APPENDIX F

HYDROLOGY and WATER QUALITY STUDIES

FUSCOE ENGINEERING

CONCEPTUAL
WATER QUALITY MANAGEMENT PLAN (PWQMP)

ESPERANZA VILLAGE
TTM 19161

YORBA LINDA, CA

PLANNING APPLICATION NO. PA21-0111

REGISTERED PROFESSIONAL ENGINEER
TREVOR S. DODSON
NO. C42029
CIVIL
STATE OF CALIFORNIA

PREPARED FOR
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PROJECT MANAGER
Trevor Dodson, PE

DATE PREPARED: June 14, 2021
DATE REVISED: August 25, 2021
November 18, 2022
PROJECT NUMBER: 774-012-02

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FUSCOE ENGINEERING

CONCEPTUAL WATER QUALITY MANAGEMENT PLAN (CWQMP)

ESPERANZA VILLAGE

YORBA LINDA, CA / NOVEMBER 18, 2022

FUSCOE ENGINEERING

CONCEPTUAL WATER QUALITY MANAGEMENT PLAN (CWQMP)

ESPERANZA VILLAGE

YORBA LINDA, CA / NOVEMBER 18, 2022

FUSCOE ENGINEERING

CONCEPTUAL WATER QUALITY MANAGEMENT PLAN (CWQMP)

ESPERANZA VILLAGE

YORBA LINDA, CA / NOVEMBER 18, 2022

CONCEPTUAL
WATER QUALITY MANAGEMENT PLAN (PWQMP)

ESPERANZA VILLAGE

6821 Fairlynn Blvd., Yorba Linda, County of Orange

TENTATIVE TRACT MAP NO. 19161

PLANNING APPLICATION NO. PA21-0111

Prepared for:

ROI ESPERANZA LLC
4199 Campus Drive Suite 200
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714.342.2502

Prepared by:

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16795 Von Karman, Suite 100
Irvine, CA 92618
949.474.1960
Trevor Dodson, PE

Date Prepared: June 14, 2021
Date Revised: August 25, 2021
November 18, 2022

PROJECT OWNER'S CERTIFICATION			
Permit/Application No.:	PA21-0111	**Grading Permit No.:**	Pending
Tract/Parcel Map and Lot(s)No.:	TTM 19161	**Building Permit No.:**	Pending
Address of Project Site and APN:	6821 Fairlynn Blvd., Yorba Linda, CA 92886		

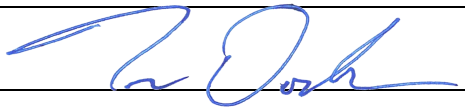
This Water Quality Management Plan (WQMP) has been prepared for ROI ESPERANZA LLC by FUSCOE ENGINEERING, INC. The WQMP is intended to comply with the requirements of the County of Orange NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan , including the ongoing operation and maintenance of all best management practices (BMPs), and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

OWNER:			
Name:	Alex Wong		
Title:	Manager		
Company:	ROI Esperanza LLC		
Address:	4199 Campus Drive Suite 200, Irvine, CA 92612		
Email:	alex@redoakinc.com		
Telephone #:	714.342.2502		
I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein.			
Owner Signature:		**Date:**	

Preparer (Engineer):			
Title	Project Manager	PE Registration #	C042029
Company	Fuscoe Engineering, Inc.		
Address	16795 Von Karman Suite 100,, Irvine, CA 92606		
Email	tdodson@fuscoe.com		
Telephone #	(949) 474-1960		

I hereby certify that this Water Quality Management Plan is in compliance with, and meets the requirements set forth in, Order No. R8-2009-0030/NPDES No. CAS618030, of the Santa Ana Regional Water Quality Control Board.

Preparer Signature		Date	11/22/2022
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- Site Plan
- WQMP Exhibit
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- Typical Cross Sections
- Modular Wetland Systems

EDUCATIONAL MATERIALS (INCLUDED IN APPENDIX C)

- The Ocean Begins at Your Front Door
- Homeowners Guide for Sustainable Water Use
- Household Tips
- Proper Disposal of Household Hazardous Waste
- Recycle at Your Local Used Oil Collection Center (North County)
- Responsible Pest Control
- Tips for the Home Improvement Projects
- Tips for Horse Care
- Tips for Landscaping and Gardening
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- DF-1 Drainage System Operation & Maintenance
- R-3 Automobile Parking
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- SD-12 Efficient Irrigation
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SECTION I DISCRETIONARY PERMITS AND WATER QUALITY CONDITIONS

PROJECT INFORMATION			
Permit/Application No.:	PA21-0111	**Grading or Building Permit No.:**	Pending
Address of Project Site (or Tract Map and Lot Number if no address) and APN:	6821 Fairlynn Blvd., Yorba Linda, CA 92886 APN 349-071-17		
WATER QUALITY CONDITIONS OF APPROVAL OR ISSUANCE			
Discretionary Permit(s):	Pending issuance.		
Water Quality Conditions of Approval or Issuance applied to this project: **(Please list verbatim.)**	[WQ01] WATER QUALITY MANAGEMENT PLAN Prior to the issuance of any grading or building permits, the applicant shall submit for review and approval by the Manager, Permit Services, a Water Quality Management Plan (WQMP) specifically identifying Best Management Practices (BMPs) that will be used onsite to control predictable pollutant runoff. The applicant shall utilize the Orange County Drainage Area Management Plan (DAMP), Model WQMP, and Technical Guidance Manual for reference, and the County's WQMP template for submittal. This WQMP shall include the following: - Detailed site and project description - Potential stormwater pollutants - Post-development drainage characteristics - Low Impact Development (LID) BMP selection and analysis - Structural and Non-Structural source control BMPs - Site design and drainage plan (BMP Exhibit) - GIS coordinates for all LID and Treatment Control BMPs - Operation and Maintenance (O&M) Plan that (1) describes the long-term operation and maintenance requirements for BMPs identified in the BMP Exhibit; (2) identifies the entity that will be responsible for long-term operation and maintenance of the referenced BMPs; and (3) describes the mechanism for funding the long-term operation and maintenance of the referenced BMPs The BMP Exhibit from the approved WQMP shall be included as a sheet in all plan sets submitted for plan check and all BMPs shall be depicted on these plans. Grading and building plans must be consistent with the approved BMP exhibit.		

CONCEPTUAL WQMP	
Was a Conceptual Water Quality Management Plan previously approved for this project?	None.
WATERSHED-BASED PLAN CONDITIONS	
Applicable conditions from watershed – based plans including WIHMPs and TMDLs:	Not Applicable

SECTION II PROJECT DESCRIPTION

II.1 PROJECT DESCRIPTION

The proposed Esperanza Village TTM 19161 project site encompasses approximately 2.58 acres in an unincorporated portion of Orange County adjacent to the City of Yorba Linda. The project site is bounded by Esperanza Avenue to the south, Fairgreen Avenue to the north, and existing residential and commercial development to the west. A Vicinity Map is included in Section VI. Under existing conditions, the project site is an existing commercial site with 3 buildings and surface parking lots.

The table below summarizes the proposed project.

DESCRIPTION OF PROPOSED PROJECT				
Development Category (Model WQMP, Table 7.11-2; or 7.11-3):	8. 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.			
Project Area (ft^2):	112,164 ft^2 (2.58 acres)			
# of Dwelling Units:	44			
SIC Code:	N/A			
Narrative Project Description:	The proposed project includes the removal of the existing buildings and parking lots for the construction of 8 numbered residential lots and 6 lettered lots for future condominium land uses. Garages and additional uncovered parking spaces are also proposed as part of the project.			
Project Area:	**Pervious Area**	**Pervious Area Percentage**	**Impervious Area**	**Impervious Area Percentage**
Pre-Project Conditions:	0.56 ac	22%	2.02 ac	78%
Post-Project Conditions:	0.52 ac	20%	2.06 ac	80%
Drainage Patterns/ Connections:	Under existing conditions, runoff from the existing site generally sheet flows to ribbon gutters that flow south and outlet to the surface of Esperanza Road. Runoff is then intercepted by an existing catch basin on the north side of the curb at Esperanza Road approximately 250 ft westerly from the intersection of Fairlynn Boulevard and Esperanza Road. The existing storm drain pipe running along Esperanza Road is a 112" WSP and a 54" RCP pipe which continues north to Fairlynn Boulevard. The storm drain lateral from the catch basin, assuming it to be 18" RCP, from the catch basin connects southerly to the existing 54" RCP.			

DESCRIPTION OF PROPOSED PROJECT	
	The private storm drain systems proposed for this project will have four (4) collection points with catch basins. The first one is located at the southeasterly curb entry at Fairlynn Boulevard designated as CB #1, the second one is at the northwesterly curb of the drive aisle designated as CB#2, the third one is 110 ft from the entry at Esperanza Road designated as CB #3 and the last one is at the entry at Esperanza Road designated as CB #4. All these catch basins are connected via an 18" RCP pipe that runs north to south of the drive aisle and terminates to a junction structure connected to the existing 112" WSP at Esperanza Road.

PROJECT FEATURES	
Building Summary:	A total of 44 3-story townhomes are proposed in 8 buildings. Further details will be provided in the Final WQMP.
Landscaped Areas:	The project site will include landscaping around the perimeter of the site, adjacent to sidewalks and surrounding the proposed buildings. Approximately 20 percent of the site will be landscaped. Further details on the proposed landscaping will be provided in the Final WQMP.
Parking Facilities:	Parking will be provided onsite within the proposed residential garages, and as uncovered spaces for guests and tenants. Additional information and parking counts will be provided in the Final WQMP.
Other Project Features:	The site is not anticipated to have any outdoor trash storage areas, loading docks, outdoor storage areas, community car wash racks, equipment wash areas, or food preparation areas associated with food service establishments. Trash will be managed by each individual homeowner within garages.
Outdoor Activities:	Outdoor areas throughout the site will be used for recreational and open space purposes and will include landscaping and surface parking for guests and residents.
Materials Stored:	No outdoor storage of materials is anticipated (materials will be stored indoors). Materials anticipated to be stored on-site include those associated with residential developments (i.e. cleaning products, maintenance, etc.); however, no hazardous wastes will be stored on-site.
Wastes Generated:	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.

II.2 POTENTIAL STORM WATER POLLUTANTS

The table below, derived from Table 2 of the Countywide Model WQMP Technical Guidance Document (December 2013), summarizes the categories of land use or project features of concern and the general pollutant categories associated with them.

ANTICIPATED & POTENTIAL POLLUTANTS GENERATED BY LAND USE TYPE

Priority Project Categories and/or Project Features	General Pollutant Categories							
	Suspended Solid/ Sediments	Nutrients	Heavy Metals	Pathogens (Bacteria/ Virus)	Pesticides	Oil & Grease	Toxic Organic Compounds	Trash & Debris
Detached Residential Development	E	E	N	E	E	E	N	E
Attached Residential Development	E	E	N	E	E	E(2)	N	E
Commercial/Industrial Development	E(1)	E(1)	E(5)	E(3)	E(1)	E	E	E
Automotive Repair Shops	N	N	E	N	N	E	E	E
Restaurants	E(1)(2)	E(1)	E(2)	E	E(1)	E	N	E
Hillside Development >5,000 ft^2	E	E	N	E	E	E	N	E
Parking Lots	E	E(1)	E	E(4)	E(1)	E	E	E
Streets, Highways, & Freeways	E	E(1)	E	E(4)	E(1)	E	E	E
Retail Gasoline Outlets	N	N	E	N	N	E	E	E

Notes:
E = expected to be of concern N = not expected to be of concern
(1) Expected pollutant if landscaping exists on-site, otherwise not expected.
(2) Expected pollutant if the project includes uncovered parking areas, otherwise not expected.
(3) Expected pollutant if land use involves food or animal waste products, otherwise not expected.
(4) Bacterial indicators are routinely detected in pavement runoff.
(5) Expected if outdoor storage or metal roofs, otherwise not expected.
Source: County of Orange. (2013, December 20). Technical Guidance Document for the Preparation of Conceptual/ Preliminary and/or Project Water Quality Management Plans (WQMPs). Table 2.1.

