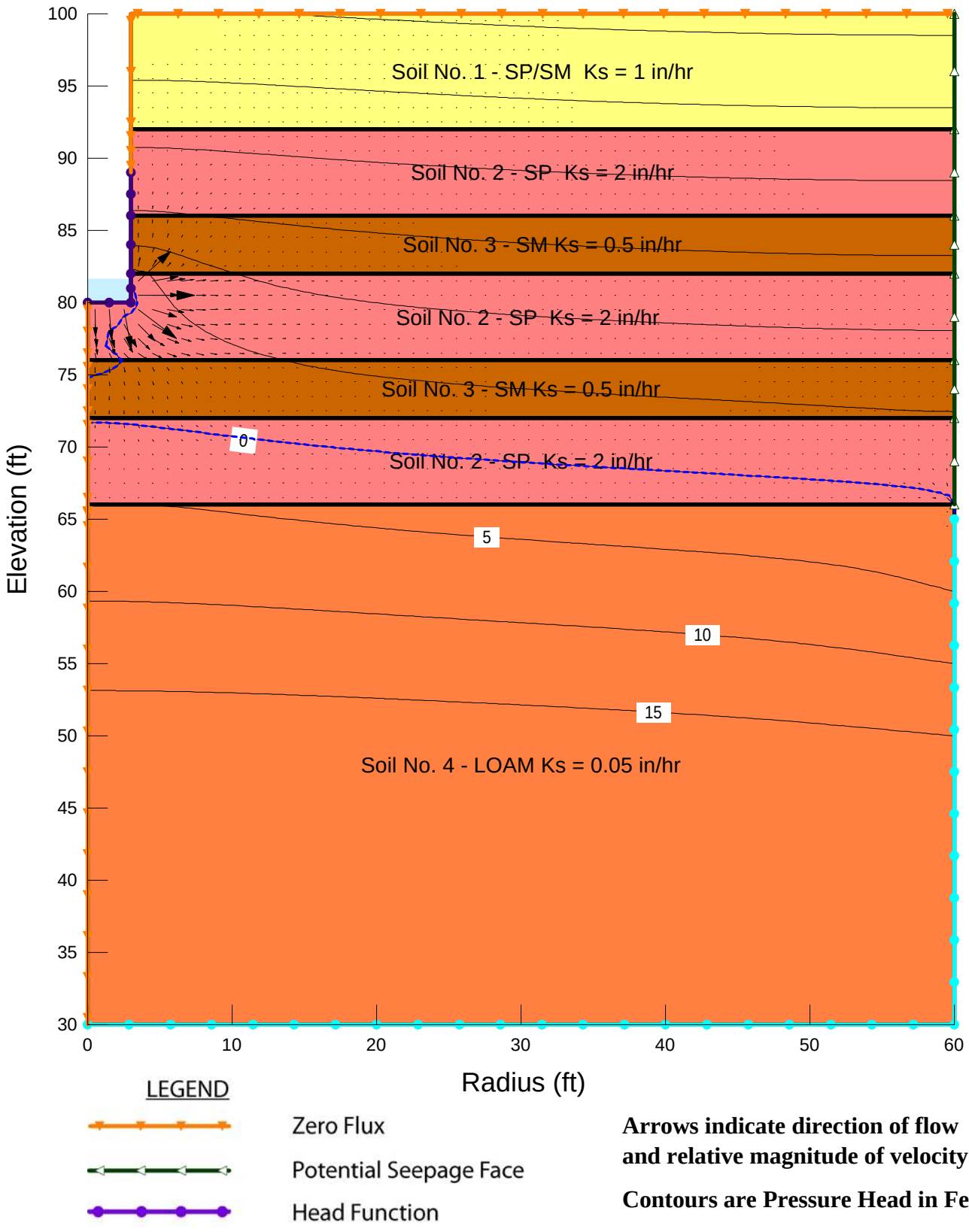
TRANSIENT 2 hrs



Arrows indicate direction of flow and relative magnitude of velocity.

Contours are Pressure Head in Feet.

TRANSIENT 2.5 hrs



Arrows indicate direction of flow and relative magnitude of velocity.

Contours are Pressure Head in Feet.

APPENDIX C

PERCOLATION TESTING AND ANALYSES

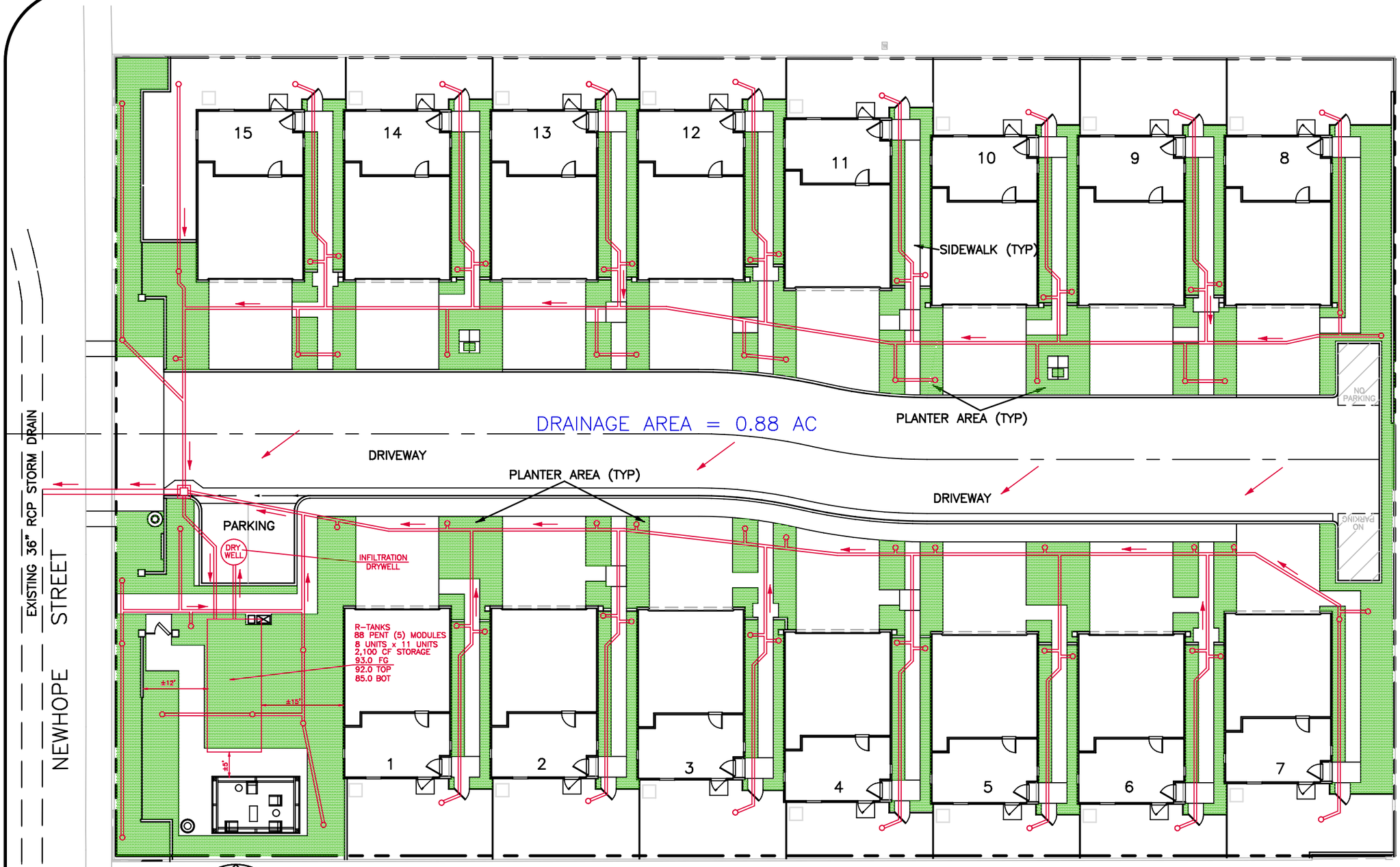
The educational materials included in this PWQMP are provided to inform people involved in future uses, activities, or ownership of the site about the potential pitfalls associated with careless storm water management. "The Ocean Begins at Your Front Door" provides users with information about storm water that is/will be generated on site, what happens when water enters a storm drain, and its ultimate fate, discharging into the ocean. Also included are activities guidelines to educate anyone who is or will be associated with activities that have a potential to impact storm water runoff quality, and provide a menu of BMPs to effectively reduce the generation of storm water runoff pollutants from a variety of activities. The educational materials that may be used for the proposed project are included in Attachment B of this PWQMP and are listed below.

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

Tips for Residential Pool, Landscape and Hardscape Drains	☐		☐
Tips for Projects Using Paint	☒		☐

Attachment C

Preliminary PWQMP Site Plan



A NO DUMPING STENCIL DETAIL N.T.S.

N

20 0 20 40 60

Scale 1" = 20'

INFILTRATION SUMMARY:

DESIGN CAPTURE VOLUME:	2,095 cf
R-TANK STORAGE PROVIDED:	2,100 cf
PEAK INFILTRATION FLOW:	0.038 cfs
FACTOR OF SAFETY:	3.0
DESIGN INFILTRATION RATE:	0.013 cfs
DRAW DOWN	< 72 hrs

WATER QUALITY MANAGEMENT SITE PLAN TENTATIVE TRACT NO. 19298

GARDEN GROVE

LATEST REVISION: 1/17/24

Attachment D

Preliminary Hydrology Report

ALAN R. SHORT, P.E.

HYDROLOGY REPORT

FOR

CITY OF GARDEN GROVE

TENTATIVE TRACT NO. 19298
12828 NEWHOPE STREET

PREPARED FOR:

THE OLSON COMPANY
3010 OLD RANCH PARKWAY, SUITE 100
SEAL BEACH, CA. 92740

PREPARED BY:

Alan R Short

_____

ALAN R. SHORT, P.E.
RCE 30873, EXPIRES 3/31/24

Latest Revision: February 5, 2024

7263 W. GALEN DR.
HERRIMAN, UT 84096
(949) 586-5200
ALANSHORTPE@GMAIL.COM

TABLE OF CONTENTS

INTRODUCTION & SUMMARY

This is a preliminary drainage study for a proposed residential development (Tentative Tract No. 19298) in the City of Garden Grove, County of Orange, as shown on the Vicinity Map. The site is bounded on the west by Newhope Street, on the east by existing single-family homes fronting on Lemonwood Lane, on the north and south by private streets, Zeta Street and Dunklee Lane which serve the existing condominium project surrounding the property on three sides.

The project site is currently a single-family home which drains to the west and is surrounded by walls on all sides. There is an existing 36" RCP storm drain in Newhope street (flowing South) with existing catch basins approximately 500' south of the property. All runoff from this property currently flows to these existing catch basins.

In the post-development condition, the proposed drainage pattern is generally the same. The initial drainage is collected in a proposed area drain system to deliver the required 2,095 ft^3 "Design Capture Volume" to a proposed infiltration drywell with some "R-Tank" detention storage, as recommended in the Geotechnical Report. Storm flows will then be conveyed through a proposed 10" pipe into the existing 36" RCP storm drain within Newhope Street. Currently, there are no water quality devices at the site.

The immediate downstream storm drain facilities consist of reinforced concrete pipes (i.e. 36" RCP) and a reinforced concrete channel (C05S10), and ultimately draining into the East Garden Grove Wintersburg Channel (OCFCD Facility No. C05). The "*Susceptibility Analysis Anaheim Bay – Huntington Harbor" map*, dated April 22, 2010 (attached), indicates that this property is not subject to hydromodification.