Priority Project Categories and/or Features: Attached Residential Development

POLLUTANTS OF CONCERN		
Pollutant	E = Expected to be of concern N =Not Expected to be of concern	Additional Information and Comments
Suspended Solid/ Sediment	E	
Nutrients	E	
Heavy Metals	E	
Pathogens (Bacteria/Virus)	E	
Pesticides	E	
Oil & Grease	E	
Toxic Organic Compounds	E	
Trash & Debris	E	

II.3 HYDROLOGIC CONDITIONS OF CONCERN

The purpose of this section is to identify any hydrologic conditions of concern (HCOC) with respect to downstream flooding, erosion potential of natural channels downstream, impacts of increased flows on natural habitat, etc. As specified in Section 2.3.3 of the 2011 Model WQMP, projects must identify and mitigate any HCOCs. A HCOC is a combination of upland hydrologic conditions and stream biological and physical conditions that presents a condition of concern for physical and/or biological degradation of streams.

In the North Orange County permit area, HCOCs are considered to exist if any streams located downstream from the project are determined to be potentially susceptible to hydromodification impacts and either of the following conditions exists:

- Post-development runoff volume for the 2-yr, 24-hr storm exceeds the pre-development runoff volume for the 2-yr, 24-hr storm by more than 5 percent

or

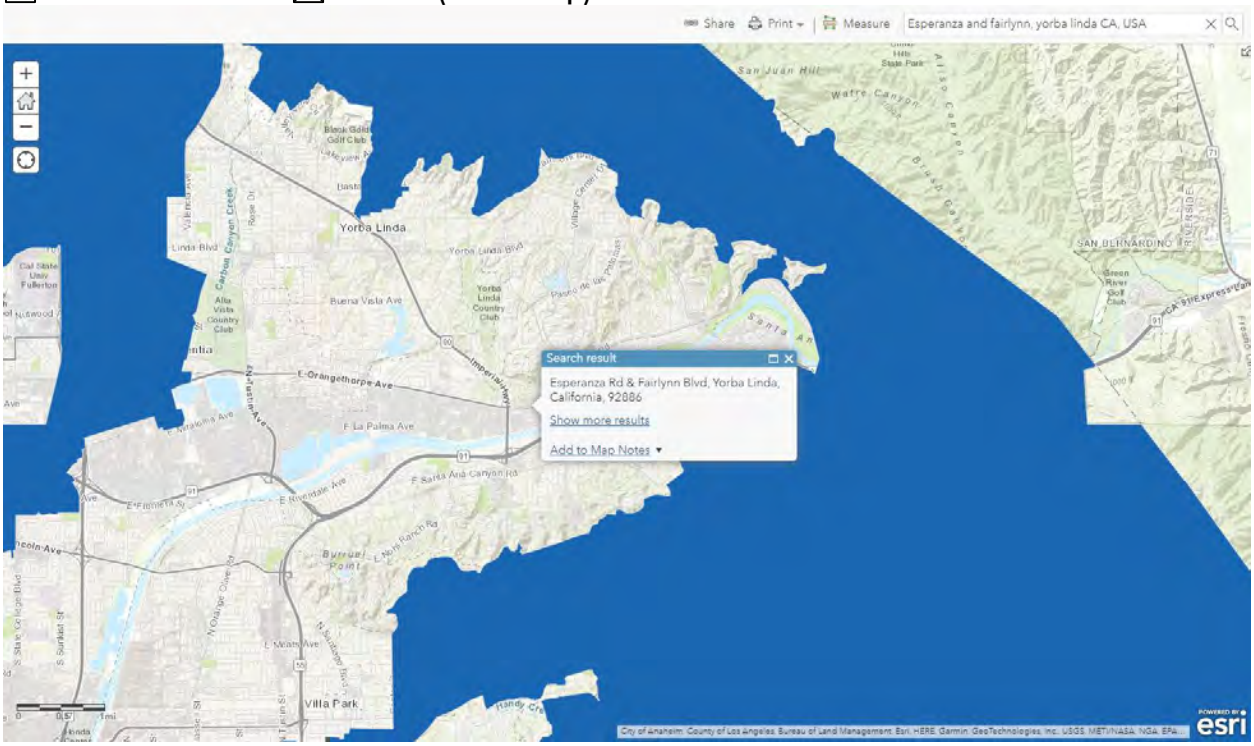
- Time of concentration (Tc) of post-development runoff for the 2-yr, 24-hr storm event exceeds the time of concentration of the pre-development condition for the 2-yr, 24-hr storm event by more than 5 percent.

If these conditions do not exist or streams are not potentially susceptible to hydromodification impacts, an HCOC does not exist and hydromodification does not need to be considered further. In the North Orange County permit area, downstream channels are considered not susceptible to hydromodification,

and therefore do not have the potential for a HCOC, if all downstream conveyance channels that will receive runoff from the project are engineered, hardened, and regularly maintained to ensure design flow capacity, and no sensitive habitat areas will be affected.

Is the proposed project potentially susceptible to hydromodification impacts?

☐ **Yes** ☒ **No (show map)**



According to Figure XVI-3c within the Technical Guidance Document, the proposed project falls within an area not susceptible to hydromodification impacts. All runoff from the site ultimately drains to the Santa Ana River, which is improved and maintained by the Orange County Flood Control District. A copy of Figure XVI-3a is included in Appendix A.

Although not required, 2-year peak flow calculations were analyzed to confirm if the project is subject to DVC controlled treatment or HCOC controlled treatment. Peak flow runoff for the 2-year event decreased from 5.05 cfs to 4.57 cfs for from existing to proposed conditions, a decrease of 0.48 cfs (9.5%). The time of concentration (Tc) increased from 5.9 min to 7.2 minutes from existing to proposed conditions, an increase of 1.3 (22%). Based on these parameters, 2-year volumes will be less than existing conditions. Therefore, DVC is the controlling design parameter.

II.4 POST DEVELOPMENT DRAINAGE CHARACTERISTICS

The private storm drain systems proposed for this project will have four (4) collection points with catch basins. The first one is located at the southeasterly curb entry at Fairlynn Boulevard designated as CB #1, the second one is at the northwesterly curb of the drive aisle designated as CB#2, the third one is 110 ft from the entry at Esperanza Road designated as CB #3 and the last one is at the entry at Esperanza Road designated as CB #4. All these catch basins are connected via an 18" RCP pipe that

runs north to south of the drive aisle and terminates to a junction structure connected to the existing 112" WSP at Esperanza Road. All runoff ultimately discharges into Reach 2 of the Santa Ana River.

II.5 PROPERTY OWNERSHIP/MANAGEMENT

PROPERTY OWNERSHIP/MANAGEMENT	
Private Streets:	ROI Esperanza LLC / HOA
Landscaped Areas:	ROI Esperanza LLC / HOA
Easements:	ROI Esperanza LLC / HOA
Buildings:	ROI Esperanza LLC / HOA
Structural BMPs:	ROI Esperanza LLC / HOA

A Home Owners Association (HOA) will be formed upon project completion. The HOA will be responsible for inspecting and maintaining all BMPs prescribed for Esperanza Village. Until a HOA is formally established, ROI Esperanza LLC shall assume all BMP maintenance and inspection responsibilities for the proposed project. Inspection and maintenance responsibilities are outlined in Section V of this report.

SECTION III SITE DESCRIPTION

III.1 PHYSICAL SETTING

Planning Area/ Community Name:	Esperanza Village
Address:	6821 Fairlynn Blvd., Yorba Linda, CA 92886
Project Area Description:	Northwest corner of Esperanza Avenue and Fairlynn Boulevard in the City of Yorba Linda
Land Use:	1B
Zoning:	R2 (proposed)
Acreage:	2.58
Predominant Soil Type:	D
Impervious Conditions:	Existing Impervious: 78% (22% Pervious) Proposed Impervious: 80% (20% Pervious)

III.2 SITE CHARACTERISTICS

Precipitation Zone:	0.9 inches
Topography:	The project site at its current condition is a commercial center comprising of 3 single story buildings with a parking lot surrounding it and a gas station. The gas station is not-a -part of the development and will remain.
Existing Drainage Patterns/ Connections:	Under existing conditions, runoff from the existing site generally sheet flows to ribbon gutters that flow south and outlet to the surface of Esperanza Road. Runoff is then intercepted by an existing catch basin on the north side of the curb at Esperanza Road approximately 250 ft westerly from the intersection of Fairlynn Boulevard and Esperanza Road. The existing storm drain pipe running along Esperanza Road is a 112" WSP and a 54" RCP pipe which continues north to Fairlynn Boulevard. The storm drain lateral from the catch basin, assuming it to be 18" RCP, from the catch basin connects southerly to the existing 54" RCP.

Proposed Drainage Patterns/ Connections:	The private storm drain systems proposed for this project will have four (4) collection points with catch basins. The first one is located at the southeasterly curb entry at Fairlynn Boulevard designated as CB #1, the second one is at the northwesterly curb of the drive aisle designated as CB#2, the third one is 110 ft from the entry at Esperanza Road designated as CB #3 and the last one is at the entry at Esperanza Road designated as CB #4. All these catch basins are connected via an 18" RCP pipe that runs north to south of the drive aisle and terminates to a junction structure connected to the existing 112" WSP at Esperanza Road.
Soil Type, Geology, and Infiltration Properties:	The site's predominate soil type is HSC D, as illustrated in the TGD Figure XVI.2a (see Appendix A). Group D soils are clay loam, silty clay loam, sandy clay, silty clay or clay. This HSG has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential. A geotechnical study is currently being conducted on the project site, and results will be included with this PWQMP upon completion as part of future submittals. Results of preliminary infiltration testing showed a measured infiltration rate of 0.1 in/hr.
Hydrogeologic (Groundwater) Conditions:	The project site is located in an area with high groundwater levels, approximately 5 to between 5 and 10 feet bgs as illustrated in the TGD Figure XVI-2e (see Appendix F). Additional details on groundwater depths will be provided in future submittals of this WQMP upon completion of the geotechnical study for the project site.
Geotechnical Conditions (relevant to infiltration):	Due to the presence of Type D soils and low infiltration rates (<0.3 in/hr), direct infiltration of runoff with large-scale infiltration BMPs onsite is considered infeasible. Infiltration of runoff from within landscaped rain gardens onsite will occur at natural rates.
Off-Site Drainage:	Under existing conditions, the project site receives offsite runon from approximately 0.37 acres from the existing condominium complex northwest of the project site. Under proposed conditions, this runoff will be diverted to a separate catch basin and drain to the proposed storm drain mainline on the project site. All project site runoff will be treated prior to discharging into this mainline to avoid co-mingling with the offsite runon.
Utility and Infrastructure Information:	There are several existing utility easements on the site, and are identified and described further in the attached Vesting Tentative Tract Map 19161 (see Section VI).

III.3 WATERSHED DESCRIPTION

Receiving Waters:	Santa Ana River, Reach 2
303(d) Listed Impairments:	None.

Applicable TMDLs:	None.
Pollutants of Concern for the Project:	Suspended Solid/ Sediment, Nutrients, Heavy Metals, Pathogens (Bacteria/Virus), Pesticides, Oil & Grease, Toxic Organic Compounds, Trash & Debris
Hydrologic Conditions of Concern (HCOCs):	Not applicable.
Environmentally Sensitive and Special Biological Significant Areas:	None.

SECTION IV BEST MANAGEMENT PRACTICES (BMPs)

IV.1 PROJECT PERFORMANCE CRITERIA

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

PROJECT PERFORMANCE CRITERIA	
Hydromodification Control Performance Criteria: **(Model WQMP Section 7.II-2.4.2.2)**	If a hydrologic condition of concern (HCOC) exists, priority projects shall implement onsite or regional hydromodification controls such that: ▪ Post-development runoff volume for the two-year frequency storm does not exceed that of the predevelopment condition by more than five percent, and ▪ Time of concentration of post-development runoff for the two-year storm event is not less than that for the predevelopment condition by more than five percent. Where the Project WQMP documents that excess runoff volume from the two-year runoff event cannot feasibly be retained and where in-stream controls cannot be used to otherwise mitigate HCOCs, the project shall implement on-site or regional hydromodification controls to: ▪ Retain the excess volume from the two-year runoff event to the MEP, and ▪ Implement on-site or regional hydromodification controls such that the post-development runoff two-year peak flow rate is no greater than 110 percent of the predevelopment runoff two-year peak flow rate.
LID Performance Criteria: **(Model WQMP Section 7.II-2.4.3)**	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.
Treatment Control BMP Performance Criteria: **(Model WQMP Section 7.II-3.2.2)**	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.