Rational Method hydrology, in accordance with the Orange County Hydrology Manual dated 1986 and its latest addendum, was used to calculate the peak flow discharges. Advance Engineering Software (AES), Version 19.0 was utilized for the hydrology calculations. "Orange County Local Drainage Manual" was used as reference for hydraulic parameters. The results are as follows:

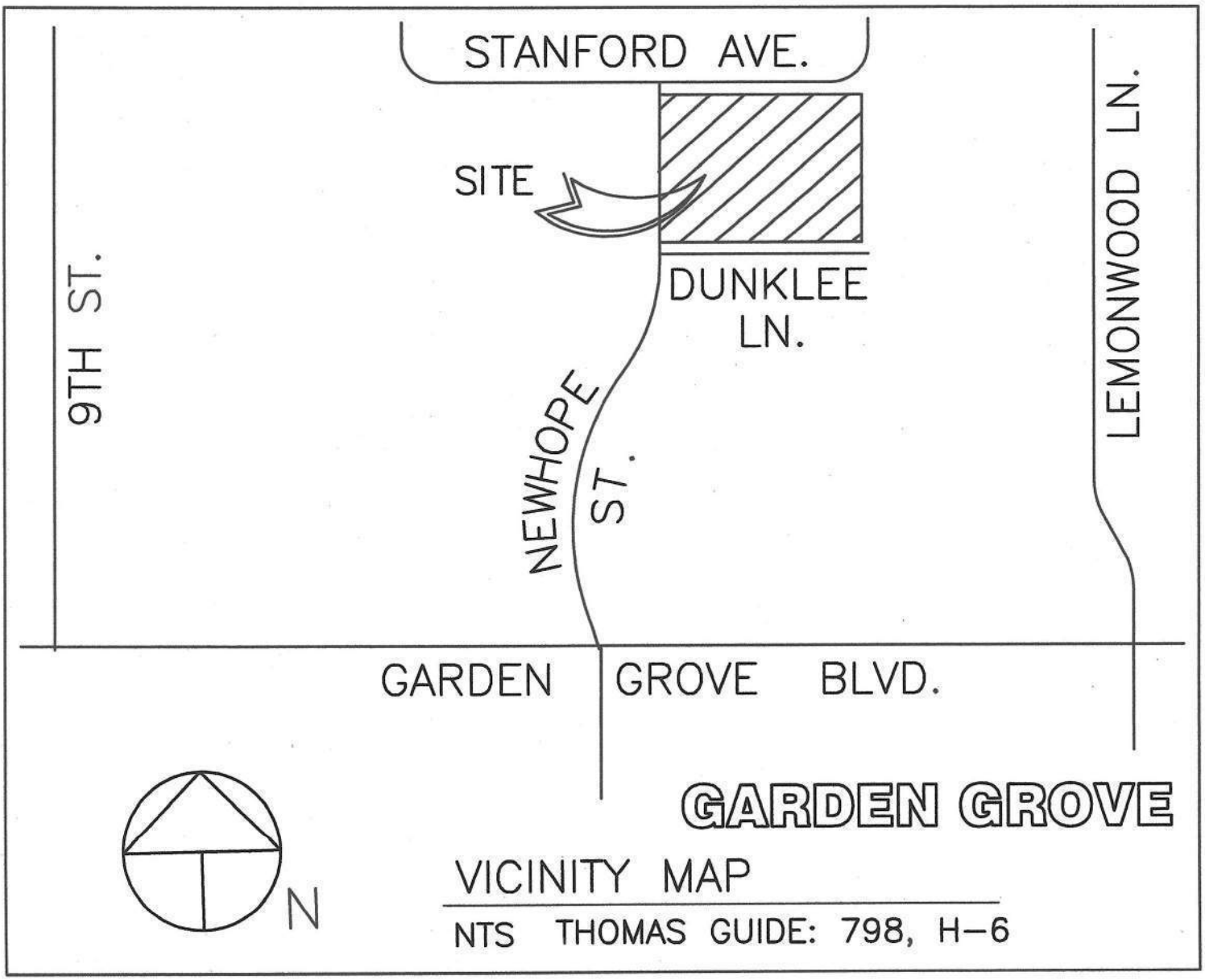
	Pre-Development	Post-Development
10-Year	1.72	2.42
25-Year	2.10	2.90
100-Year	2.73	3.72

Since the proposed site is in a flow-by condition, the on-site storm drain system (i.e. PVC pipes, area drains and parkway culvert) will be designed to carry the 10-Year Storm Event flows.

The increase in the developed flow is considered minor as the additional volume is relatively negligible.

Hydraulic calculations are included to check the capacity of the proposed private street to accommodate the 100-Year storm flow (flows will be contained within the propose sidewalk and street), and tp size the on-site area drain pipes. (See Section 4)

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) No. 06059C0143J, dated December 3, 2009, the site is located within Zone “X” (i.e. *“0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile”*).



GARDEN GROVE

VICINITY MAP

NTS THOMAS GUIDE: 798, H–6

2. Rational Method Hydrology

Pre-Development

10-Year Storm Event
25-Year Storm Event
100-Year Storm Event

```
**************************************************************************
          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 1355

                        Analysis prepared by:



 ************************* DESCRIPTION OF STUDY *************************
* Tract 84168, City of Garden Grove                                      *
* 10-Year Storm Event                                                    *
*                                                                        *
 ************************************************************************

  FILE NAME: GG.DAT
  TIME/DATE OF STUDY: 20:45 08/23/2023
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

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

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ====  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 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) =    90.00
 ELEVATION DATA: UPSTREAM(FEET) =     95.30  DOWNSTREAM(FEET) =     94.10

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.986
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.351
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 ".4 DWELLING/ACRE"         B        0.03      0.30     0.900    56    6.99
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
 SUBAREA RUNOFF(CFS) =      0.08
 TOTAL AREA(ACRES) =      0.03   PEAK FLOW RATE(CFS) =      0.08

****************************************************************************
 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) =   315.00
 ELEVATION DATA: UPSTREAM(FEET) =     95.30  DOWNSTREAM(FEET) =     93.10

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.638
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.386
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "1 DWELLING/ACRE"          B        0.85      0.30     0.800    56   12.64
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.800
 SUBAREA RUNOFF(CFS) =      1.64
 TOTAL AREA(ACRES) =      0.85   PEAK FLOW RATE(CFS) =      1.64
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =        0.9  TC(MIN.) =     12.64
 EFFECTIVE AREA(ACRES) =      0.85  AREA-AVERAGED Fm(INCH/HR)=  0.24
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.800
 PEAK FLOW RATE(CFS)   =       1.64
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
          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 1355

                        Analysis prepared by:



 ************************* DESCRIPTION OF STUDY *************************
* Tract 84168, City of Garden Grove                                      *
* 25-Year Storm Event                                                    *
*                                                                        *
 ************************************************************************

  FILE NAME: GG.DAT
  TIME/DATE OF STUDY: 20:46 08/23/2023
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ====  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 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) =    90.00
 ELEVATION DATA: UPSTREAM(FEET) =     95.30  DOWNSTREAM(FEET) =     94.10

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.986
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.992
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 ".4 DWELLING/ACRE"          B        0.03      0.30     0.900    56    6.99
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
 SUBAREA RUNOFF(CFS) =      0.10
 TOTAL AREA(ACRES) =      0.03   PEAK FLOW RATE(CFS) =      0.10

************************************************************************
 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) =   315.00
 ELEVATION DATA: UPSTREAM(FEET) =     95.30  DOWNSTREAM(FEET) =     93.10

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.638
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.854
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "1 DWELLING/ACRE"           B        0.85      0.30     0.800    56   12.64
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.800
 SUBAREA RUNOFF(CFS) =      2.00
 TOTAL AREA(ACRES) =      0.85   PEAK FLOW RATE(CFS) =      2.00
========================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =        0.9  TC(MIN.) =     12.64
 EFFECTIVE AREA(ACRES) =      0.85  AREA-AVERAGED Fm(INCH/HR)=  0.24
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.800
 PEAK FLOW RATE(CFS)    =       2.00
========================================================================
========================================================================
 END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
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                        Analysis prepared by:
```

```
 ************************* DESCRIPTION OF STUDY *************************
* Tract 84168, City of Garden Grove                                      *
* 100-Year Storm Event                                                   *
*                                                                        *
 ************************************************************************

  FILE NAME: GG.DAT
  TIME/DATE OF STUDY: 20:47 08/23/2023
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)     SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ====== =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

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

**************************************************************************
  FLOW PROCESS FROM NODE      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) =    90.00
 ELEVATION DATA: UPSTREAM(FEET) =     95.30  DOWNSTREAM(FEET) =     94.10

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.986
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.108
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 ".4 DWELLING/ACRE"          B        0.03      0.30     0.900    76    6.99
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
 SUBAREA RUNOFF(CFS) =      0.13
 TOTAL AREA(ACRES) =      0.03   PEAK FLOW RATE(CFS) =      0.13

************************************************************************
 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) =   315.00
 ELEVATION DATA: UPSTREAM(FEET) =     95.30  DOWNSTREAM(FEET) =     93.10

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.638
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.637
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "1 DWELLING/ACRE"           B        0.85      0.30     0.800    76   12.64
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.800
 SUBAREA RUNOFF(CFS) =      2.60
 TOTAL AREA(ACRES) =      0.85   PEAK FLOW RATE(CFS) =      2.60
========================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =        0.9  TC(MIN.) =     12.64
 EFFECTIVE AREA(ACRES) =      0.85  AREA-AVERAGED Fm(INCH/HR)=  0.24
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.800
 PEAK FLOW RATE(CFS)    =       2.60
========================================================================
========================================================================
 END OF RATIONAL METHOD ANALYSIS
```

NEWHOPE STREET

N

1"=20'