PROJECT PERFORMANCE CRITERIA	
LID Design Storm Capture Volume:	DCV = C × d × A × 43560 sf/ac × 1/12 in/ft Where: DCV = design storm capture volume, cu-ft C = runoff coefficient = (0.75 × imp + 0.15) Imp = impervious fraction of drainage area (ranges from 0 to 1) d = storm depth (inches) A = tributary area (acres) Imp = 80% d = 0.9 inches A = 2.58 acres *DCV* = *(0.75 x* 0.8 *+0.15) x* 0.9 *inches x* 2.58 *ac x 43560 sf/ac x 1/12 in/ft* = 6,321.6 ft^3 *Refer to Section IV.2.2 for specific Drainage Manage Area (DMA) breakdown and Appendix A for detailed calculations (Worksheet B).*

IV.2 SITE DESIGN AND DRAINAGE PLAN

The following section describes the site design BMPs used in this project and the methods used to incorporate them. Careful consideration of site design is a critical first step in storm water pollution prevention from new developments and redevelopments.

IV.2.1 Site Design BMPs

Minimize Impervious Area

Impervious surfaces have been minimized by incorporating landscaped areas throughout the site surrounding the proposed buildings, adjacent to sidewalks, and around the site perimeter.

Maximize Natural Infiltration Capacity

The natural soils on the project site are Type D soils so there is little natural infiltration capacity on the project site. Infiltration was determined to be infeasible for water quality treatment due to the low infiltration rates of those onsite soils, but site design, hydrologic source control (HSC) and rain garden bioretention features will be implemented on the project site to the maximum extent feasible to provide runoff reduction and disconnect impervious areas. Refer to Section IV.3.2 for details.

Preserve Existing Drainage Patterns and Time of Concentration

There are no existing jurisdictional habitat or sensitive areas to preserve on the project site. All disturbed areas will either be paved or landscaped.

Disconnect Impervious Areas

Landscaping will be provided adjacent to sidewalks and around perimeters of the proposed buildings. Rain gardens will also be located throughout the the site to further disconnect impervious areas and allow for infiltration of runoff at natural rates. Low-flows and first-flush runoff will drain to bioretention units for water quality treatment via bio-filtration.

Protect Existing Vegetation and Sensitive Areas, and Revegetate Disturbed Areas

There are no existing vegetated or sensitive areas to preserve on the project site. All disturbed areas will either be paved or landscaped.

Xeriscape Landscaping

Xeriscape landscaping is not proposed for the project. However, native and/or tolerant landscaping will be incorporated into the site design consistent with City guidelines.

IV.2.2 Drainage Management Areas

In accordance with the MS4 permit and the 2011 Model WQMP, the project site has been divided into Drainage Management Areas (DMAs) to be utilized for defining drainage areas and sizing LID and other treatment control BMPs. DMAs have been delineated based on the proposed site grading patterns, drainage patterns, storm drain and catch basin locations.

The design capture volumes (DCV) and treatment flow rates (Q_{Design}) for each DMA are summarized in the table below. These have been derived utilizing the "Simple Method" in accordance with the TGD Section III.1.1. Actual BMP sizing requirements, including 80 percent capture design volumes, flow rates, depths, and other design details for the specific BMPs proposed are provided in Sections IV.3.1 and IV.3.4 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 Appendix A.

DRAINAGE MANAGEMENT AREAS (DMAs)								
DMA/ Drainage Area ID[1]	Tributary Drainage Area (ft^2)	Tributary Drainage Area (ac)	% Imp.	Design Storm Depth[2] (in)	Estimated Tc (min)	Rainfall Intensity[3] (in/hr)	Simple Method DCV[4] (ft^3)	Q_{Design} [5] (cfs)
A1	22,426.2	0.515	80%	0.9	5	0.26	1,261.9	0.100
A2	25,634.4	0.588	80%	0.9	5	0.26	1,440.7	0.115
A3	8,171.1	0.188	80%	0.9	5	0.26	460.6	0.037
A4	6,160.2	0.141	80%	0.9	5	0.26	345.5	0.027
A5	26,152.8	0.600	80%	0.9	5	0.26	1,470.2	0.117
A6	23,508.7	0.540	80%	0.9	5	0.26	1,323.1	0.105
A7	15,991.1	0.37	Not Applicable – Offsite Runon (does not co-mingle with untreated onsite flows)					
B1	1,229.0	0.028	Not Applicable – 100% Landscaping (self-treating area)					

Notes:
1. Refer to exhibits in Section VI for locations of each DMA.
2. Per Figure XVI-1 of the Technical Guidance Document, dated December 20, 2013. See also Appendix A.
3. Per Figure III.4 of the Technical Guidance Document, dated December 20, 2013. See also Appendix A.
4. Per Section III.1.1 of the Technical Guidance Document.
5. Per Section III.3.3 and Worksheet D of the Technical Guidance Document.

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 R8-2009-0030) requires the evaluation and use of LID features using the following hierarchy of treatment: infiltration, evapotranspiration, harvest/reuse, and biotreatment. The following sections summarize the LID BMPs proposed for the project in accordance with the permit hierarchy and performance criteria outlined in Section IV.1.

IV.3.1 Hydrologic Source Controls (HSCs)

Hydrologic source controls (HSCs) can be considered to be a hybrid between site design practices and LID BMPs. HSCs are distinguished from site design BMPs in that they do not reduce the tributary area or reduce the imperviousness of a drainage area; rather they reduce the runoff volume that would result from a drainage area with a given imperviousness compared to what would result if HSCs were not used. HSC's will be identified during final design in collaboration with the landscape plans.

HYDROLOGIC SOURCE CONTROLS		
ID	**Name**	**Included?**
HSC-1	Localized on-lot infiltration	☐
HSC-2	Impervious area dispersion (e.g. roof top disconnection)	☐
HSC-3	Street trees (canopy interception)	☐
HSC-4	Residential rain barrels (not actively managed)	☐
HSC-5	Green roofs/Brown roofs	☐
HSC-6	Blue roofs	☐
HSC-7	Impervious area reduction (e.g. permeable pavers, site design)	☐

IV.3.2 Infiltration BMPs

Infiltration BMPs are LID BMPs that capture, store and infiltrate storm water runoff. These BMPs are engineered to store a specified volume of water and have no design surface discharge (underdrain or outlet structure) until this volume is exceeded. Examples of infiltration BMPs include infiltration trenches, bioretention without underdrains, drywells, permeable pavement, and underground infiltration galleries.

INFILTRATION		
ID	**Name**	**Included?**
INF-3 INF-4	Bioretention Without Underdrains	☐
	Rain Gardens	☐
	Porous Landscaping	☐
	Infiltration Planters	☐
	Retention Swales	☐
INF-2	Infiltration Trenches	☐
INF-1	Infiltration Basins	☐
INF-5	Drywells	☐
INF-7	Subsurface Infiltration Galleries	☐
--	French Drains	☐
INF-6	Permeable Asphalt	☐
	Permeable Concrete	☐
	Permeable Concrete Pavers	☐
	Other:	☐

Based on the regional D soil-type and low measured infiltration rates (<0.3 in/hr), large-scale focused infiltration BMPs are not considered feasible for the project.

IV.3.3 Evapotranspiration & Rainwater Harvesting BMPs

Evapotranspiration (ET) BMPs are a class of retention BMPs that discharges stored volume predominately to ET, though some infiltration may occur. ET includes both evaporation and transpiration, and ET BMPs may incorporate one or more of these processes. BMPs must be designed to achieve the maximum feasible ET, where required to demonstrate that the maximum amount of water has been retained on-site. Since ET is not the sole process in these BMPs, specific design and sizing criteria have not been developed for ET-based BMPs.

EVAPOTRANSPIRATION		
ID	**Name**	**Included?**
--	HSCs, *see Section IV.3.1*	☐

EVAPOTRANSPIRATION		
ID	**Name**	**Included?**
--	Surface-based infiltration BMPs	☐
--	Biotreatment BMPs, see *Section VI.3.4*	☐
	Other:	☐

Harvest and use (aka. Rainwater Harvesting) BMPs are LID BMPs that capture and store storm water runoff for later use. These BMPs are engineered to store a specified volume of water and have no design surface discharge until this volume is exceeded. Harvest and use BMPs include both above-ground and below-ground cisterns. Examples of uses for harvested water include irrigation, toilet and urinal flushing, vehicle washing, evaporative cooling, industrial processes and other non-potable uses.

HARVEST & REUSE / RAINWATER HARVESTING		
ID	**Name**	**Included?**
HU-1	Above-ground cisterns and basins	☐
HU-2	Underground detention	☐
--	Other:	☐

In order to quantify harvested water demand for the common areas of the project, the Modified Estimated Applied Water Use (EAWU) method was used, consistent with Appendix X of the Model WQMP's Technical Guidance Document (TGD), dated December 20, 2013.

The Modified EAWU method is modified from the OC Irrigation Code (County Ordinance No. 09-010) to account for the wet season demand and storm events (assuming that no irrigation would be applied for approximately 30% of the days in the wet season).

The equation used to calculate the Modified EAWU is:

$$Modified\ EAWU = \frac{(ETo_{wet} \times K_L \times LA \times 0.015)}{IE}$$

Where:

$Modified\ EAWU$ = estimated daily average water use during wet season
ETo_{wet} = average reference ET from November through April (inches per month) per Table X.2 of the TGD
K_L = landscape coefficient (Table X.4 of the TGD)
LA = landscape area irrigated with harvested water (square feet)
IE = irrigation efficiency (assumed at 90%)

Note: In the equation, the coefficient (0.015) accounts for unit conversions and shut down of irrigation during and for three days following a significant precipitation event.

For a system to be considered "feasible", the system must be designed with a storage volume equal to the DCV from the tributary area and achieve more than 40% capture. The system must also be able to drawdown in 30 days to meet the 40% capture value. In addition, Table X.6 of the Technical Guidance Document sets forth the demand thresholds for minimum partial capture.

TABLE X.6: HARVESTED WATER DEMAND THRESHOLDS FOR MINIMUM PARTIAL CAPTURE	
Design Capture Storm Depth, inches	Wet Season Demand Required for Minimum Partial Capture, gpd per impervious acre
0.60	490
0.65	530
0.70	570
0.75	610
0.80	650
0.85	690
0.90	730
0.95	770
1.00	810

The following table summarizes the estimated applied water use for the common area landscaping of the project.

ESTIMATED APPLIED WATER USE (EAWU) FOR COMMON AREA LANDSCAPING									
Landscape Type	Total Area (ac)	% Impervious	Impervious Tributary (ac)	Irrigated LS Area (ac)	ETo_{wet} [1] (in/mo)	K_L [2]	Modified EAWU (gpd)	Modified EAWU per impervious acre (gpd/ac)	Minimum Capture Threshold [3] (gpd/ac)
Mixed	2.58	80%	2.06	0.52	2.93	0.55	603.69	292.49	730
Design Capture Volume (gal)				47,286	Drawdown (days)				78.3

Notes:

1 Per Table X.2 for Santa Ana Region (similar climate type), Model WQMP Technical Guidance Document, dated December 20, 2013.
2 Per Table X.4 of the Model WQMP Technical Guidance Document, dated December 20, 2013.
3 Per Table X.6 of Model WQMP Technical Guidance Document, dated December 20, 2013.

As shown above, the project site does not have sufficient water demand during the wet season to support harvest and reuse. The project does not meet the minimum capture threshold of 730 gallons per day/acre with its Modified EAWU or estimated daily average water usage during the wet season. Therefore the DCV will not be fully utilized and emptied for the next storm event. Drawdown of the DCV is anticipated to take approximately 78 days by the landscape's water demand usage, which is greater than the maximum drawdown time of 30 days.

IV.3.4 Biotreatment BMPs

Biotreatment BMPs are a broad class of LID BMPs that reduce storm water volume to the maximum extent practicable, treat storm water using a suite of treatment mechanisms characteristic of biologically active systems, and discharge water to the downstream storm drain system or directly to receiving waters. Treatment mechanisms include media filtration (though biologically-active media), vegetative filtration (straining, sedimentation, interception, and stabilization of particles resulting from shallow flow through vegetation), general sorption processes (i.e., absorption, adsorption, ion-exchange, precipitation, surface complexation), biologically-mediated transformations, and other processes to address both suspended and dissolved constituents. Examples of biotreatment BMPs include bioretention with underdrains, vegetated swales, constructed wetlands, and proprietary biotreatment systems.

BIOTREATMENT		
ID	**Name**	**Included?**
BIO-1	Bioretention with underdrains	☐
	Storm Water planter boxes with underdrains	☐
	Rain gardens with underdrains	☒
BIO-5	Constructed wetlands	☐
BIO-2	Vegetated swales	☐
BIO-3	Vegetated filter strips	☐
BIO-7	Proprietary vegetated biotreatment systems	☒
BIO-4	Wet extended detention basin	☐
BIO-6	Dry extended detention basins	☐
--	Other:	☐

In order to meet the Recommended Minimum Criteria for Site Design for Redevelopment Projects (Table XI.1, TGD 2013), three (3) percent of the site must be made available for LID BMPs (recommended effective area). Approximately 3,400 square feet of bioretention rain gardens are proposed on the project site and allow low-flow infiltration of runoff at natural rates. The process to achieve three percent involved multiple iterations to the Site Plan and included adjustments to trees, utilities and removal of site amenities. Client These features also provide biofiltration of runoff within the media layer above the gravel. The bioretention rain gardens will be utilized on site in order to provide retention of runoff

to the extent feasible based on grading and drainage constraints. Runoff from sidewalk and hardscape areas around the perimeter of the buildings will drain to landscape areas where feasible. In addition, where feasible, runoff from portions of the roofs will drain to adjacent planter areas. However, due to the preliminary nature of the project's current design phase, locations of roof drains and area drains are not designed at this entitlement stage, and individual tributary areas to the rain gardens cannot be established at this time. The rain gardens will be designed to pond between 12" to 18" dependent upon the localized constraints. The amount of runoff treated by the rain gardens will be accounted for during final design. The volume captured and infiltrated/biotreated by the rain gardens, is expected to be between 3,400 and 5,100 cubic feet, will be subtracted from the required treatment volume/flow rates in the Final WQMP.

Since large-scale, focused infiltration has been deemed infeasible due to the presence of clayey, Type D soils and geotechnical concerns, and harvest and reuse is considered infeasible due to insufficient demand, biotreatment BMPs will be utilized on-site for water quality treatment of the remainder of the site DCV. Several biotreatment BMPs were evaluated for use on the project site, including vegetated swales, filter strips, and proprietary bioretention facilities. Vegetated swales and filter strips were not selected due to insufficient space and length requirements. In addition, these BMPs do not treat the Project's pollutant of concern to a medium-to-high effectiveness per Table 4.2 of the TGD (see below). Other large-scale biotreatment BMPs such as extended detention basins were not considered due to their large land area requirements and low overall treatment effectiveness for the pollutants of concern.

For the purposes of this Conceptual WQMP, Modular Wetland Systems, a proprietary bioretention system, were selected to treat the remainder of the DVC for the project site based on their ability to treat the project's pollutants of concerns to a medium or high effectiveness and the sites grading and drainage constraints. The table below, derived from Table 4.2 of the TGD and testing data provided by the manufacturer, compares the overall treatment effectiveness of Modular Wetland Systems with other types of biotreatment BMPs.

POLLUTANTS OF CONCERN AND PERFORMANCE RATINGS					
Pollutant of Concern[1]	Treatment Effectiveness				
	Vegetated Swales[2]	Vegetated Filter Strips[2]	Dry Extended Detention Basins[2]	Bioretention System[2]	Modular Wetlands Proprietary Bioretention Units[3]
Suspended Solid/ Sediment	Medium	Medium	Medium	High	High
Nutrients	Low	Low	Low	Low	Medium-High
Pathogens (Bacteria/Virus)	Low	Low	Low	Medium	Medium-High
Pesticides	N/A	N/A	N/A	N/A	N/A
Oil & Grease	Medium	Medium	Medium	High	High
Trash & Debris	Medium	Low	High	High	High

POLLUTANTS OF CONCERN AND PERFORMANCE RATINGS					
Pollutant of Concern[1]	Treatment Effectiveness				
	Vegetated Swales[2]	Vegetated Filter Strips[2]	Dry Extended Detention Basins[2]	Bioretention System[2]	Modular Wetlands Proprietary Bioretention Units[3]

Notes:

1 See Section II.2 of this WQMP.
2 Per Table 4.2 of the Model WQMP's companion Technical Guidance Document dated December 20, 2013.
3 Based on Washington State University Technology Assessment Protocol – Ecology (TAPE) third-party independent field tests for a high-flow biotreatment system with raised under drain (Modular Wetland System-Linear). Refer to manufacturer documentation (attached) for specific removal efficiencies and source references.

In addition, there are several advantages of the Modular Wetland System over traditional bioretention planters including the following reasons:

- Modular Wetlands are the only proprietary biotreatment device approved through the Washington State University TAPE (Technology Assessment Protocol – Ecology) program for basic storm water treatment and enhanced treatment including sediment, nutrients and heavy metals (all proposed pollutants of concern for the project and for downstream watersheds). TAPE approval is based on a series of independent field studies using strict sampling criteria to validate vendor's claims. TAPE approval is considered one of the most stringent and most reliable in the Country.
- Modular Wetlands have a pre-treatment chamber that is specifically designed to capture fine sediments and particulates through a series of BioMediaGREEN sponges which prohibit the fines and particulates from entering the bioretention chamber and accelerating potential clogging of the bioretention soil.
- Modular Wetland systems are specifically designed for higher flow through treatment rates as compared to traditional bioretention cells which reduces the potential for nutrient and copper leaching under more stagnant conditions (a common occurrence with planters that are left unmaintained).

Modular Wetlands by Bio Clean, a Forterra Company, are proprietary biotreatment systems that utilize multi-stage treatment processes including screening media filtration, settling, and biofiltration. The pre-treatment chamber contains the first three stages of treatment, and includes a catch basin inlet filter to capture trash, debris, gross solids and sediments, a settling chamber for separating out larger solids, and a media filter cartridge for capturing fine TSS, metals, nutrients, and bacteria. Runoff then flows through the wetland chamber where treatment is achieved through a variety of physical, chemical, and biological processes. As storm water passes down through the planting soil, pollutants are filtered, adsorbed, biodegraded and sequestered by the soil and plants, functioning similar to bioretention systems. The discharge chamber at the end of the unit collects treated flows and discharges back into the storm drain system.

Three Modular Wetland units are proposed, located along the proposed drive aisles adjacent to the proposed catch basins. Since the exact treatment capabilities of the rain gardens throughout the site are not yet known, the MWS units were conservatively sized to treat runoff from the entire drainage areas.

In accordance with the Model WQMP and TGD, the bioretention/biotreatment BMPs will be sized to treat runoff from the Design Capture Storm (85th percentile, 24-hour). As Modular Wetlands are sized based on flow rate, they were sized utilizing the methodology for flow based BMPs (TGD Section III.1.2 and Worksheet D) and per the cut sheets provided by the manufacturer. Locations and tributary drainage areas are shown on the WQMP Exhibit included in Section VI. BMP details are also included in Section VI. Detailed calculations and associated TGD Worksheets are included in Appendix A. Operation and maintenance details are included in Section V and Appendix D (O&M Plan).

MODULAR WETLAND SYSTEM DESIGN SUMMARY							
DMA ID(1,2,6)	Area (ac)	% Imp.(3)	Tc (min)(3)	Rainfall Intensity (in/hr)	Q_{Design}(3) (cfs)	Size / Model(4,5)	Combined Treatment Capacity (5) (cfs)
A1+A2	1.10	80%	5	0.26	0.215	MWS-L-8-8-V	0.231
A3+A4+A5	0.93	80%	5	0.26	0.181	MWS-L-4-17-V	0.206
A6	0.54	80%	5	0.26	0.105	MWS-L-4-8-V	0.115

Notes:
(1) See also Section IV.2.2.
(2) Refer to WQMP Exhibit in Section VI for locations of each drainage area and BMP.
(3) Detailed calculations and worksheets are included in Appendix A. Pending final design.
(4) Unit details and specifications are included in Section VI. Additional details will be provided in the Final WQMP.
(5) Treatment capacities of each unit are based on wetland media design loading rate (controlled by downstream orifice) and perimeter surface area of wetland media provided. Individual unit sizing calculations provided by the manufacturer are included on each cut sheet/detail included in Section VI. Additional details including inverts and pipe sizes will be provided in the Final WQMP.
(6) DMA boundaries subject to change in final WQMP depending on DMAs tributary to rain gardens and their final volumes retained.

IV.3.5 Hydromodification Control BMPs

Not applicable.

IV.3.6 Regional/Sub-Regional LID BMPs

Not applicable.

IV.3.7 Treatment Control BMPs

Treatment control BMPs can only be considered if the project conformance analysis indicates that it is not feasible to retain the full design capture volume with LID BMPs.

TREATMENT CONTROL BMPs		
ID	Name	Included?
TRT-1	Sand Filters	☐
TRT-2	Cartridge Media Filter	☐

TREATMENT CONTROL BMPs		
ID	Name	Included?
PRE-1	Hydrodynamic Separation Device	☐
PRE-2	Catch Basin Insert	☐
	Other:	☐

Not applicable.

IV.3.8 Non-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.

NON-STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Included?	Not Applicable?	If Not Applicable, Provide Brief Reason
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)	☐	☒	Not applicable.
N6	Local Water Quality Permit Compliance	☐	☒	The County of Orange Linda does not issue water quality permits.
N7	Spill Contingency Plan	☐	☒	Not applicable.
N8	Underground Storage Tank Compliance	☐	☒	Not applicable.
N9	Hazardous Materials Disclosure Compliance	☐	☒	Not applicable.
N10	Uniform Fire Code Implementation	☐	☒	Not applicable.
N11	Common Area Litter Control	☐	☒	Not applicable.
N12	Employee Training	☐	☒	Not applicable.

NON-STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Included?	Not Applicable?	If Not Applicable, Provide Brief Reason
N13	Housekeeping of Loading Docks	☐	☒	Not applicable.
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	Not applicable.

N1, Education for Property Owners, Tenants and Occupants

Educational materials will be provided to tenants, including brochures and restrictions to reduce pollutants from reaching the storm drain system. Examples include tips for pet care, household tips, and proper household hazardous waste disposal. Tenants will be provided with these materials by the property management prior to occupancy, and periodically thereafter. Refer to Section VII for a list of materials available and attached to this WQMP. Additional materials are available through the County of Orange Stormwater Program website (http://ocwatersheds.com/PublicEd/) and the California Stormwater Quality Association's (CASQA) BMP Handbooks (http://www.cabmphandbooks.com/).

N2, Activity Restrictions

The Owner/HOA shall develop ongoing activity restrictions that include those that have the potential to create adverse impacts on water quality. Activities include, but are not limited to: handling and disposal of contaminants, fertilizer and pesticide application restrictions, litter control and pick-up, and vehicle or equipment repair and maintenance in non-designated areas, as well as any other activities that may potentially contribute to water pollution.

N3, Common Area Landscape Management

Management programs will be designed and implemented by the Owner/HOA to maintain all the common areas within the project site. These programs will cover how to reduce the potential pollutant sources of fertilizer and pesticide uses, utilization of water-efficient landscaping practices and proper disposal of landscape wastes by the owner/developer and/or contractors.

N4, BMP Maintenance

The Owner/HOA 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 staff, landscape contractor, and/or any other necessary maintenance contractors. Details on BMP maintenance are provided in Section V of this WQMP, and the O&M Plan is included in Appendix D.