	TOTAL AREA	0.88 AC
	PERVIOUS AREA	0.57 AC
	% PERVIOUS	64.8 %
	% IMPERVIOUS	35.2 %

PERVIOUS AREA
EXISTING CONDITION
TENTATIVE TRACT NO. 84168

LATEST REVISION: 8/8/23

GARDEN GROVE

2. Rational Method Hydrology

Post-Development

10-Year Storm Event
25-Year Storm Event
100-Year Storm Event

```
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                        Analysis prepared by:



 ************************* DESCRIPTION OF STUDY *************************
* Tentative Tract No. 19298, City of Garden Grove                       *
* 10-Year Storm Event                                                   *
*                                                                       *
 *************************************************************************

  FILE NAME: GGP.DAT
  TIME/DATE OF STUDY: 08:33 09/10/2023
=========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
=========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

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

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ====  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 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     30.00 TO NODE     31.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   327.00
  ELEVATION DATA: UPSTREAM(FEET) =     96.50  DOWNSTREAM(FEET) =     92.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.922
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.118
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        0.88      0.30      0.200    56    7.92
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      2.42
  TOTAL AREA(ACRES) =      0.88   PEAK FLOW RATE(CFS) =      2.42

****************************************************************************
  FLOW PROCESS FROM NODE     31.00 TO NODE     32.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    91.00  DOWNSTREAM(FEET) =    86.00
  FLOW LENGTH(FEET) =    27.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   4.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.41
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.42
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    7.95
  LONGEST FLOWPATH FROM NODE     30.00 TO NODE     32.00 =     354.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        0.9  TC(MIN.) =      7.95
  EFFECTIVE AREA(ACRES) =      0.88  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.200
  PEAK FLOW RATE(CFS)   =       2.42
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
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                        Analysis prepared by:



 ************************* DESCRIPTION OF STUDY *************************
* Tentative Tract No. 19298, City of Garden Grove                        *
* 25-Year Storm Event                                                    *
*                                                                        *
 ************************************************************************

  FILE NAME: GGP.DAT
  TIME/DATE OF STUDY: 08:32 09/10/2023
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ====  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 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     30.00 TO NODE     31.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   327.00
  ELEVATION DATA: UPSTREAM(FEET) =     96.50  DOWNSTREAM(FEET) =     92.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.922
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.717
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"        B        0.88      0.30      0.200    56    7.92
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      2.90
  TOTAL AREA(ACRES) =      0.88   PEAK FLOW RATE(CFS) =      2.90

****************************************************************************
  FLOW PROCESS FROM NODE     31.00 TO NODE     32.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    91.00  DOWNSTREAM(FEET) =    86.00
  FLOW LENGTH(FEET) =    27.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   3.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.62
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.90
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    7.95
  LONGEST FLOWPATH FROM NODE     30.00 TO NODE     32.00 =     354.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        0.9  TC(MIN.) =      7.95
  EFFECTIVE AREA(ACRES) =      0.88  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.200
  PEAK FLOW RATE(CFS)   =       2.90
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
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                        Analysis prepared by:



 ************************** DESCRIPTION OF STUDY **************************
* Tentative Tract No. 19298, City of Garden Grove                         *
* 100-Year Storm Event                                                    *
*                                                                         *
 *************************************************************************

  FILE NAME: GGP.DAT
  TIME/DATE OF STUDY: 08:31 09/10/2023
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ====  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

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

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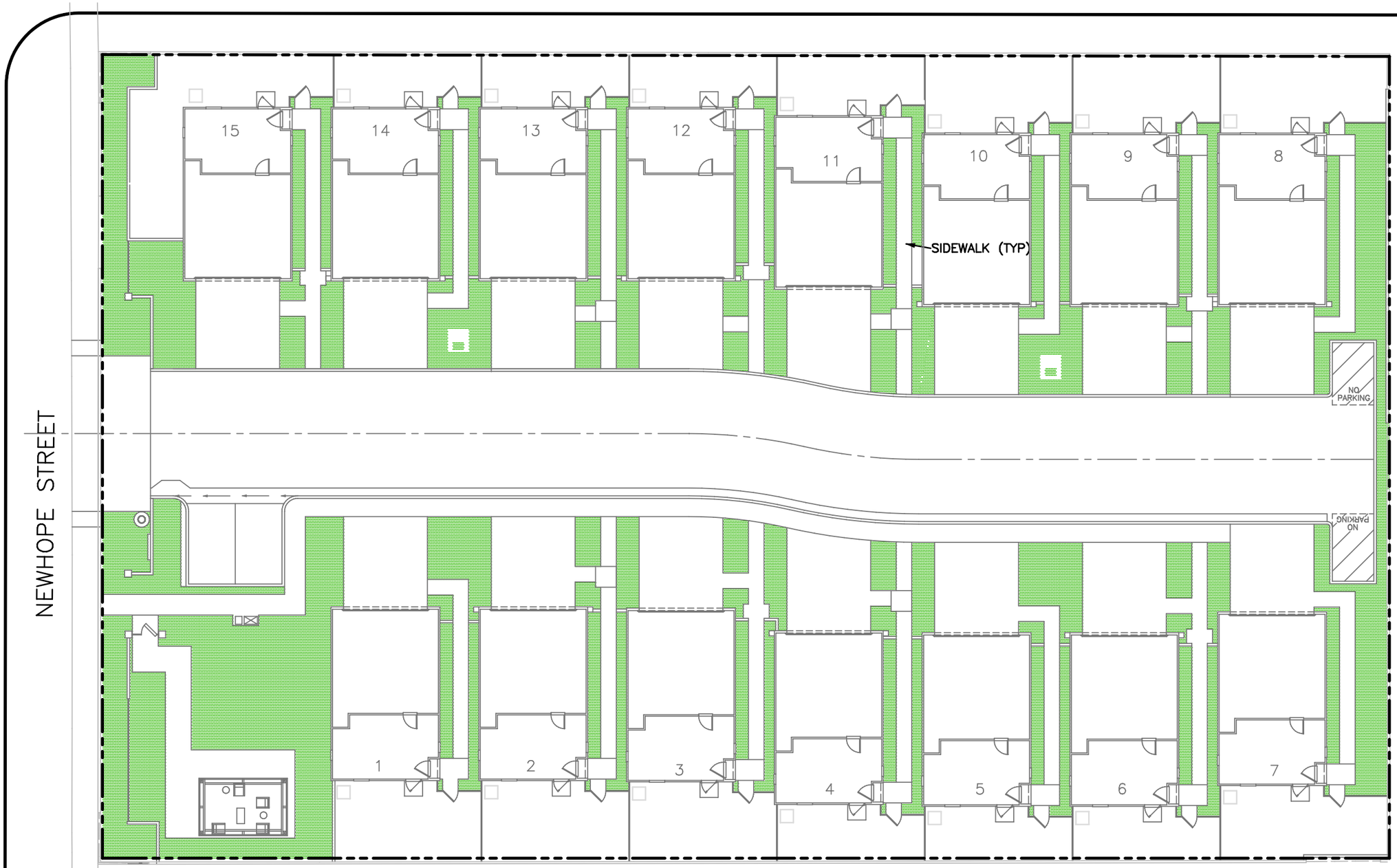

```
------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   327.00
 ELEVATION DATA: UPSTREAM(FEET) =     96.50  DOWNSTREAM(FEET) =     92.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.922
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.753
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "11+ DWELLINGS/ACRE"       B        0.88      0.30     0.200    76    7.92
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA RUNOFF(CFS) =      3.72
 TOTAL AREA(ACRES) =      0.88   PEAK FLOW RATE(CFS) =      3.72

************************************************************************
 FLOW PROCESS FROM NODE     31.00 TO NODE     32.00 IS CODE =  31
------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
========================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    91.00  DOWNSTREAM(FEET) =    86.00
 FLOW LENGTH(FEET) =    27.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN   9.0 INCH PIPE IS   4.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  16.63
 ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       3.72
 PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    7.95
 LONGEST FLOWPATH FROM NODE     30.00 TO NODE     32.00 =     354.00 FEET.
========================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =        0.9  TC(MIN.) =      7.95
 EFFECTIVE AREA(ACRES) =      0.88  AREA-AVERAGED Fm(INCH/HR)=  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.200
 PEAK FLOW RATE(CFS)   =       3.72
========================================================================
========================================================================
 END OF RATIONAL METHOD ANALYSIS
```



N

1"=20'

TOTAL AREA	0.88	AC
PERVIOUS AREA	0.19	AC
% PERVIOUS	21.6	%
% IMPERVIOUS	78.4	%

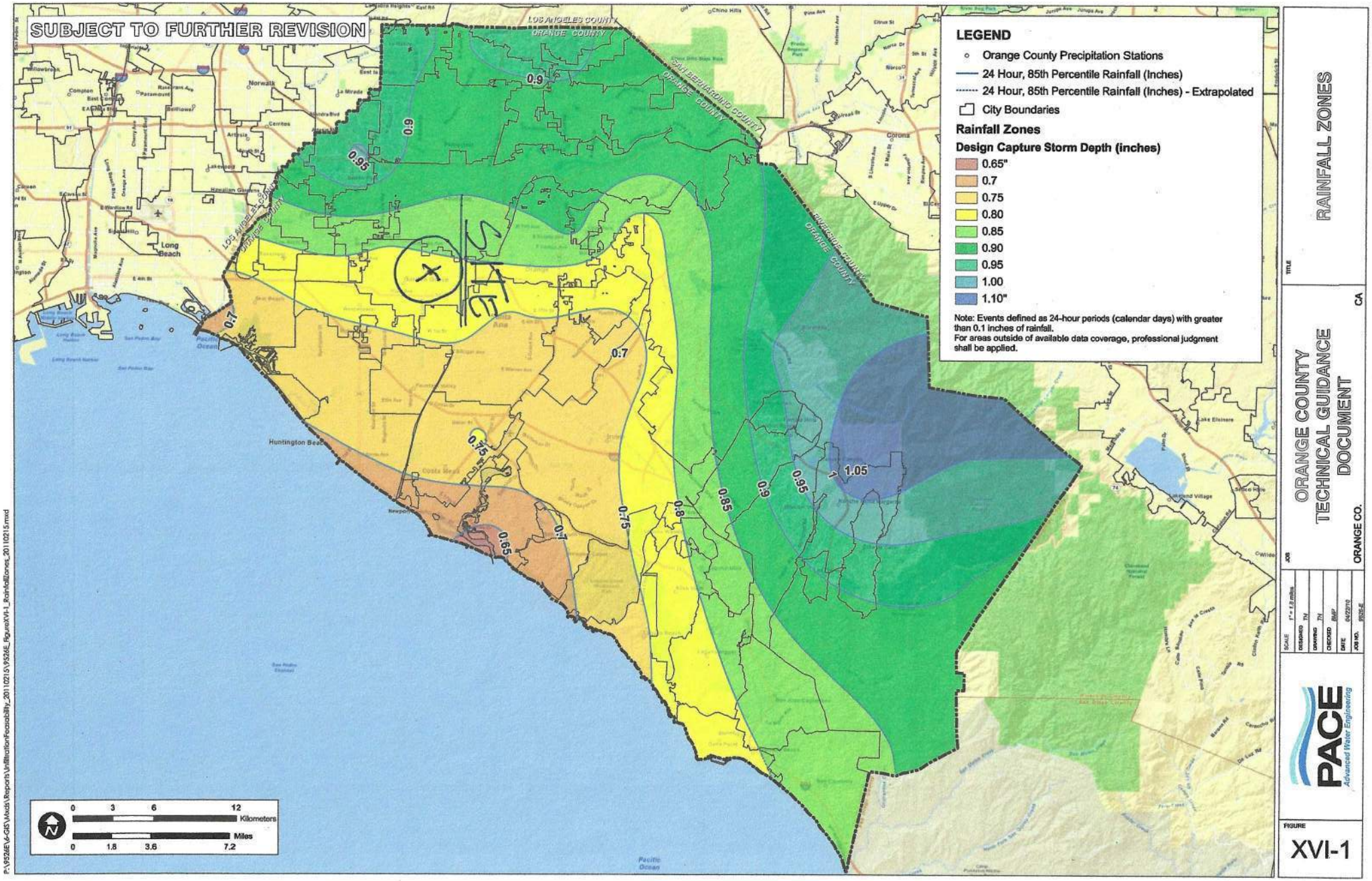
PERVIOUS AREA
PROPOSED CONDITION
TENTATIVE TRACT NO. 19298
GARDEN GROVE

3. Stormwater Quality Design Flow Calculations

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=	0.78	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=		inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=		inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.88	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.78	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.74	
4	Calculate runoff volume, V_{design}= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	2,095	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.



TITLE: RAINFALL ZONES

JOB: ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT

CA

ORANGE CO.

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

PACE
Advanced Water Engineering

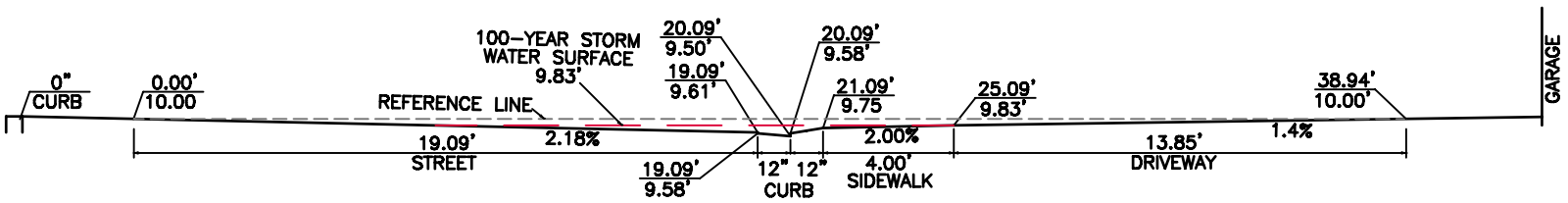
FIGURE
XVI-1

P:\9526\EVA-GIS\Mxds\Reports\InfiltrationFeasibility_20110215\9526E_Figures\XVI-1_RainfallZones_20110215.mxd

4. Preliminary Hydraulics

Private Street Capacity

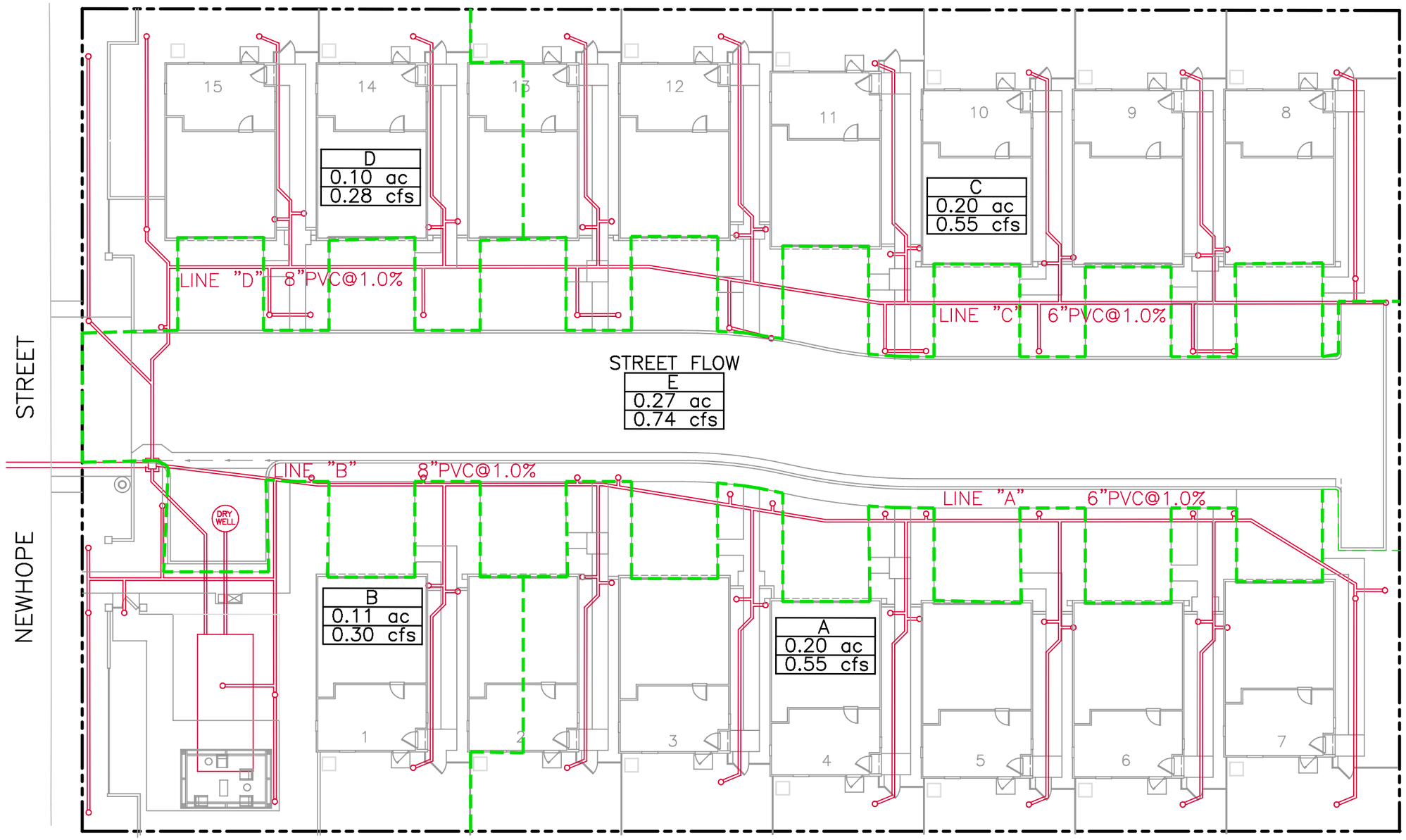
Area Drain Pipe Sizing



STREET SLOPE = 0.0100
CROSS SECTION AREA = 7.146 SF
100-YEAR STORM FLOW = 3.72 cfs