N11, Common Area Litter Control

The Owner/HOA will be responsible for performing trash pickup and sweeping of littered common areas on a weekly basis or whenever necessary. Responsibilities will also include noting improper disposal materials by the public and reporting such violations for investigation.

N12, Employee Training

All employees of the Owner/HOA and any contractors will require training to ensure that employees are aware of maintenance activities that may result in pollutants reaching the storm drain. Training will include, but not be limited to, spill cleanup procedures, proper waste disposal, housekeeping practices, etc.

N14, Common Area Catch Basin Inspection

All on-site catch basin inlets and drainage facilities shall be inspected and maintained by the Owner/HOA at least once a year, prior to the rainy season, no later than October 1st of each year.

N15, Street Sweeping Private Streets and Parking Lots

The Owner/HOA shall be responsible for sweeping all on-site drive aisles and parking areas within the project on a quarterly basis.

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				
ID	Name	Included?	Not Applicable?	If Not Applicable, Provide Brief Reason
S1 SD-13	Provide storm drain system stenciling and signage	☒	☐	
S2 SD-34	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	Not applicable.
S3 SD-32	Design and construct trash and waste storage areas to reduce pollution introduction	☐	☒	Not applicable. Trash will be managed by individual homeowners.
S4 SD-12	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☒	☐	
S6 SD-31	Properly Design: Dock areas	☐	☒	Not applicable.

STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Included?	Not Applicable?	If Not Applicable, Provide Brief Reason
S7 SD-31	Properly Design: Maintenance bays	☐	☒	Not applicable.
S8 SD-33	Properly Design: Vehicle wash areas	☐	☒	Not applicable.
S9 SD-36	Properly Design: Outdoor processing areas	☐	☒	Not applicable.
S10	Properly Design: Equipment wash areas	☐	☒	Not applicable.
S11 SD-30	Properly Design: Fueling areas	☐	☒	Not applicable.
S12 SD-10	Properly Design: Hillside landscaping	☐	☒	Not applicable.
S13	Properly Design: Wash water control for food preparation areas	☐	☒	Not applicable.
S14	Properly Design: Community car wash racks	☐	☒	Not applicable.

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

The phrase "NO DUMPING! DRAINS TO OCEAN", or an equally effective phrase approved by the City, will be stenciled on all major storm drain inlets within the project site to alert the public to the destination of pollutants discharged into storm water. Stencils shall be in place prior to release of certificate of occupancy. Stencils shall be inspected for legibility on an annual basis and re-stenciled as necessary.

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

The Owner/HOA will be responsible for the installation and maintenance of all common landscape areas utilizing similar planting materials with similar water requirements to reduce excess irrigation runoff. The Owner/HOA will be responsible for implementing all efficient irrigation systems for common area landscaping including, but not limited to, provisions for water sensors and programmable irrigation cycles. This includes smart timers, rain sensors, and moisture shut-off valves. The irrigation systems shall be in conformance with water efficiency guidelines. Systems shall be tested twice per year, and water used during testing/flushing shall not be discharged to the storm drain system.

S5, Protect slopes and channels and provide energy dissipation

The site drainage design shall include appropriate BMPs to decrease the potential for erosion of slopes and/or channels. The design shall be consistent with Federal, State, and local standards (e.g., RWQCB, ACOE, CDFG). Where feasible, the following principles shall be considered: 1) convey runoff safely from the tops of slopes, 2) avoid disturbing steep or unstable slopes, as well as natural channels, 3)

implement a permanent stabilization BMP on disturbed slopes and channels as quickly as possible, such as native vegetation, and 4) install energy dissipaters at the outlets of new storm drains, culverts, or channels.

IV.4 ALTERNATIVE COMPLIANCE PLAN

IV.4.1 Water Quality Credits

Not applicable.

IV.4.2 Alternative Compliance Plan Information

Not applicable.

SECTION V INSPECTION/MAINTENANCE RESPONSIBILITY FOR BMPs

It has been determined that the Owner, ROI Esperanza LLC shall assume all BMP inspection and maintenance responsibilities for the Esperanza Village project, until an HOA is formally established.

Contact Name:	Pending – to be provided in the Final WQMP
Company:	ROI Esperanza LLC
Address:	4199 Campus Drive Suite 200, Irvine, CA 92612
Phone:	714.342.2502
Email:	

Should the maintenance responsibility be transferred at any time during the operational life of Esperanza Village, such as when an HOA or POA is formed for a project, a formal notice of transfer shall be submitted to the County of Orange at the time responsibility of the property subject to this WQMP is transferred. The transfer of responsibility shall be incorporated into this WQMP as an amendment.

The Owner/HOA 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 Appendix D.

The County of Orange may conduct verifications to assure that implementation and appropriate maintenance of structural and non-structural BMPs prescribed within this WQMP is taking place at the project site. The Owner/HOA shall retain operations, inspections and maintenance records of these BMPs and they will be made available to the City or County 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 BMP maintenance shall be funded through fees paid into the HOA. ROI Esperanza LLC, which will set up the HOA shall oversee that adequate funding for BMP maintenance is included within the HOA fee structure including annual maintenance fees and long-term maintenance reserve funds.

The Operations and Maintenance (O&M) Plan can be found in Appendix D.

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
LOW IMPACT DEVELOPMENT (LID) BMPs				
BIO-1	Rain Gardens With Underdrains	▪ Maintain vegetation and media to perpetuate a robust vegetative and microbial community (thin/trim vegetation, replace spent media and mulch). ▪ Periodically remove dead vegetative biomass to prevent export of nutrients or clogging of the system. ▪ Remove accumulated sediment before it significantly interferes with system function. ▪ Conduct maintenance to prevent surface clogging (surface scarring, raking, mulch replacement, etc.). ▪ Maintain splash blocks/energy dissipation and scour-protection as required based on facility inspection. ▪ Routinely remove accumulated sediment at the inlet and outlet and trash and debris from the area. ▪ Repair torn or broken liners as necessary. ▪ Trim plants within the wetland chamber as needed in conjunction with routine landscape maintenance activities (typically 2x per year). No fertilizer shall be used. Major maintenance shall be provided when the performance of the facility declines significantly and cannot be restored through routine maintenance. Any standing water removed during the maintenance operation must be disposed to a sanitary sewer at an approved discharge location. Trimmings, clippings,	2x per year	Owner/HOA

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
		and other landscape wastes shall be properly disposed of in accordance with local regulations.		
BIO-7	Proprietary Biotreatment: Modular Wetland Systems (MWS) #1, #2 & #3	The Modular Wetland units shall be maintained in accordance with manufacturer's specifications. The system shall be inspected at a minimum of once every six months, prior to the start of the rainy season (October 1) each year, and after major storm events. Typical maintenance includes: ▪ Removing trash & debris from the catch basin screening filter (by hand, 2x per year at a minimum). ▪ Removal of sediment and solids in the settlement chamber (vacuum truck, once per year at a minimum). ▪ Replacement of the BioMediaGREEN™ filter cartridge and drain-down filter (if equipped, once per year at a minimum) ▪ Trim plants within the wetland chamber as needed in conjunction with routine landscape maintenance activities (typically 2x per year). No fertilizer shall be used. Wetland chamber should be inspected during rain events to verify flow through the system. If little to no flow is observed from the lower valve or orifice plate, the wetland media may require replacement. If prior treatment stages are properly maintained, the life of the wetland media can be up to 20 years.	2x per year	Owner/HOA
NON-STRUCTURAL SOURCE CONTROL BMPs				

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
N1	Education for Property Owners, Tenants and Occupants	Educational materials will be provided to tenants annually. Materials to be distributed are found in Appendix C. Tenants will be provided these materials by the HOA prior to occupancy and periodically thereafter.	Annually	Owner/HOA
N2	Activity Restrictions	The owner and/or developer will prescribe activity restrictions to protect surface water quality, through lease terms or other equally effective measure, for the property. Restrictions include, but are not limited to, prohibiting vehicle maintenance or vehicle washing.	Ongoing	Owner/HOA
N3	Common Area Landscape Management	Maintenance shall be consistent with City requirements. Fertilizer and/or pesticide usage shall be consistent with County Management Guidelines for Use of Fertilizers (OC DAMP Section 5.5) as well as local requirements. 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 to prevent exposure of erodible surfaces. Trimmings, clippings, and other landscape wastes shall be properly disposed of in accordance with local regulations. Materials temporarily stockpiled during maintenance activities shall be placed away from water courses and storm drain inlets.	Monthly	Owner/HOA
N4	BMP Maintenance	Maintenance of structural BMPs implemented at the project site shall be performed at the frequency prescribed in the O&M Plan included in this WQMP (Appendix D). Records of inspections and BMP maintenance shall be kept by the owner/developer and shall be available for review upon request.	Ongoing	Owner/HOA

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	**Inspection/Maintenance Activities**	**Minimum Frequency**	**Responsible Party**
N11	Common Area Litter Control	Litter patrol, violations investigations, reporting and other litter control activities shall be performed on a weekly basis and in conjunction with routine maintenance activities.	Weekly	Owner/HOA
N12	Employee Training	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 on an as needed basis.	Annually	Owner/HOA
N14	Common Area Catch Basin Inspection	Catch basin inlets and other drainage facilities shall be inspected after each storm event and once per year. Storm drain inlets and other drainage facilities shall be cleaned prior to the rainy season, by October 1 each year.	Annually	Owner/HOA
N15	Street Sweeping Private Streets and Parking Lots	Private streets will be swept on a quarterly basis, at minimum.	Quarterly	Owner/HOA
STRUCTURAL SOURCE CONTROL BMPs				
S1 SD-13	Provide storm drain system stenciling and signage	Storm drain stencils shall be inspected for legibility, at minimum, once prior to the storm season, no later than October 1 each year. Those determined to be illegible will be re-stenciled as soon as possible.	Annually	Owner/HOA
S4 SD-12	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	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, and day or night time temperatures. System testing shall occur twice per	2x per year	Owner/HOA

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
		year. Water from testing/flushing shall be collected and properly disposed to the sewer system and shall not discharge to the storm drain system.		
S5	Protect slopes and channels and provide energy dissipation	To be performed in conjunction with maintenance activities. Maintain vegetative cover and/or mulch to eliminate exposed soils. Any eroded surfaces to be repaired immediately. Inspections to be performed twice each year (spring and fall) and after major storm events to check for signs of erosion, gullies, and sloughing	Monthly	Owner/HOA

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

The exhibits provided in this section are to illustrate the post construction BMPs prescribed within this WQMP. 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 and treatment control BMPs are shown as well.