```
 ==========================================================================
                ** RESULTS OF IRREGULAR CHANNEL ANALYSIS **
                  CALCULATIONS BASED ON MANNINGS EQUATION
               WITH ALL DIMENSIONS IN FEET OR FEET AND SECONDS

 ==========================================================================
          (c) Copyright 1983-2016 Advanced Engineering Software (aes)
              Ver. 23.0  Release Date: 07/01/2016  License ID 1355

                             Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
*                                                                        *
*                                                                        *
*                                                                        *
 ************************************************************************

    TIME/DATE OF STUDY: 16:32 02/04/2024
--------------------------------------------------------------------------
            * ENTERED INFORMATION FOR SUBCHANNEL NUMBER  1 :
            NODE NUMBER      "X" COORDINATE     "Y" COORDINATE

                 1                 0.00             10.00
                 2                19.09              9.61
                 3                19.10              9.58
                 4                20.09              9.50
                 5                20.10              9.58
                 6                21.09              9.75
                 7                25.09              9.83
                 8                38.94             10.00
            SUBCHANNEL SLOPE(FEET/FEET) = 0.010000
            SUBCHANNEL MANNINGS FRICTION FACTOR = 0.015000

..........................................................................
         SUBCHANNEL FLOW(CFS) =       4.0
         SUBCHANNEL FLOW AREA(SQUARE FEET) =       1.80
         SUBCHANNEL FLOW VELOCITY(FEET/SEC.) =    2.228
         SUBCHANNEL FROUDE NUMBER =  1.198
         SUBCHANNEL FLOW TOP-WIDTH(FEET) =      16.77
         SUBCHANNEL HYDRAULIC DEPTH(FEET) =    0.11

--------------------------------------------------------------------------
```

```
---------------------------------------------------------------------------
         TOTAL IRREGULAR CHANNEL FLOW(CFS) WANTED =       3.72
         COMPUTED IRREGULAR CHANNEL FLOW(CFS) =       4.01

         ESTIMATED IRREGULAR CHANNEL NORMAL DEPTH WATER SURFACE
         ELEVATION.............................      9.83


              NOTE: WATER SURFACE IS BELOW EXTREME
                    LEFT AND RIGHT BANK ELEVATIONS.

---------------------------------------------------------------------------
```



2/3/24

PIPE LOCATION MAP
TENTATIVE TRACT No. 19298
CITY OF GARDEN GROVE

Garden Grove TT 19298 – Pipe Sizing Summary

Line	Q10	Slope	Size	Contributing Sub-Areas
A	0.55	1.0%	6″	A
B	0.85	1.0%	8″	A,B
C	0.55	1.0%	6″	C
D	0.83	1.0%	8″	C,D

```
_____________________________________________________________________
**********************************************************************
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1355

                          Analysis prepared by:


----------------------------------------------------------------------
  TIME/DATE OF STUDY: 16:36 02/04/2024
======================================================
 Problem Descriptions:
  TT 19298, Garden Grove
  10-Year Storm Event
  Line "A"
**********************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
----------------------------------------------------------------------
    PIPE DIAMETER(FEET) =   0.500
    PIPE SLOPE(FEET/FEET) =  0.0100
    PIPEFLOW(CFS) =         0.55
    MANNINGS FRICTION FACTOR = 0.012000
======================================================
    CRITICAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------
    CRITICAL DEPTH(FEET) =      0.38
    CRITICAL FLOW AREA(SQUARE FEET) =     0.159
    CRITICAL FLOW TOP-WIDTH(FEET) =   0.430
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =            3.68
    CRITICAL FLOW VELOCITY(FEET/SEC.) =     3.454
    CRITICAL FLOW VELOCITY HEAD(FEET) =            0.19
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      0.37
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =            0.56
======================================================
    NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------
    NORMAL DEPTH(FEET) =      0.37
    FLOW AREA(SQUARE FEET) =      0.16
    FLOW TOP-WIDTH(FEET) =     0.436
    FLOW PRESSURE + MOMENTUM(POUNDS) =            3.74
    FLOW VELOCITY(FEET/SEC.) =           3.506
    FLOW VELOCITY HEAD(FEET) =           0.191
    HYDRAULIC DEPTH(FEET) =      0.36
    FROUDE NUMBER =     1.030
    SPECIFIC ENERGY(FEET) =           0.56
======================================================
```

```
_____________________________________________________________________
**********************************************************************
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                          Analysis prepared by:



----------------------------------------------------------------------------
  TIME/DATE OF STUDY: 16:40 02/04/2024
============================================================
 Problem Descriptions:
  TT 19298, Garden Grove
  LIne "B"
  10-Year Storm Event
**********************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
----------------------------------------------------------------------------
    PIPE DIAMETER(FEET) =   0.670
    PIPE SLOPE(FEET/FEET) =  0.0100
    PIPEFLOW(CFS) =         0.85
    MANNINGS FRICTION FACTOR = 0.012000
============================================================
    CRITICAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    CRITICAL DEPTH(FEET) =      0.44
    CRITICAL FLOW AREA(SQUARE FEET) =     0.243
    CRITICAL FLOW TOP-WIDTH(FEET) =   0.639
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =            8.65
    CRITICAL FLOW VELOCITY(FEET/SEC.) =     3.499
    CRITICAL FLOW VELOCITY HEAD(FEET) =            0.19
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      0.38
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =           0.63
============================================================
    NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =      0.39
    FLOW AREA(SQUARE FEET) =      0.21
    FLOW TOP-WIDTH(FEET) =     0.661
    FLOW PRESSURE + MOMENTUM(POUNDS) =           8.80
    FLOW VELOCITY(FEET/SEC.) =           3.993
    FLOW VELOCITY HEAD(FEET) =           0.248
    HYDRAULIC DEPTH(FEET) =      0.32
    FROUDE NUMBER =     1.240
    SPECIFIC ENERGY(FEET) =           0.64
============================================================
```

```
_____________________________________________________________________
**********************************************************************
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1355

                          Analysis prepared by:


----------------------------------------------------------------------
  TIME/DATE OF STUDY: 16:43 02/04/2024
======================================================
 Problem Descriptions:
  TT 19298, City of Garden Grove
  Line "C"
  10-Year Storm Event
**********************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
----------------------------------------------------------------------
    PIPE DIAMETER(FEET) =   0.500
    PIPE SLOPE(FEET/FEET) =  0.0100
    PIPEFLOW(CFS) =         0.55
    MANNINGS FRICTION FACTOR = 0.012000
======================================================
    CRITICAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------
    CRITICAL DEPTH(FEET) =      0.38
    CRITICAL FLOW AREA(SQUARE FEET) =     0.159
    CRITICAL FLOW TOP-WIDTH(FEET) =   0.430
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =            3.68
    CRITICAL FLOW VELOCITY(FEET/SEC.) =     3.454
    CRITICAL FLOW VELOCITY HEAD(FEET) =            0.19
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      0.37
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =            0.56
============================================================
    NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------
    NORMAL DEPTH(FEET) =      0.37
    FLOW AREA(SQUARE FEET) =      0.16
    FLOW TOP-WIDTH(FEET) =     0.436
    FLOW PRESSURE + MOMENTUM(POUNDS) =            3.74
    FLOW VELOCITY(FEET/SEC.) =           3.506
    FLOW VELOCITY HEAD(FEET) =           0.191
    HYDRAULIC DEPTH(FEET) =      0.36
    FROUDE NUMBER =     1.030
    SPECIFIC ENERGY(FEET) =           0.56
============================================================
```

```
_____________________________________________________________________
**********************************************************************
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1355

                          Analysis prepared by:


----------------------------------------------------------------------
  TIME/DATE OF STUDY: 16:45 02/04/2024
======================================================
 Problem Descriptions:
  TT 19298, City of Garden Grove
  Line "D"
  10-Year Storm Event
**********************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
----------------------------------------------------------------------
    PIPE DIAMETER(FEET) =   0.670
    PIPE SLOPE(FEET/FEET) =  0.0100
    PIPEFLOW(CFS) =         0.83
    MANNINGS FRICTION FACTOR = 0.012000
======================================================
    CRITICAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------
    CRITICAL DEPTH(FEET) =      0.43
    CRITICAL FLOW AREA(SQUARE FEET) =     0.239
    CRITICAL FLOW TOP-WIDTH(FEET) =   0.642
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =            8.38
    CRITICAL FLOW VELOCITY(FEET/SEC.) =     3.466
    CRITICAL FLOW VELOCITY HEAD(FEET) =            0.19
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      0.37
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =            0.62
======================================================
    NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------
    NORMAL DEPTH(FEET) =      0.38
    FLOW AREA(SQUARE FEET) =      0.21
    FLOW TOP-WIDTH(FEET) =     0.663
    FLOW PRESSURE + MOMENTUM(POUNDS) =            8.53
    FLOW VELOCITY(FEET/SEC.) =           3.971
    FLOW VELOCITY HEAD(FEET) =           0.245
    HYDRAULIC DEPTH(FEET) =      0.32
    FROUDE NUMBER =     1.246
    SPECIFIC ENERGY(FEET) =           0.63
======================================================
```
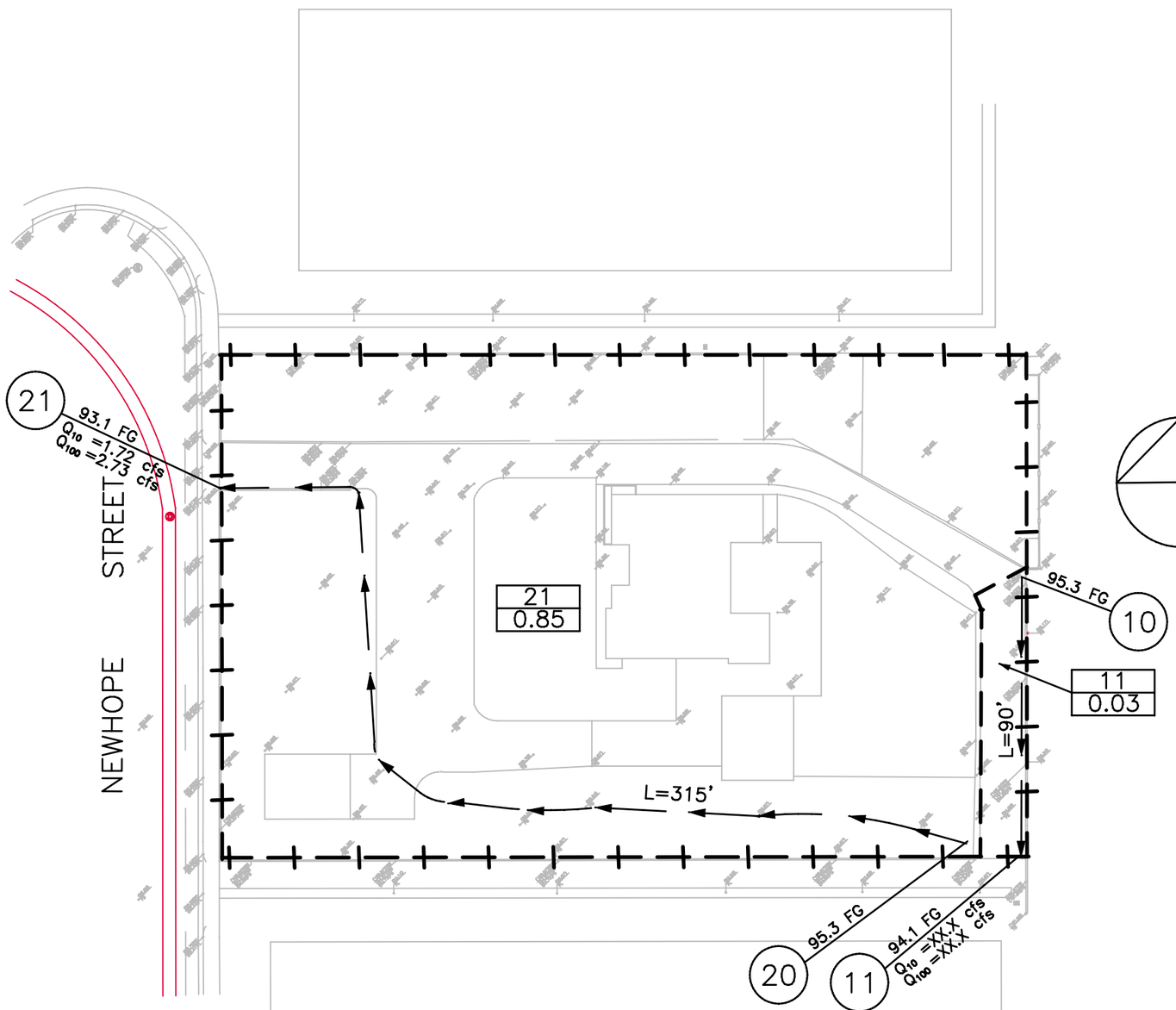
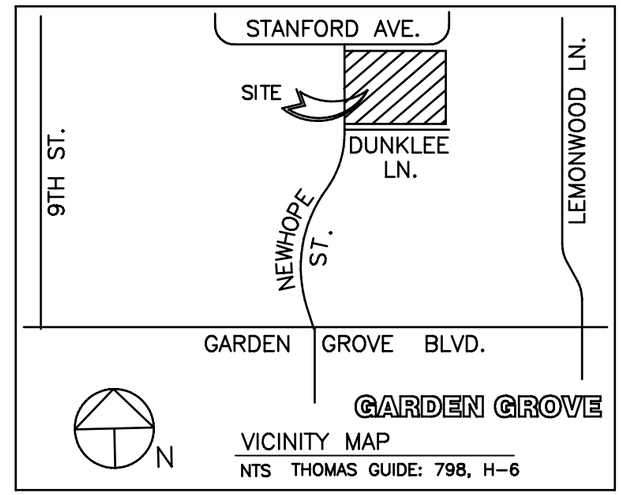
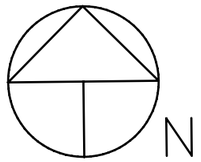

Appendix A

Pre- and Post-Development Hydrology Maps







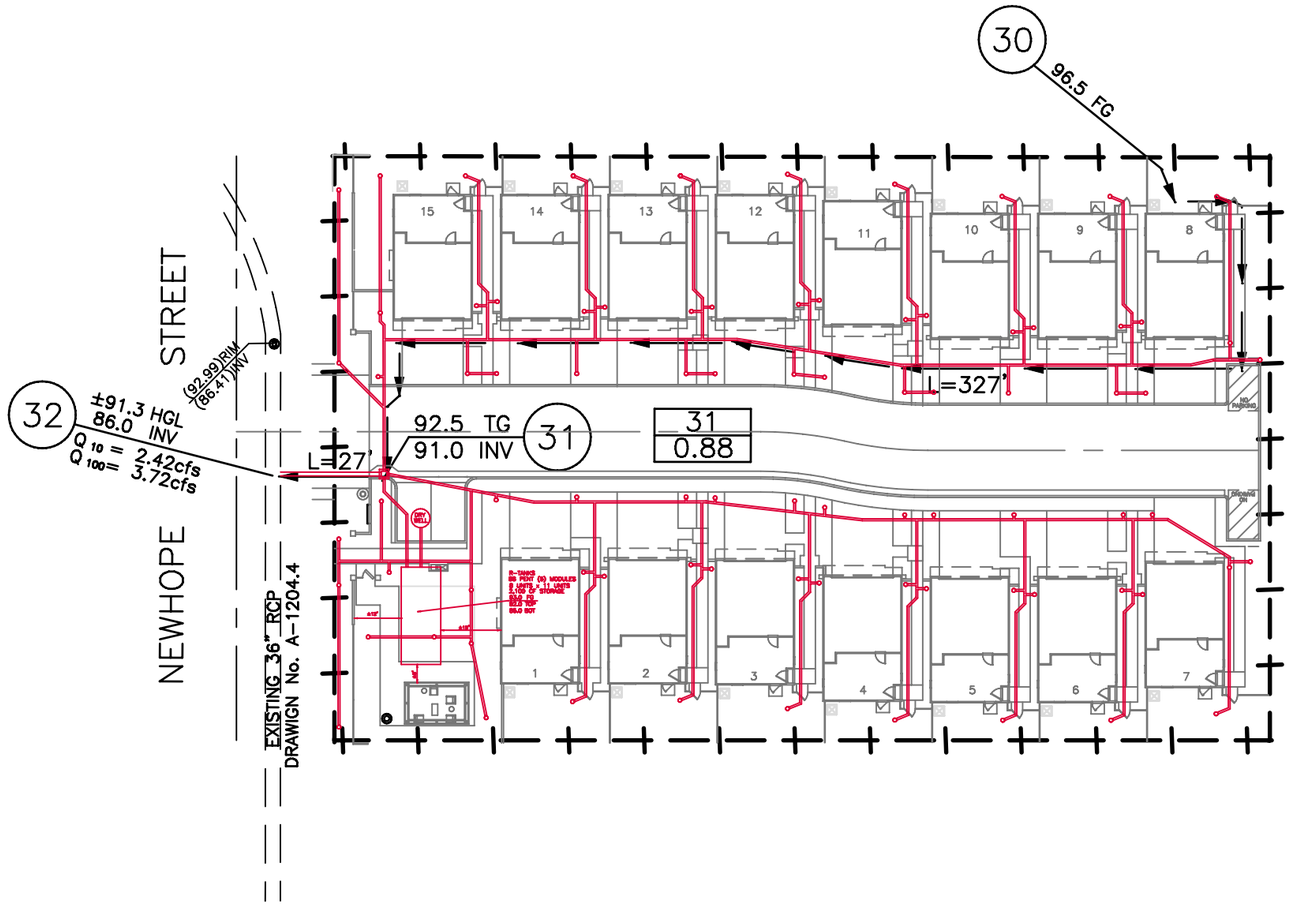
Scale 1" = 40'

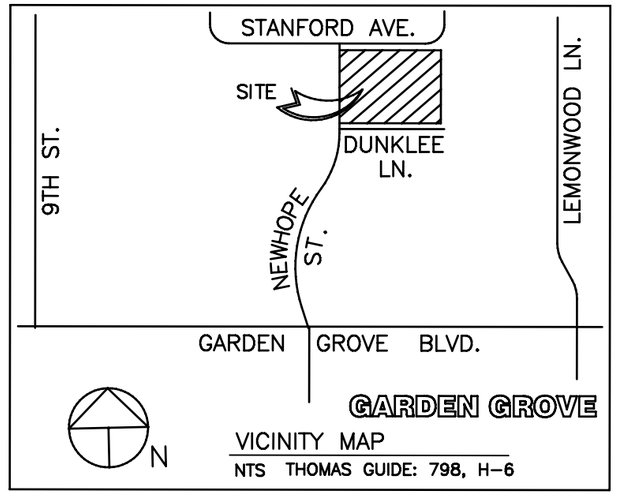
LEGEND

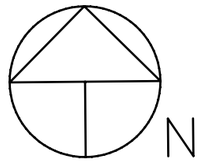
- DRAINAGE BOUNDARY
- SUB–AREA BOUNDARY
- (10) NODAL POINT
- 21 / 0.13 TRIBUTARY NODAL POINT / AREA (AC)

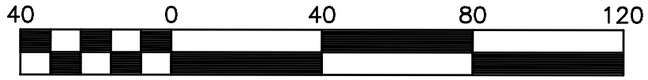
9/15/23

EXISTING HYDROLOGY MAP
TENTATIVE TRACT No. 19298
CITY OF GARDEN GROVE









LEGEND

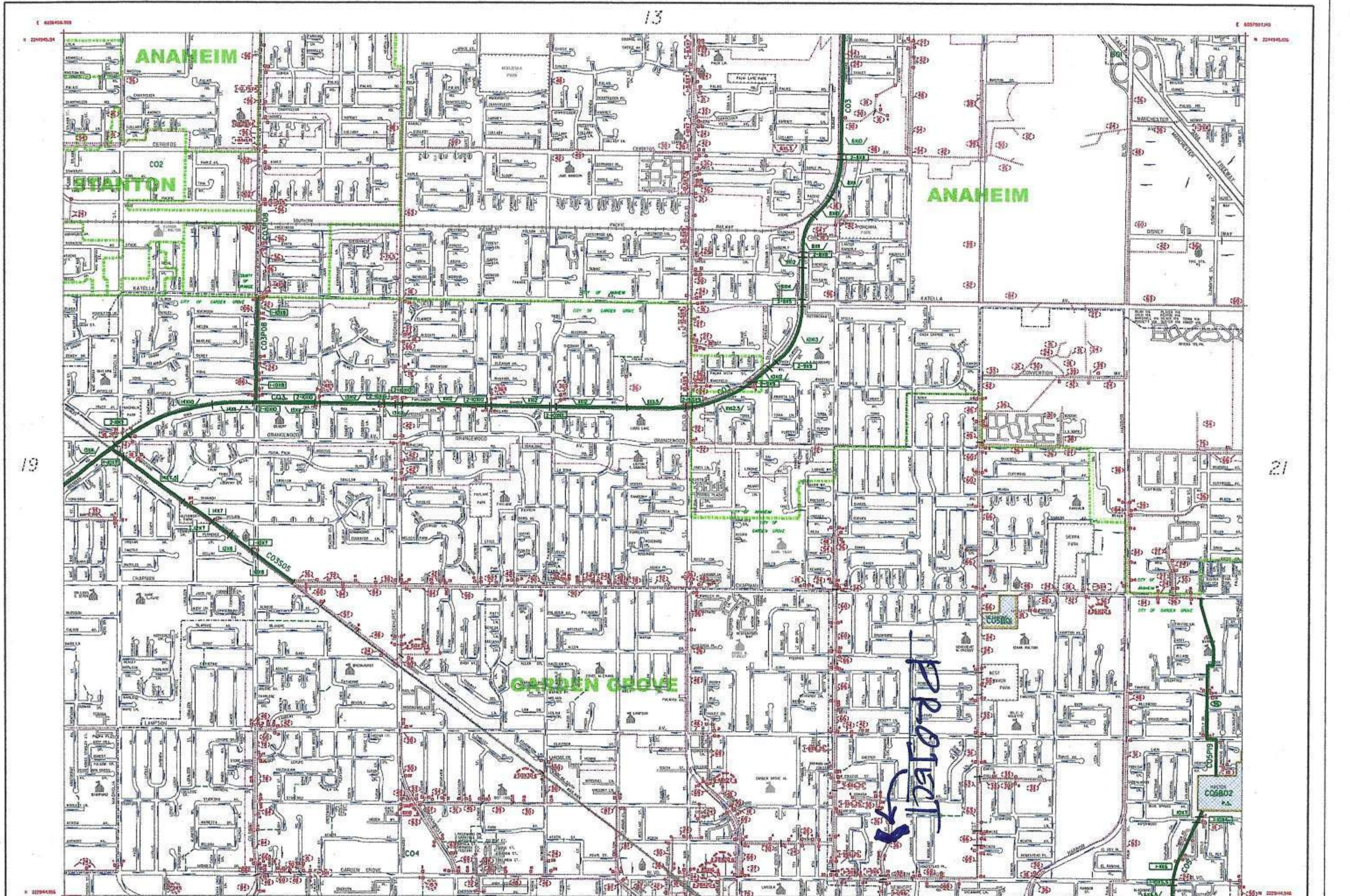
- DRAINAGE BOUNDARY
- SUB-AREA BOUNDARY
- (10) NODAL POINT
- 31 / 0.88 TRIBUTARY NODAL POINT AREA (AC)

2/2/24

PROPOSED HYDROLOGY MAP
TENTATIVE TRACT No. 19298
CITY OF GARDEN GROVE

Appendix B

Susceptibility Analysis Map



NOTICE

The drainage information has been prepared for information purposes only. The location, ownership, facility information and limits have been determined from available information provided by public agencies, but may not be exact, accurate, or up-to-date. The user of this information is responsible for verifying exact location, ownership, accuracy, and the regional versus local character of drainage facilities.

Additional information may be obtained from public plans and recorded deeds. Facility designations included with this information are for convenience only and are not controlling or intended to imply ownership by the County or the Orange County Flood Control District (OCFCD). The information is being provided as a courtesy and neither the County of Orange nor OCFCD assume any liabilities for inaccuracy of the information.

To notify OC Public Works (OCPW) Flood Control Division of additions or corrections, please contact Sal Gutierrez at (714) 834-5396 or by email at sal.gutierrez@rdmd.ocgov.com

ORANGE COUNTY FLOOD CONTROL DISTRICT

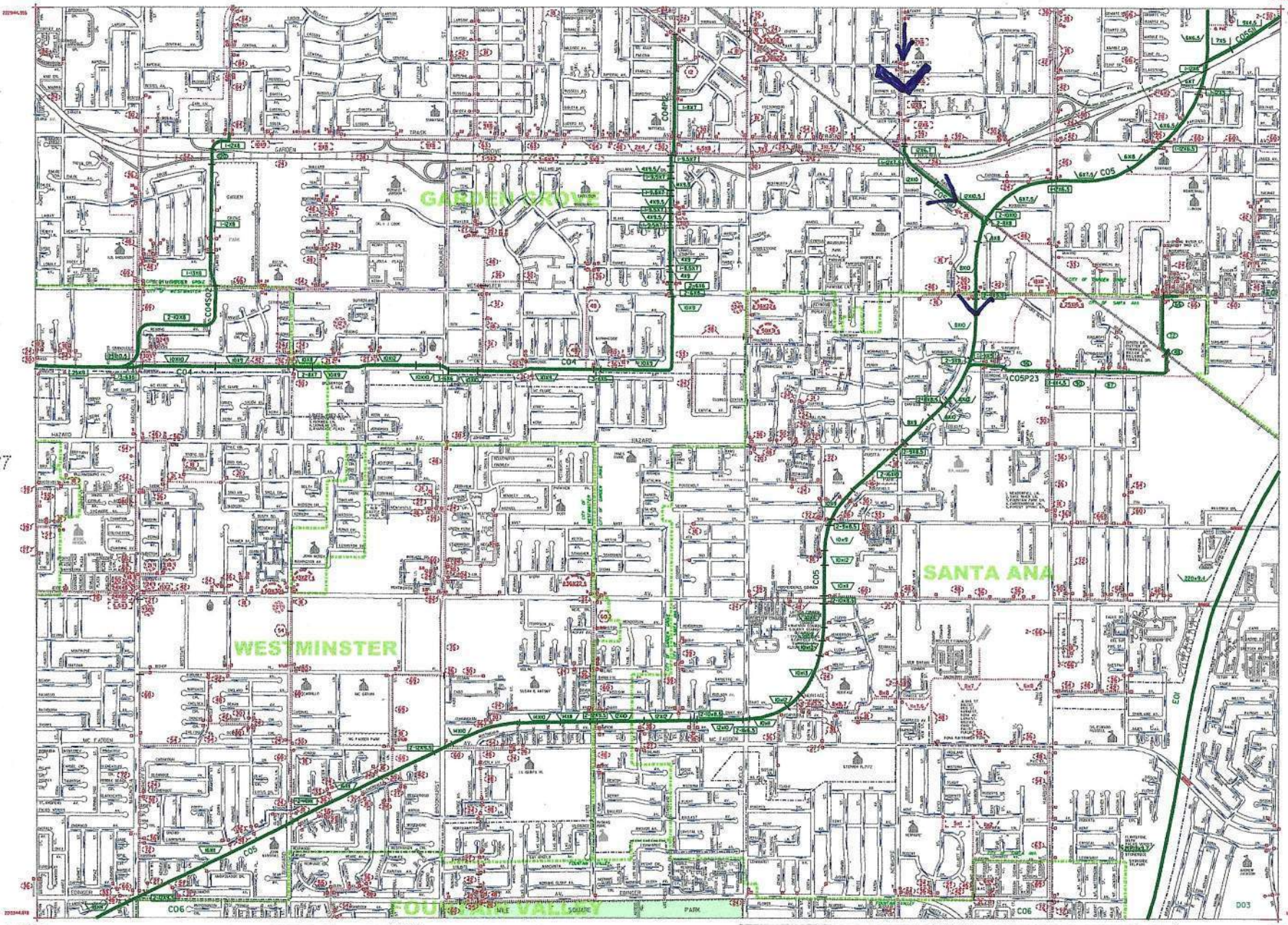
BASE MAP OF DRAINAGE FACILITIES IN ORANGE COUNTY

REVISION	DATE	SHEET NO.	DWG. NO.
R. GUTIERREZ	JAN.02/2009	20	MAPS-113-3

Channel Drainage Area Boundary
Major Sub-Area Drainage Boundary
Minor Sub-Area Drainage Boundary
Existing O.C.F.C.D. Facility
Existing Local Facility
Existing Retarding Basin or Reservoir
Natural Watercourse
City Limits
Greenbelt
Pump Station
Catch Basin (length in feet)
Drop Inlet or Other Entry
OCFCD Basins or Reservoirs
Ownership (if other than City or County): Private=P State=S Federal=F

EXISTING FACILITIES — O.C.F.C.D. / LOCAL

Earth Trapezoidal Channel (base width by height in feet)
Reinforced Concrete Trapezoidal Channel (base width by height in feet)
Reinforced Concrete Rectangular Channel (base width by height in feet)
Reinforced Concrete Box (RCB) (number of bends-span by height in feet)
Reinforced Concrete Pipe (RCP) (diameter in inches)
Metal Sheet Channel (MSC) (base width by pile height in feet/Sheet pile total length)
Corrugated Metal Pipe (CMP) (diameter in inches)
Concrete Pipe (diameter in inches)
Concrete Oval Pipe (width by height in inches)
Steel Pipe (diameter in inches)
Reinforced Concrete Arch (base span by height in inches)
Corrugated Metal Arch (base span by height in inches)


20
27
29
37
28
28
GARDEN GROVE
WESTMINSTER
SANTA ANA
FOUNTAIN VALLEY
C04
C05
C05P23
C06
D03
EOI
NOTICE
The drainage information has been prepared for information purposes only. The location, ownership, facility information and limits have been determined from available information provided by public agencies, but may not be exact, accurate, or up-to-date. The user of this information is responsible for verifying exact location, ownership, accuracy, and the regional versus local character of drainage facilities.
Additional information may be obtained from public plans and recorded deeds. Facility designations included with this information are for convenience only and are not controlling or intended to imply ownership by the County or the Orange County Flood Control District (OCFCD). The information is being provided as a courtesy and neither the County of Orange nor OCFCD assume any liabilities for inaccuracy of the information.
To notify the Resources & Development Management Department (RDMD) of additions or corrections, please contact Sal Gutierrez at (714) 834-5396 or by email at sal.gutierrez@rdmd.ocgov.com
ORANGE COUNTY FLOOD CONTROL DISTRICT
BASE MAP
OF DRAINAGE FACILITIES
IN ORANGE COUNTY
SHEET NO. 28
DWG NO. MAPS-113-3
Channel Drainage Area Boundary
Major Sub-Area Drainage Boundary
Minor Sub-Area Drainage Boundary
Existing O.C.F.C.D. Facility
Existing Local Facility
Existing Retaining Basin or Reservoir
Natural Watercourse
City Limits
Greenbelt
Pump Station
Catch Basin (length in feet)
Drop Inlet or Other Entry
OCFCD Basins or Reservoirs
EXISTING FACILITIES
O.C.F.C.D.
LOCAL
Earth Trapezoidal Channel (base width by height in feet)
Reinforced Concrete Trapezoidal Channel (base width by height in feet)
Reinforced Concrete Rectangular Channel (base width by height in feet)
Reinforced Concrete Box (RCB) (number of barrels-span by height in feet)
Reinforced Concrete Pipe (RCP) (diameter in inches)
Metal Sheet Channel (MSC) (Base width by pile height in feet-Sheet pile total length)
Corrugated Metal Pipe (CMP) (diameter in inches)
Concrete Pipe (diameter in inches)
Concrete Oval Pipe (width by height in inches)
Steel Pipe (diameter in inches)
Reinforced Concrete Arch (base span by height in inches)
Corrugated Metal Arch (base span by height in inches)

Susceptibility

Potential Areas of Erosion, Habitat, & Physical Structure Susceptibility

Channel Type

Earth (Unstable)

Earth (Stabilized)

Stabilized

Tidel Influence

<= Mean High Water Line (4.28')

Water Body

Basin

Lake

Federal & Other Lands

Seal Beach National Wildlife Refuge

Airports/Military

San Gabriel-Coyote Creek

Los Alamitos Naval Air Station

Seal Beach Naval Weapons Station

Seal Beach National Wildlife Refuge

West Street Retarding Basin

Haster Retarding Basin

Newland Retarding Basin

Lake Huntington

PROJECT

C05

Santa Ana River

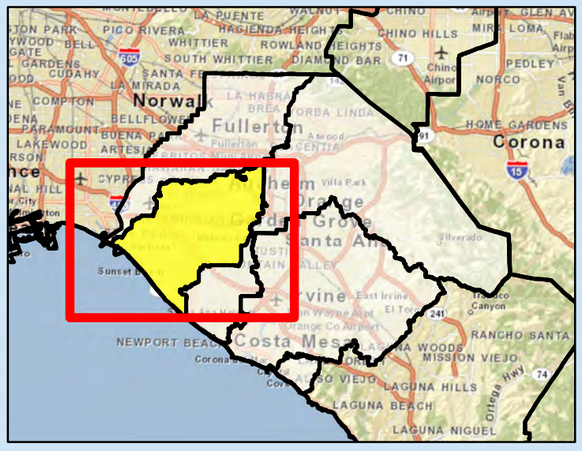
Newport Bay

John Wayne Airport

Pacific Ocean

Feet

0 6,500 13,000



TITLE: SUSCEPTIBILITY ANALYIS ANAHEIM BAY-HUNTINGTON HARBOR

JOB: ORANGE COUNTY WATERSHED MASTER PLANNING ORANGE CO. CA

SCALE	DESIGNED	DRAWING	CHECKED	DATE	JOB NO.
1" = 6500'	TH	TH	BMP	04/22/10	9526-E

PACE Advanced Water Engineering

FIGURE 2

P:\9526E\6-GIS\Mxds\Workspace\SusceptibleAnalysis_20100422\9526E_AnaheimBay_20100331.mxd

Appendix C

National Flood Hazard Layer FIRMette

1DWLRQDO)ORRG+D]DUG/DHU)LUPHWWH

FEMA

/HJHQG