EXHIBITS

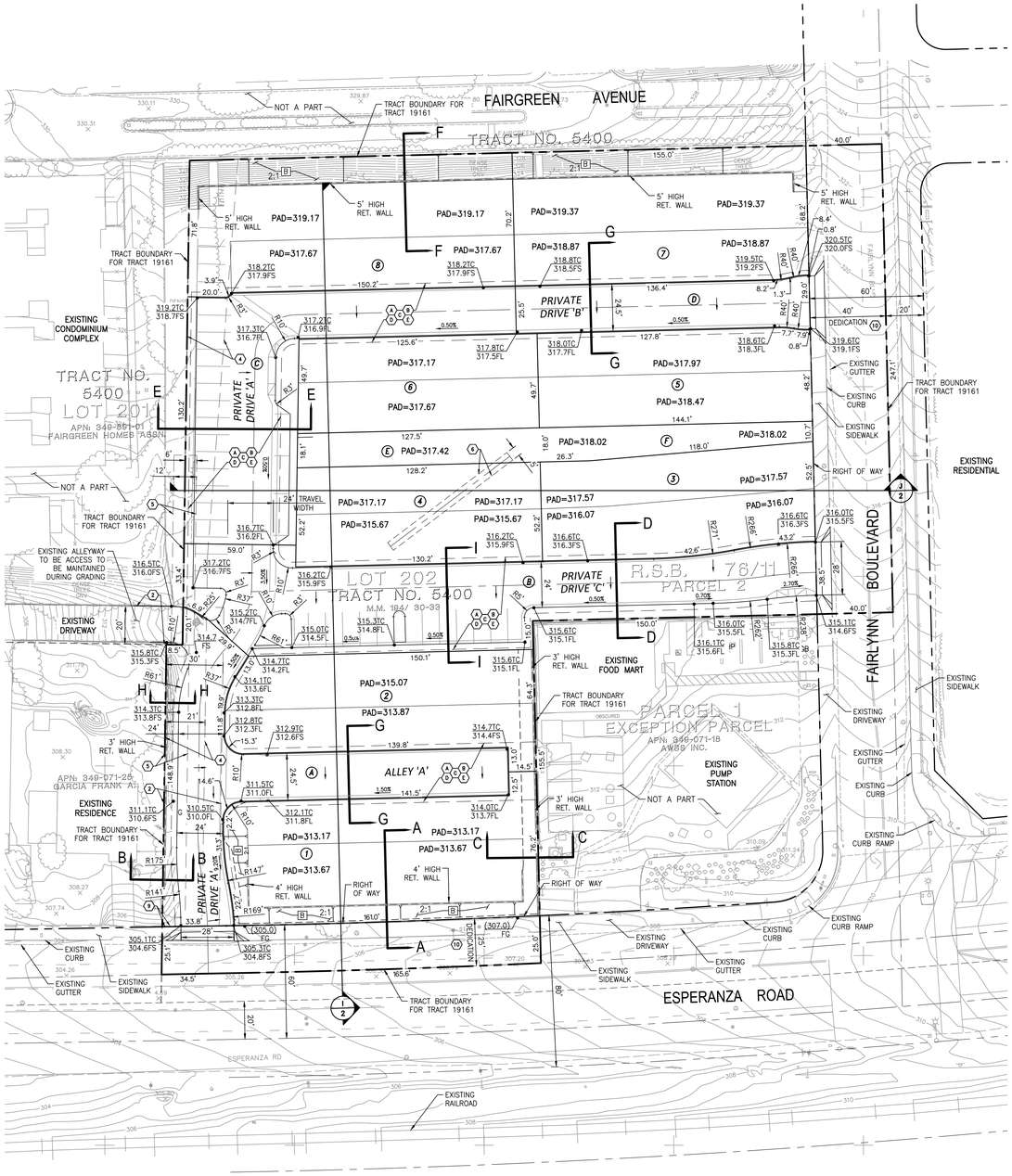
- Vicinity Map
- Site Plan / Tentative Tract Map
- Conceptual WQMP Exhibit
- Esperanza – Rain Gardens Exhibit
- Typical Cross Sections

BMP DETAILS & FACT SHEETS

- Modular Wetland Systems
- BIO-7 Proprietary Bioretention

VICINITY MAP

VESTING TENTATIVE TRACT MAP 19161
FOR CONDOMINIUM PURPOSES
6821 FAIRLYNN BLVD.



EXISTING EASEMENTS

(2) EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO AS DELINEATED OR AS OFFERED FOR DEDICATION, ON THE MAP OF SAID TRACT/PLAT;
PURPOSE: VEHICULAR ACCESS
AFFECTS: AS SHOWN ON SAID MAP

(4) EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO AS SET FORTH IN A DOCUMENT:

PURPOSE: SEWER PIPELINES RECORDING DATE: FEBRUARY 28, 1964
RECORDING NO: BOOK 6943, PAGE 683 OF OFFICIAL RECORDS
AFFECTS: SAID LAND MORE PARTICULARLY DESCRIBED THEREIN

(5) EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO AS SET FORTH IN A DOCUMENT:

GRANTED TO: SOUTHERN CALIFORNIA EDISON COMPANY
PURPOSE: PUBLIC UTILITIES
RECORDING DATE: APRIL 16, 1964
RECORDING NO: BOOK 7007, PAGE 894 OF OFFICIAL RECORDS
AFFECTS: SAID LAND MORE PARTICULARLY DESCRIBED THEREIN

(6) EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERTO, AS GRANTED IN A DOCUMENT:

GRANTED TO: SOUTHERN CALIFORNIA EDISON COMPANY
PURPOSE: PUBLIC UTILITIES
RECORDING DATE: MARCH 17, 1977
RECORDING NO: BOOK 12108, PAGE 652 OF OFFICIAL RECORDS
AFFECTS: SAID LAND MORE PARTICULARLY DESCRIBED THEREIN

(9) EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO AS CONDEMNED BY AN INSTRUMENT, ENTITLED: FINAL ORDER OF CONDEMNATION
CASE NO.: 05CC12878
PURPOSE: HIGHWAY
RECORDING DATE: APRIL 2, 2007
RECORDING NO: 2007-000209791 OF OFFICIAL RECORDS
AFFECTS: SAID LAND MORE PARTICULARLY DESCRIBED THEREIN

(10) EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT:
GRANTED TO: THE CITY OF YORBA LINDA

EXISTING EASEMENTS DISPOSITION

(2) EXISTING EASEMENT TO REMAIN AS IS

(4) EXISTING EASEMENT TO REMAIN AS IS

(5) EXISTING EASEMENT TO REMAIN AS IS

(6) EXISTING EASEMENT TO BE ABANDONED

(9) EXISTING EASEMENT TO REMAIN AS IS

(10) EXISTING EASEMENT TO REMAIN AS IS

PROPOSED EASEMENTS

(A) PROPOSED EASEMENT TO YORBA LINDA WATER DISTRICT FOR SEWER AND ACCESS PURPOSES

(B) PROPOSED EASEMENT TO GOLDEN STATE WATER COMPANY FOR WATER AND ACCESS PURPOSES

(C) PROPOSED EASEMENT FOR EMERGENCY ACCESS AND PUBLIC SECURITY VEHICLE INGRESS AND EGRESS PURPOSES

(D) PROPOSED RECIPROCAL INGRESS/EGRESS AND DRIVEWAY MANEUVERABILITY ACCESS EASEMENT FOR THE BENEFIT OF ALL LOTS IN TRACT NO. 19161

(E) PROPOSED UTILITY EASEMENT

SLOPE DESIGNATIONS

[B] TYPE 'B' SLOPES PER SEC. 7-9-283 MAINTAINED BY HOMEOWNERS ASSOCIATION

APPLICANT

ROI ESPERANZA LLC
4199 CAMPUS DRIVE, SUITE 200
IRVINE, CA 92612
(714)342-2502

CIVIL ENGINEER

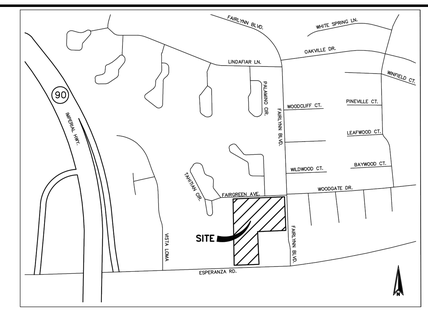
FUSCOE ENGINEERING, INC.
16795 VON KARMAN AVENUE
IRVINE, CA 92606
(949)474-1960

LEGEND

EASEMENT LINE
TRACT BOUNDARY
LOT LINE
(1) LOT NUMBER

GENERAL INFORMATION

1. EXISTING LAND USE: COMMERCIAL
2. PROPOSED LAND USE: RESIDENTIAL-CONDOMINIUMS
3. ADJACENT LAND USE :
   N – RESIDENTIAL
   W – RESIDENTIAL
   S – PUBLIC STREET (ESPERANZA ROAD)
   E – PUBLIC STREET (FAIRLYNN BLVD.)
4. EXISTING GENERAL PLAN USE: 1-B RESIDENTIAL
5. EXISTING ZONING: C-1 COMMERCIAL WITH H OVERLAY
6. PROPOSED ZONING: R-2
7. THIS TRACT LIES IN FLOOD ZONE 'X' PER FEDERAL EMERGENCY MANAGEMENT AGENCY FIRM MAP NO.: 06059C0156J EFFECTIVE DATE : 12/3/2009
8. GAS SERVICE WILL BE PROVIDED BY THE SOUTHERN CALIFORNIA GAS COMPANY.
9. ELECTRIC SERVICE WILL BE PROVIDED BY THE SOUTHERN CALIFORNIA EDISON COMPANY.
10. TELEPHONE SERVICE WILL BE PROVIDED BY: AT&T U-VERSE, FRONTIER COMMUNICATIONS, OR SPECTRUM (TIME WARNER) CABLE.
11. CABLE T.V. SERVICES WILL BE PROVIDED BY: AT&T U-VERSE, FRONTIER COMMUNICATIONS, OR SPECTRUM (TIME WARNER) CABLE.
12. TRASH COLLECTION WILL BE INDIVIDUAL CURB SIDE PICKUP PER APPROVED TRASH COLLECTION PLAN.
13. PROPOSED SEWER FACILITIES: STANDARD LATERAL CONNECTIONS TO SEWER SYSTEM SHALL BE IN ACCORDANCE WITH THE YORBA LINDA WATER DISTRICT'S STANDARD SPECIFICATIONS FOR THE CONSTRUCTION OF SEWER FACILITIES.
14. PROPOSED WATER FACILITIES: STANDARD DOMESTIC CONNECTIONS TO WATER SYSTEM SHALL BE IN ACCORDANCE WITH THE GOLDEN STATE WATER COMPANY'S STANDARD SPECIFICATIONS FOR THE CONSTRUCTION OF WATER FACILITIES.
15. PROPOSED HIGH SPEED COMMUNICATION TECHNOLOGY, INCLUDING WIRELESS TECHNOLOGY, WILL BE AVAILABLE AT THE TIME OF DEVELOPMENT. CONSTRUCTION TO ALL HOMES TO PROVIDE OPPORTUNITIES FOR TELECOMMUTING, ON-LINE SHOPPING AND OTHER ADVANCE COMMUNICATION ACTIVITIES.
16. DRAINAGE ON THIS SITE WILL BE CONVEYED BY MEANS OF A PRIVATE STORM DRAIN SYSTEM CONSISTING OF VARYING SIZES OF PRIVATE STORM DRAIN PIPES AND AREA DRAINS.
17. THE DEVELOPER WILL COMPLY WITH ENERGY CONSERVATION MEASURES SET FORTH IN TITLE XXIV OF THE CALIFORNIA ADMINISTRATIVE CODE.
18. ALL EXISTING EASEMENTS ARE TO REMAIN IN THEIR CURRENT DESIGNATED LOCATIONS UNLESS OTHERWISE NOTED.
19. TOTAL LENGTH OF PROPOSED PRIVATE DRIVES AND ALLEYS IS APPROXIMATELY 1,100 L.F.
20. TOTAL PROJECT ACREAGE IS 2.57 GROSS AC.
21. ALL SIDEWALKS, CURB RETURNS, PEDESTRIAN CROSSINGS AND RAMPS WILL MEET TITLE 24 AND AMERICANS WITH DISABILITIES ACT REQUIREMENTS.
22. ALL PUBLIC AND PRIVATE STREETS AND STORM DRAIN FACILITIES WILL BE CONSTRUCTED IN CONFORMANCE WITH ORANGE COUNTY PUBLIC WORKS STANDARDS. ROLLED CURB AND GUTTER AND ROLLED CURB WILL BE CONSTRUCTED AS SHOWN ON SHEET C-2. ALL SEWER FACILITIES WILL BE CONSTRUCTED IN CONFORMANCE WITH YORBA LINDA WATER DISTRICT STANDARDS. ALL WATER FACILITIES WILL BE CONSTRUCTED IN CONFORMANCE WITH GOLDEN STATE WATER DISTRICT STANDARDS.
23. THE PROJECT SITE LIES WITHIN THE PLACENTIA-YORBA LINDA UNIFIED SCHOOL DISTRICT.
24. THE SUBDIVIDER RESERVES THE RIGHT TO FILE MULTIPLE FINAL MAPS FOR THIS VESTING TENTATIVE TRACT MAP.
25. ALL PARTIES HAVING A BENEFICIARY INTEREST IN THE PROPERTY BEING SUBDIVIDED ARE AWARE OF AND CONSENT TO THE FILING OF THIS VESTING TENTATIVE TRACT MAP.
26. THE ASSESSOR'S PARCEL NUMBER FOR THE PROJECT AREA IS: 349-071-17.
27. ALL EXISTING EASEMENTS AND IRREVOCABLE OFFERS OF DEDICATION THAT AFFECT THE PROPERTY BEING SUBDIVIDED ARE SHOWN ON THE VESTING TENTATIVE TRACT MAP.
28. THE GRADING QUANTITIES ARE APPROXIMATELY 7,000 CY OF CUT AND 500 CY OF FILL.



VICINITY MAP

LEGAL DESCRIPTION

LOT 202 OF TRACT NO. 5400, IN THE COUNTY OF ORANGE, STATE OF CALIFORNIA, AS PER MAP RECORDED IN BOOK 194, PAGES 30 TO 33, INCLUSIVE, OF MISCELLANEOUS MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY.

EXCEPT THAT PORTION THEREOF DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHERLY TERMINUS OF THAT CERTAIN CURVE AT THE SOUTHEAST CORNER OF SAID LOT; THENCE NORTH 1°22'33" WEST 124.20 FEET ALONG THE EAST LINE OF SAID LOT; THENCE SOUTH 88°37'27" WEST 150.00 FEET; THENCE SOUTH 1°22'33" EAST TO THE SOUTHERLY LINE OF SAID LOT; THENCE EASTERLY ALONG SAID SOUTHERLY LINE TO THE BEGINNING OF SAID CURVE AT SAID SOUTHEAST CORNER, CONCAVE NORTHWESTERLY HAVING A RADIUS OF 27.00 FEET; THENCE EASTERLY AND NORTHERLY 41.19 FEET ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 87°23'51" TO THE POINT OF BEGINNING.

EXCEPT ALL OIL, GAS, ASPHALTUM AND OTHER HYDROCARBONS AND OTHER MINERALS, WHETHER SIMILAR TO THOSE HEREIN SPECIFIED OR NOT, WITHIN THE UNDERLYING OR THAT MAY BE PRODUCED FROM SAID PROPERTY AND THE SOLE AND EXCLUSIVE RIGHT TO DRILL SLANTED WELLS FROM ADJACENT LANDS INTO AND THROUGH, AND TO DEVELOP MINES AND CONSTRUCT TUNNELS, SHAFTS AND OTHER WORKS IN AND THROUGH, THE SUBSURFACE OF SAID PROPERTY FOR THE PURPOSE OF RECOVERING SAID MINERALS, OR ANY OF THEM, FROM SAID PROPERTY OR OTHER PROPERTY; OR BOTH, AND THE RIGHT TO USE THAT PORTION OF THE SUBSURFACE OF SAID PROPERTY LYING BELOW A DEPTH OF 500 FEET FROM THE SURFACE OF SAID PROPERTY FOR ALL PURPOSES PERTAINING TO OR INCIDENT TO THE PRODUCTION OF, THE STORAGE OF, CONSERVATION OF, OR EXPLORING FOR OIL, GAS, ASPHALTUM, AND OTHER HYDROCARBONS AND OTHER MINERALS WHETHER SIMILAR TO THOSE SPECIFIED OR NOT, OR ANY OF SAID SUBSTANCES, BY MEANS OF ANY METHOD NOW KNOWN OR UNKNOWN, BUT NOT INCLUDING WITHIN THIS EXCEPTION ANY RIGHT TO USE THE SURFACE OF SAID PROPERTY OR THAT PORTION OF THE SUBSURFACE THEREOF LYING ABOVE A DEPTH OF 500 FEET BELOW THE SURFACE FOR THE AFORESAID PURPOSES, AS RESERVED BY STERN REALTY COMPANY, A CORPORATION, IN THE DEED RECORDED NOVEMBER 9, 1962, IN BOOK 6317, PAGE 443 OF OFFICIAL RECORDS.

APN: 349-071-17

SHEET INDEX

STATISTICAL SUMMARY:

LETTERED LOTS	AREA (SF)	AREA (AC)	PROPOSED LAND USE
A	9,202.4	0.21	PRIVATE ALLEY (ALLEY 'A') AND PRIVATE DRIVE (PRIVATE DRIVE 'A')
B	13,804.8	0.32	PRIVATE DRIVE (PRIVATE DRIVE 'A') AND PRIVATE DRIVE (PRIVATE DRIVE 'C')
C	10,711.2	0.25	PRIVATE DRIVE (PRIVATE DRIVE 'A') AND PRIVATE DRIVE (PRIVATE DRIVE 'B')
D	3,985.0	0.09	PRIVATE DRIVE (PRIVATE DRIVE 'B')
E	2,308.1	0.05	PRIVATE WALKWAY
F	2,167.4	0.05	PRIVATE WALKWAY
TOTALS	42,178.9	0.97	

STATISTICAL SUMMARY:

NUMBERED LOTS	AREA (SF)	AREA (AC)	PROPOSED LAND USE
1	10,785.0	0.25	6-PLEX
2	8,407.5	0.19	6-PLEX
3	7,651.9	0.18	5-PLEX
4	6,746.1	0.15	5-PLEX
5	7,142.1	0.16	5-PLEX
6	6,285.3	0.14	5-PLEX
7	10,856.3	0.25	6-PLEX
8	12,068.5	0.28	6-PLEX
TOTALS	69,942.7	1.60	

ESPERANZA ROAD DEDICATION: 4,997.3 SF (0.11 AC)
FAIRLYNN BLVD. DEDICATION: 9,883.4 SF (0.23 AC)

TOTAL AREA = 69,942.7 SF (1.60 AC) + 42,178.9 SF (0.97 AC) = 112,121.6 SF (2.57 AC)

30' 0' 15' 30'
SCALE: 1" = 30'

BENCHMARK

ELEVATIONS SHOWN HEREON ARE IN TERMS OF THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), BASED LOCALLY ON THE COUNTY OF ORANGE BENCHMARK:
2J-50-83 ELEV = 301.663 FEET (YEAR LEVELED 2006)

BASIS OF BEARINGS

BEARINGS HEREON ARE OF THE CALIFORNIA COORDINATE SYSTEM OF 1983 (CCS-83) ZONE VI, 2017.50 EPOCH, AS DERIVED LOCALLY BY GPS CONTINUALLY OPERATING REFERENCE STATIONS CCCS AND CNPP AS PUBLISHED BY THE CALIFORNIA SPATIAL REFERENCE CENTER.

GRID COORDINATES:
CCCS: N=2261350.6705 E=6071417.8093
CNPP: N=2258382.6264 E=6149110.3941

GRID INVERSE CCCS-CNPP
S87-48-44.02E 77749.2574 FEET

ALL DISTANCES WERE SCALED TO GROUND BY APPLYING THE COMPUTED COMBINATION FACTOR (CF) 0.9999876129.

STATEMENT OF OWNERSHIP

ROI ESPERANZA LLC DOES HEREBY STATE THAT THE PROPERTY OWNERS LISTED BELOW HAVE AUTHORIZED ROI ESPERANZA LLC TO PREPARE AND SUBMIT THIS MAP AS SHOWN WITHIN THE DISTINCTIVE BORDER LINE.

ALEX WONG
AUTHORIZED SIGNATORY

OWNER

PATEL/KING PROPERTIES, LLC
GANPAT I. PATEL – PARTNER

ENGINEER'S STATEMENT

I HEREBY STATE THAT THIS MAP WAS PREPARED UNDER MY SUPERVISION AND THAT THE OWNER OF RECORD HAS KNOWLEDGE OF AND CONSENTS TO THE FILING OF THIS MAP

TREVOR DODDSON, P.E. 42029 DATE: 8/24/2021

DEVIATION REQUEST

ROLLED CURB TO BE AS PROPOSED HEREON IN LIEU OF USING ORANGE COUNTY STD. PLAN 1201. SEE SHEET C-2.

NO.	REVISIONS	APP'D.	DATE

DEVELOPER:
ROI Esperanza LLC
4199 Campus Drive, Suite 200
Irvine, CA 92612
(949) 342-2502

FUSCOE ENGINEERING
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 fax 949.474.5315
www.fuscoe.com
CONTACT PERSON:
TREVOR S. DODDSON OFFICE: (949)474-1960

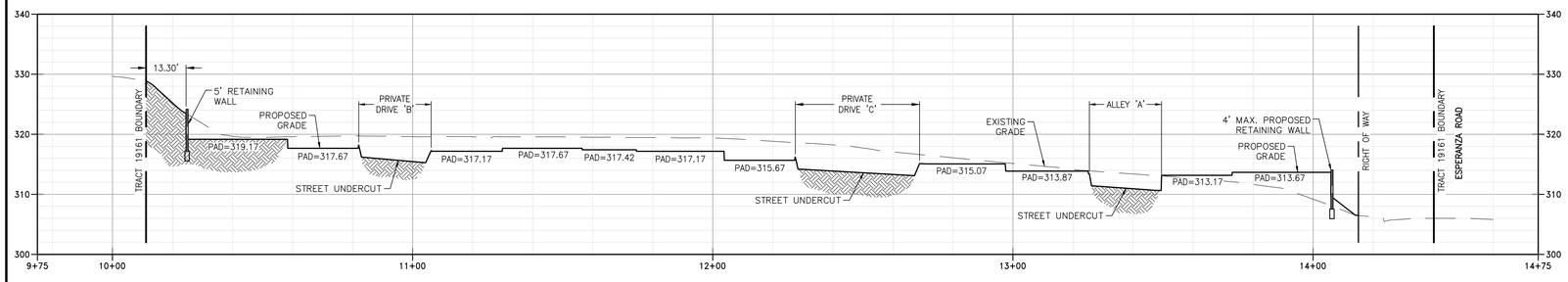
REGISTERED PROFESSIONAL ENGINEER TREVOR S. DODDSON NO. 042029 CIVIL STATE OF CALIFORNIA

Tentative Tract Map No. 19161
Tentative Tract Map No. 19161
6821 Fairlynn Blvd.
Yorba Linda, California

DRAWN: JL
DESIGN: NSM
CHECKED: TD
SCALE: AS SHOWN
JOB NO.: 774.012
SHEET C-1 OF C-3

6821 Fairlynn Blvd. | Tentative Tract Map No. 19161 | 8/24/2021 | PLAN SET: B

R:\Projects\774-012\Plans\Entitlements\Vesting Tentative Tract Map 19161\774-012-TTM_C-1 TENT TRACT MAP.dwg (08-24-21 4:31:03PM) Plotted by: Jason Li

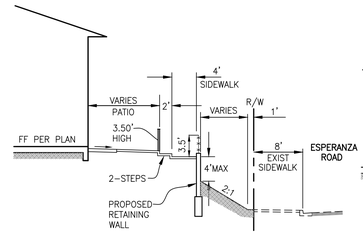


SECTION I

HORZ. SCALE: 1" = 20'
VERT. SCALE: 1" = 10'

SECTION J

HORZ. SCALE: 1" = 20'
VERT. SCALE: 1" = 10'



SECTION A-A

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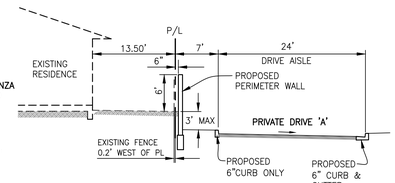

SECTION B-B

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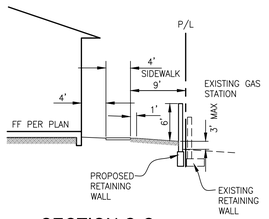

SECTION C-C

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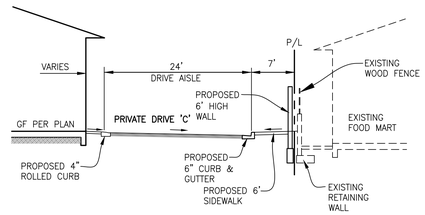

SECTION D-D

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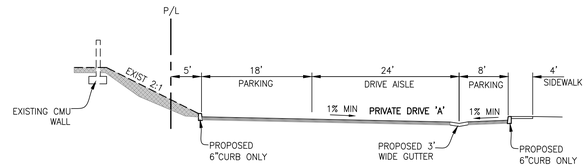