6(( ),6 5(3257)25 '(7$,/(' /(*(1' $1' ,1'(; 0$3)25),50 3$1(/ /$<287

6(&,$/)/22' +$=$5' $5($6
- :LWKRXW %DVH)ORRG (OHYDWLRQ %)(Zone A, V, A99
- :LWK %)(RU 'HSWK Zone AE, AO, AH, VE, AR
- 5HJXODWRU\ )ORRGZD\

27+(5 $5($6 2))/22' +$=$5'
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

27+(5 $5($6
- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone D

*(1(5$/ 6758&785(6
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

27+(5)($785(6
- Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

0$3 3$1(/6
- Digital Data Available
- No Digital Data Available
- Unmapped

7KH SLQ GLVSOD\HG RQ WKH PDS LV DQ DSSUR[LPDWH SRLQW VHOHFWHG E\ WKH XVHU DQG GRHV QRW UHSUHVHQW DQ DXWKRULWDWLYH SURSHUW\ ORFDWLRQ

7KLV PDS FRPSOLHV ZLWK)(0\$V VWDQGDUGV IRU WKH XVH RI GLJLWDO IORRG PDSV LI LW LV QRW YRLG DV GHVFULEHG EHORZ. 7KH EDVHPDS VKRZQ FRPSOLHV ZLWK)(0\$V EDVHPDS DFFXUDF\ VWDQGDUGV

7KH IORRG KD]DUG LQIRUPDWLRQ LV GHULYHG GLUHFWO\ IURP WKH DXWKRULWDWLYH 1)+/ ZHE VHUYLFHV SURYLGHG E\ )(0\$. 7KLV PDS ZDV H[SRUWHG RQ [date] DQG GRHV QRW UHIOHFW FKDQJHV RU DPHQGPHQWV VXEVHTXHQW WR WKLV GDWH DQG WLPH. 7KH 1)+/ DQG HIIHFWLYH LQIRUPDWLRQ PD\ FKDQJH RU EHFRPH VXSHUVHGHG E\ QHZ GDWD RYHU WLPH.

7KLV PDS LPDJH LV YRLG LI WKH RQH RU PRUH RI WKH IROORZLQJ PDS HOHPHQWV GR QRW DSSHDU: EDVHPDS LPDJHU\, IORRG]RQH ODEHOV, OHJHQG, VFDOH EDU, PDS FUHDWLRQ GDWH, FRPPXQLW\ LGHQWLILHUV,),50 SDQHO QXPEHU, DQG),50 HIIHFWLYH GDWH. 0DS LPDJHV IRU XQPDSSHG DQG XQPRGHUQL]HG DUHDV FDQQRW EH XVHG IRU UHJXODWRU\ SXUSRVHV.

)HHW

%DVHPDS ,PDJHU\ 6RXUFH: 86*6 1DWLRQDO 0DS

Attachment E

Dry Wells

Dry Wells

Uses, Regulations, and Guidelines in California and Elsewhere

Dry Well Description and Use

Dry wells are gravity-fed excavated pits lined with perforated casing and backfilled with gravel or stone (Fig. 1). Dry wells penetrate layers of clay soils with poor infiltration rates to reach more permeable layers of soil, allowing for more rapid infiltration of stormwater. They can be used in conjunction with low impact development (LID) practices to reduce the harmful effects that traditional stormwater management practices have had on the aquatic ecosystem. Dry wells not only aid in stormwater runoff reduction, but they can also increase groundwater recharge, are economical, and have minimal space requirements.

Figure 1. Idealized drawing of stormwater infiltration using a dry well

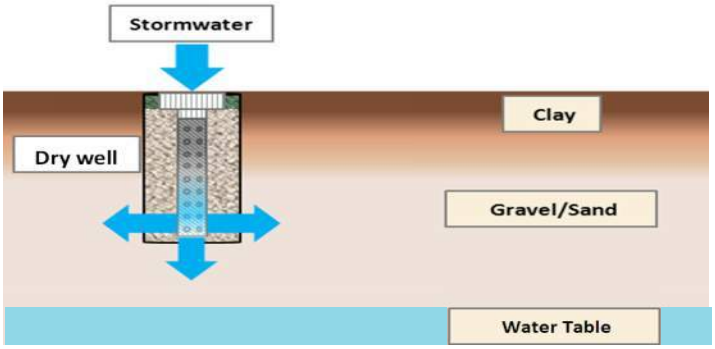


Fig. 2. Dry well installed to receive runoff flowing through a lawn (Source: R. Pitt)

In California, dry wells are used infrequently and with caution due to the concern that they provide a conduit for contaminants to enter the groundwater. In urban environments, scientific reports show a lack of correlation between the use of dry wells and groundwater contamination (Jurgens 2008, Los Angeles 2005). As a consequence, stormwater/LID guidelines often do not include dry wells. Regional Water Quality Control Boards' Standard Urban Stormwater Management Plans' (SUSMP) also differ in technical specifications for dry well construction. The California Department of Water Resources' (DWR) well water regulations are interpreted by some to have applicability to stormwater infiltration through dry wells. Due to the desire to maintain high groundwater quality and the lack of clarity about various technical considerations, many are reluctant to incorporate dry wells into stormwater management projects.

U.S. Environmental Protection Agency (EPA) - Region 9 Regulations

Dry wells and other buried infiltrative devices serving lots other than single-family homes are subject to the U.S. Environmental Protection Agency (US EPA) Underground Injection Control (UIC) regulations. A dry well is considered a Class V injection well, which is defined as a conduit for non-hazardous fluids that is deeper than it is wide. Dry wells may be authorized to operate as long as they are registered with the US EPA, and only inject uncontaminated stormwater. The US EPA has no design requirements for dry wells; that responsibility is left to local authorities. However, the following design practices are encouraged:

- Should not be constructed deeper than the seasonal high water table.
- Follow local guidelines for setback distances from the dry well bottom to the water table.
- Go through a thorough site evaluation to prevent the spread of contaminants.
- Utilize pre-treatment to remove sediment and the pollutants that they frequently carry.
- Use backfill to improve dry well column stability.

The US EPA has also set forth the following minimum requirements for Class V wells:

- Register injection wells at www.epa.gov/region09/water/groundwater/injection-wells-register.html
- Operate injection wells in a way that will not endanger underground sources of drinking water (USDW).
- Abandoned Class V wells should be properly destroyed, with notification to the US EPA, to prevent movement of contaminated fluids into USDW.

US EPA Regulations (continued)

In California, Class V wells are overseen by the US EPA's Region 9 office. Class V wells already in place that are not in the registry must cease use and the operator must contact the Regional office. An application and inventory form must be submitted, and injection can resume after 90 days, if approved. After an inventory form is submitted, the UIC Program will determine if the user is authorized to "inject". A well will be prohibited if the user endangers drinking water, fails to submit inventory information or an application to the UIC Program, or fails to respond to a written request from the UIC Program. Some dry wells in the State have been constructed without going through this registration process while some counties (e.g., Los Angeles) enforce registration as part of permitting new development.

The Role of the California Regional Water Quality Control Board

The State Water Resources Control Board and the Regional Water Quality Control Boards in California can prescribe requirements for discharges into California waters, including groundwater. Under California's Porter-Cologne Act, the Water Boards have the authority to require a person wishing to operate an injection well to file a report of the discharge. These requirements must implement the Boards' water quality control plans (Basin Plans). The requirements must take into consideration the beneficial uses (domestic water, irrigation, etc.) of the affected water and the water quality objectives necessary to protect these beneficial uses, as well as the need to prevent a nuisance.

California's Anti-Degradation Policy

When evaluating the risk and benefits of using dry wells, California's anti-degradation policy (State Water Resources Control Board Resolution No. 68-16) is also considered. The anti-degradation policy protects high quality water (water that is higher in quality than that prescribed by the Water Boards' plans and policies). Degradation of high quality water is permitted only if the discharge provides a maximum benefit to the people of the State, does not violate the Boards' Basin Plans and policies, and when the discharge is controlled by the best practicable treatment. The maximum benefit to the State is determined on a case by case basis taking into account the beneficial uses of the water, economic and social costs, the environmental aspects of the proposed discharge, and the implementation of feasible alternative treatment or control methods. Factors to be considered when evaluating the use of dry wells for stormwater management could involve determining if they:

- Provide an additional source of water to augment the water supply,
- Reduce the negative effects of runoff flowing to surface waters, and
- Minimally impact groundwater quality.

Consideration and interpretation of these and related factors are the basis on which the state's anti-degradation policy is applied to dry well use and siting.

Typical Dry Well Guidelines at the Local Level

Dry Wells and Water Well Protection Policy

Throughout California, county environmental management departments are charged with implementing California DWR regulations (Bulletins 74-81, 74-90) to protect wells used to supply drinking water. These regulations are designed to prevent contamination of groundwater through improperly constructed or decommissioned wells. County staff regularly inspect wells and the area around them to evaluate compliance with regulations. The very process that dry wells are designed to facilitate, namely the infiltration of stormwater, stands in contradiction to the goals of Bulletin 74, which prohibits surface water from entering injection wells. Currently, individual county environmental health departments in California use their best professional judgment to evaluate how to manage this challenge.

Local Guidelines

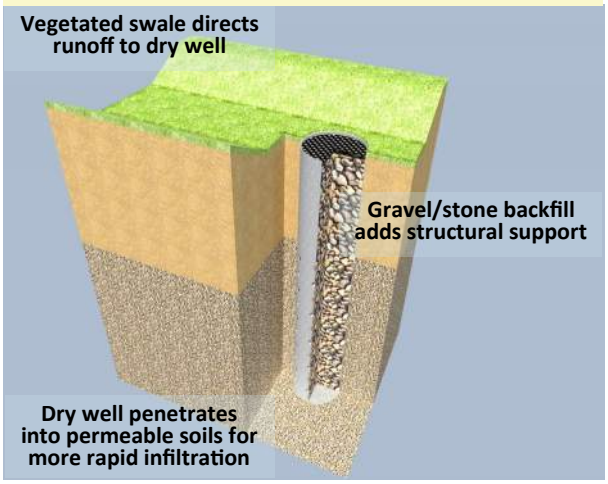
Many requirements and design specifications for dry wells come from guidelines linked to the NPDES (National Pollution Discharge Elimination System) permits, issued by the State or Regional Water Boards. In a few locales, city or county requirements also exist. In Los Angeles County, for example, information on placement and design of dry wells must be submitted as part of the permitting process for new development. Not all cities and counties have such requirements.

Local Guidelines (continued)

Design specifications differ by city/county, with some standards varying significantly. Local authorities should be consulted for specific guidelines. The following lists some of the common standards of the Los Angeles and San Diego SUSMPs as well as the Placer County LID Manual (documents that are linked to NPDES permits):

- Building setback: 10 – 20 feet minimum
- Soil: not suitable in soils with >30% clay or >40% silt
- Water table: 3 – 10 feet minimum separation between dry well bottom and seasonal high water table
- Public supply wells: 100 feet minimum setback
- Separation (center to center): 100 feet minimum
- Penetration: 10 feet minimum into permeable porous soils
- Dry well surface inlet: 3 inch minimum above bottom of retention basin
- Should not be used at sites with a slope >15%. (San Diego does not recommended sites with slopes >40%).

Figure 3. Example dry well system design



In 1951, the Regional Water Quality Control Board in the Bay Area restricted the use of dry wells in an effort to protect groundwater quality. Today, the San Francisco Public Utilities Commission recommends constructing drainage wells that are much wider than deep, therefore, they are not technically dry wells. The City of Modesto is a somewhat unique case in California in that they have been using dry wells for over 50 years as one of their principal runoff management tools. Dry wells are carefully scrutinized under the NPDES/MS4 permit. The Central Valley Regional Board requires the City of Modesto to perform extensive monitoring of stormwater and groundwater. The use of dry wells has not directly resulted in groundwater problems in Modesto (Jurgens 2008).

Dry Well Regulations in Other States

Over a dozen other states have dry well requirements in place. States surrounding California may provide a helpful overview of statewide dry well requirements currently being implemented. Oregon, for example, permits the use of dry wells, but they must be sited and constructed following their guidelines. Dry wells also must be registered with the state prior to construction and a fee, based on a sliding scale that is proportional to risk, must be paid. Arizona is another state that has used dry wells for many decades. They too have a registration system along with a fee system. The table below compares regulations between Arizona and California, both located in US EPA Region 9.

Arizona	California
Falls under USEPA Region 9 UIC program for Class V injection wells.	Falls under USEPA Region 9 UIC program for Class V injection wells.
Dry wells **must** be registered with the Arizona Department of Environmental Quality (ADEQ). Fee are required when registering.	Regional Water Quality Control Boards **can** prescribe discharge requirements for injection wells.
Requires Aquifer Protection Permit and approval by ADEQ prior to construction.	No state-wide permitting requirements for the use of dry wells.
Requires information on design, pollutant characteristics, and closure strategy.	Regional Water Quality Control Boards may require a report of discharge and other information. No formal, statewide process for registration or monitoring.
Requires monitoring, recordkeeping and reporting, contingency planning, discharge limitations, a compliance schedule, and closure guidelines.	Injection well requirements must protect beneficial uses (comply with the Anti-Degradation policy).
A general permit covers facilities that have obtained a NPDES/MS4 permit and have a stormwater pollution prevention plan implemented.	Requirements may vary by region and municipality.

Regulations in Other States (continued)

Pennsylvania, New Jersey, Washington, and Hawaii are a few of the others states with dry well regulations and guidelines. In New Jersey, some communities require dry well installation for all new and major remodels related to residential construction. They are typically designed to temporarily store and infiltrate roof runoff. Dry wells in New Jersey are prohibited in industrial or other areas where toxic chemicals might be used. In contrast, in Pennsylvania dry wells are permitted in industrial areas with restrictions, but not along roadways. In Washington, dry wells must be registered and constructed to specifications. The regulations of these states vary with respect to dry well design, use of pretreatment, separation from drinking water sources, distance from the water table, and other factors.

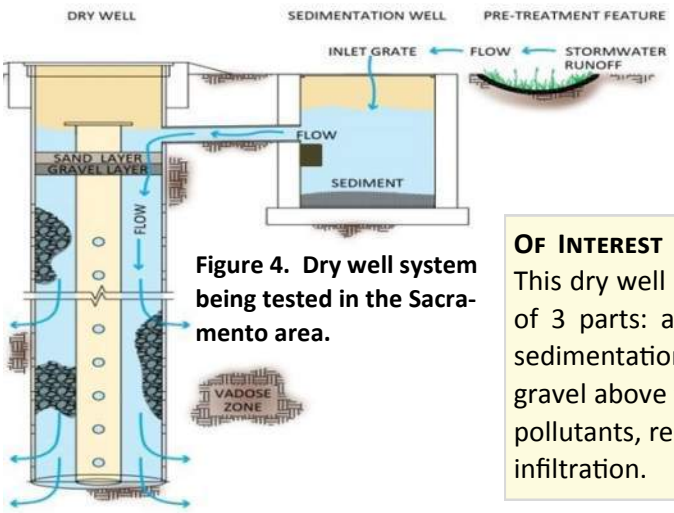


Figure 4. Dry well system being tested in the Sacramento area.

OF INTEREST Most dry wells are not holes in the ground filled with rocks. This dry well system (left) is being tested in the Sacramento area. It consists of 3 parts: a vegetated pre-treatment feature, a structural pre-treatment sedimentation well, and the dry well itself, which contains layers of sand and gravel above the rocks. The goal of this design is to maximize the removal of pollutants, reduce clogging of the dry well, and promote efficient stormwater infiltration.

Conclusions

Currently there are no uniform state regulations or guidelines for dry wells in California. However, the Regional Water Quality Control Boards have the discretion to issue waste discharge requirements and to interpret and apply the Anti-Degradation policy to the construction of new dry wells. Therefore, most regulations and guidelines occur at the city or county level and vary by region. Available information suggests that dry wells can be used safely if careful site evaluations are performed to determine if a dry well is suitable for the location. They can be an alternative to typical storm drainage systems that provide numerous benefits, including reducing localized flooding, recharging the aquifer, supporting the implementation of LID practices in areas with clay soils, thereby minimizing alterations to the hydrologic cycle which have dang effects on valuable aquatic resources.

Useful Links and References

General Information

US EPA Class V Injection Well Information
http://water.epa.gov/type/groundwater/uic/index.cfm
US EPA California Injection Well Guidelines
http://www.epa.gov/region9/water/groundwater/uic-pdfs/calif5d-muniguide.pdf

Forms and Registration

EPA Region 9 Injection Well Registration
http://www.epa.gov/region09/water/groundwater/injection-wells-register.html
Region 9 Injection Well Contact: r9iwells@epa.gov

References

Jurgens, B.C., K.R. Burow, B.A. Dalgish, & J.L. Shelton. 2008. Hydrogeology, water chemistry, and factors affecting the transport of contaminants in the zone of contribution of a public-supply well in Modesto, eastern San Joaquin Valley, California. National Water Quality Assessment Program, U.S. Geological Survey, Scientific Investigation Report 2008-5156.
http://pubs.usgs.gov/sir/2008/5156/pdf/sir20085156.pdf

The Los Angeles and San Gabriel Rivers Watershed Council. 2005. Los Angeles Basin Water Augmentation Study, Phase II Final Report. Los Angeles, CA. Posted at:
http://watershedhealth.org/Files/document/265_2005_WAS%20Phase%20II%20Final%20Report_2005.pdf

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