SECTION E-E

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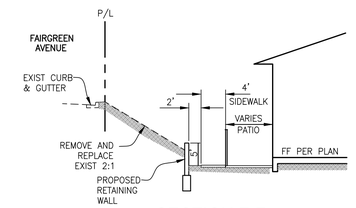

SECTION F-F

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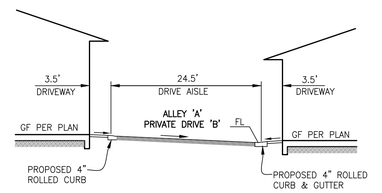

SECTION G-G

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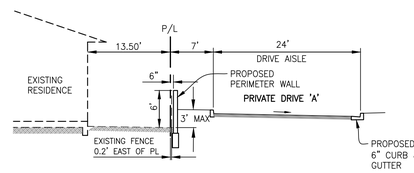

SECTION H-H

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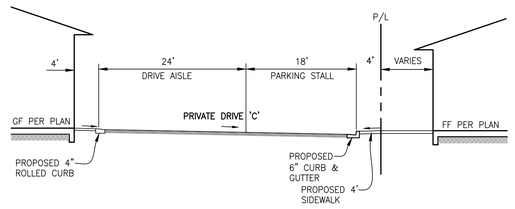

SECTION I-I

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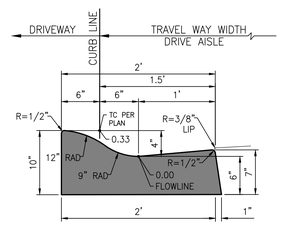
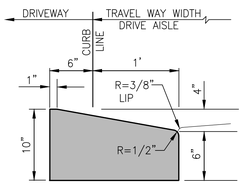


4" Rolled Curb and Gutter

NOT TO SCALE



4" Rolled Curb

NOT TO SCALE

REFER TO SHEET C-1 FOR SECTION CUTS

NO.	REVISIONS	APP'D.	DATE

DEVELOPER:

ROI Esperanza LLC
4199 Campus Drive, Suite 200
Irvine, CA 92612
(949) 342-2502

FUSCOE ENGINEERING
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 fax 949.474.5315
www.fuscoe.com
CONTACT PERSON:
TREVOR S. DODSON OFFICE: (949)474-1960

REGISTERED PROFESSIONAL ENGINEER TREVOR S. DODSON No. C42029 CIVIL STATE OF CALIFORNIA

Tentative Tract Map No. 19161
Existing and Proposed Cut and Fill Profiles
6821 Fairlynn Blvd.
Yorba Linda, California

DRAWN:	JL
DESIGN:	NSM
CHECKED:	TD
SCALE:	AS SHOWN
JOB NO.:	774.012

SHEET C-2 OF C-3

8/24/2021 | 6821 Fairlynn Blvd. Tentative Tract Map No. 19161 | PLAN SET: B

P:\PROJECTS\774\01\PLANS\ENTITLEMENTS\EXISTING TENTATIVE TRACT MAP 19161\774-01-TTM_C-2 EXISTING AND PROPOSED CUT AND FILL PROFILES.DWG (08-24-21 4:31:33PM) Plotted by: Jason La

8/24/2021 | 6821 Fairlynn Blvd. Tentative Tract Map No. 19161 | PLAN SET: B

FAIRGREEN AVENUE

FAIRLYNN BOULEVARD

ESPERANZA ROAD

EXISTING RESIDENCE (PROTECT IN PLACE)

EXISTING DRIVEWAY (PROTECT IN PLACE)

EXISTING RESIDENCE (PROTECT IN PLACE)

EXISTING BUILDING (TO BE REMOVED)

EXISTING BUILDING (TO BE REMOVED)

EXISTING BUILDING (TO BE REMOVED)

EXISTING PARKING LOT (TO BE REMOVED)

EXISTING PARKING LOT (TO BE REMOVED)

EXISTING PARKING LOT (TO BE REMOVED)

EXISTING PARKING LOT (TO BE REMOVED)

EXISTING FOOD MART (PROTECT IN PLACE)

EXISTING PUMP STATION (PROTECT IN PLACE)

EXISTING RESIDENTIAL

EXISTING ALLEYWAY TO BE ACCESS TO BE MAINTAINED DURING GRADING

TRACT BOUNDARY FOR TRACT 19161

TRACT BOUNDARY FOR TRACT 19161 AND STREET RIGHT OF WAY

RIGHT OF WAY

EXISTING GUTTER

EXISTING CURB

EXISTING SIDEWALK

EXISTING DRIVEWAY

EXISTING CURB RAMP

DENSE TREES ONV

OBSCURED

LEGEND

EXISTING EASEMENT

TRACT BOUNDARY

NO.	REVISIONS	APP'D.	DATE

DEVELOPER:

ROI Esperanza LLC
4199 Campus Drive, Suite 200
Irvine, CA 92612
(949) 342-2502

FUSCOE ENGINEERING
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 fax 949.474.5315
www.fuscoe.com
CONTACT PERSON:
TREVOR S. DODSON OFFICE: (949)474-1960

REGISTERED PROFESSIONAL ENGINEER TREVOR S. DODSON NO. C42089 CIVIL STATE OF CALIFORNIA

Tentative Tract Map No. 19161

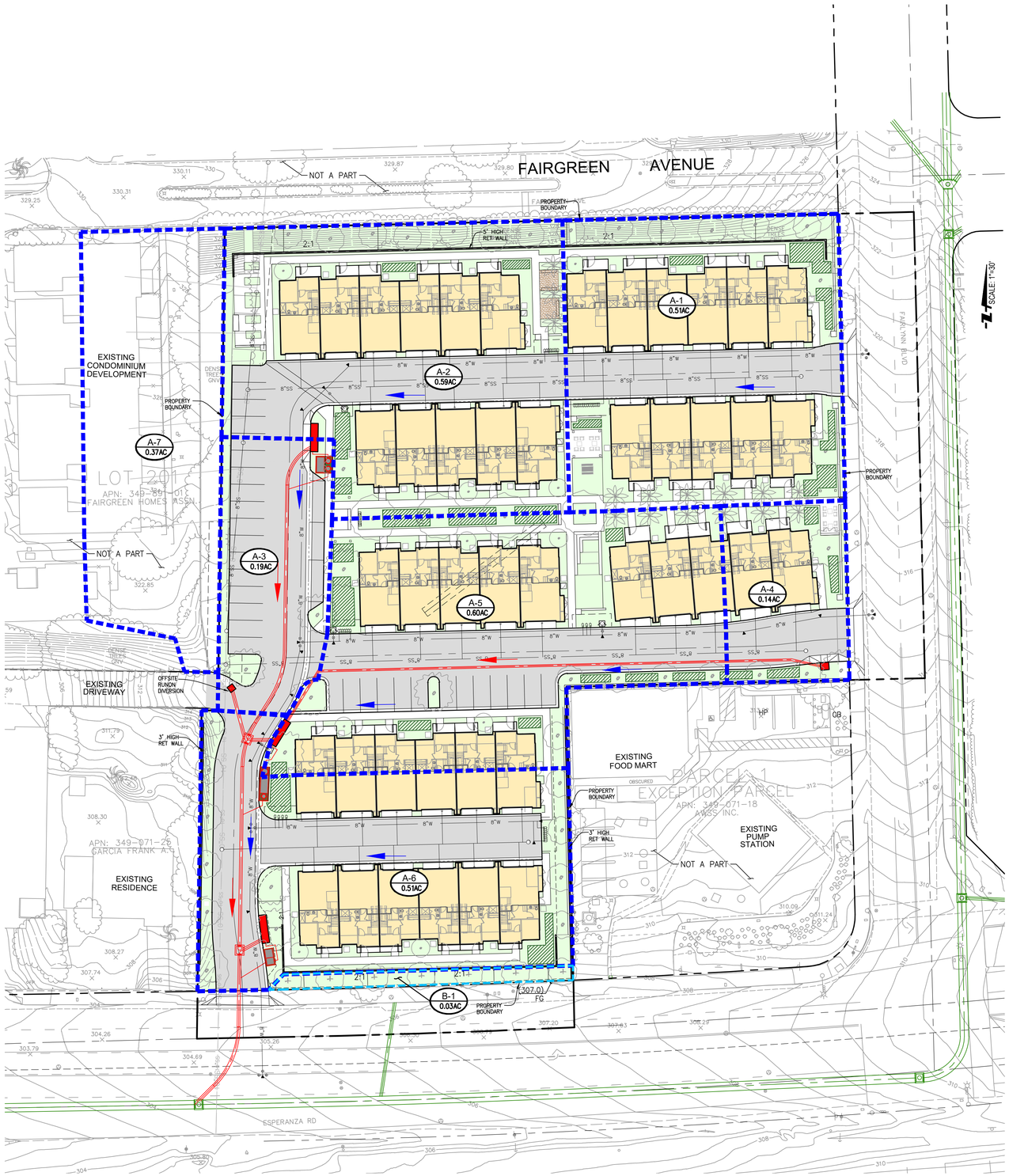
Topography

6821 Fairlynn Blvd.
Yorba Linda, California

DRAWN:	JL
DESIGN:	NSM
CHECKED:	TD
SCALE:	AS SHOWN
JOB NO.:	774.012

SHEET C-3 OF C-3

P:\PROJECTS\774.012\PLANS\ENTITLEMENTS\VESTING TENTATIVE TRACT MAP 19161\774-012-TTM_C-3 TOPOGRAPHY.DWG (08-24-21 4:31:43PM) Plotted by: Jordan Li

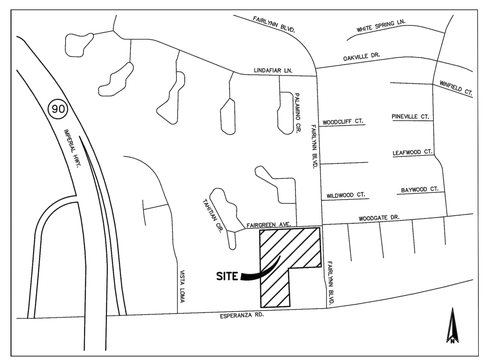


LEGEND

- PROPERTY LINE
- LOT LINE PER VTTM 19161
- UTILITY EASEMENT
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- BMP DRAINAGE MANAGEMENT AREA (DMA) BOUNDARY
- SITE DESIGN / SELF-TREATING DMA BOUNDARY
- STREET SWEEPING PRIVATE STREETS & PARKING LOTS
- PROPOSED COMMON AREA LANDSCAPING
- PROPOSED RAIN GARDEN
- CATCH BASIN STENCILING & MAINTENANCE
- PROPOSED MODULAR WETLAND SYSTEM (MWS)
- DIRECTION OF SURFACE FLOW
- DIRECTION OF STORM DRAIN FLOW
- A-1 0.51AC — DRAINAGE MANAGEMENT AREA NUMBER AND ACREAGE
- (1) — RESIDENTIAL LOT NO.
- [B] — LETTERED LOT NO.

BMP SUMMARY

DMA ID	ACREAGE	% IMPERVIOUS	DCV (CF)	BMP TYPE	BMP DIMENSIONS	MIN. TREATMENT FLOW RATE Q (CFS)	BMP CAPACITY (CFS)
A1	0.51	80%	1261.90	MWS-L-8-8	8'X8' BIOTREATMENT AREA	0.215	0.231
A2	0.59	80%	1440.70				
A3	0.19	80%	460.60	MWS-L-4-17	4'X17' BIOTREATMENT AREA	0.181	0.206
A4	0.14	80%	345.50				
A5	0.60	80%	1470.20				
A6	0.51	80%	1254.50	MWS-L-4-8	4'X8' BIOTREATMENT AREA	0.100	0.115
B1	0.03	0%	N/A	SELF-TREATING AREA	1230 SF OF 100% LANDCAPING	N/A	N/A
TOTAL SITE	2.58	80%	6321.60				
BIORETENTION RAIN GARDENS					3,400 SF	N/A	PENDING



VICINITY MAP

TENTATIVE TRACT MAP NO. 19161

PLANNING APPLICATION NO: PA21-0111

APN: 349-071-17

PROJECT ADDRESS:
6821 FAIRLYNN BLVD.
YORBA LINDA, CA

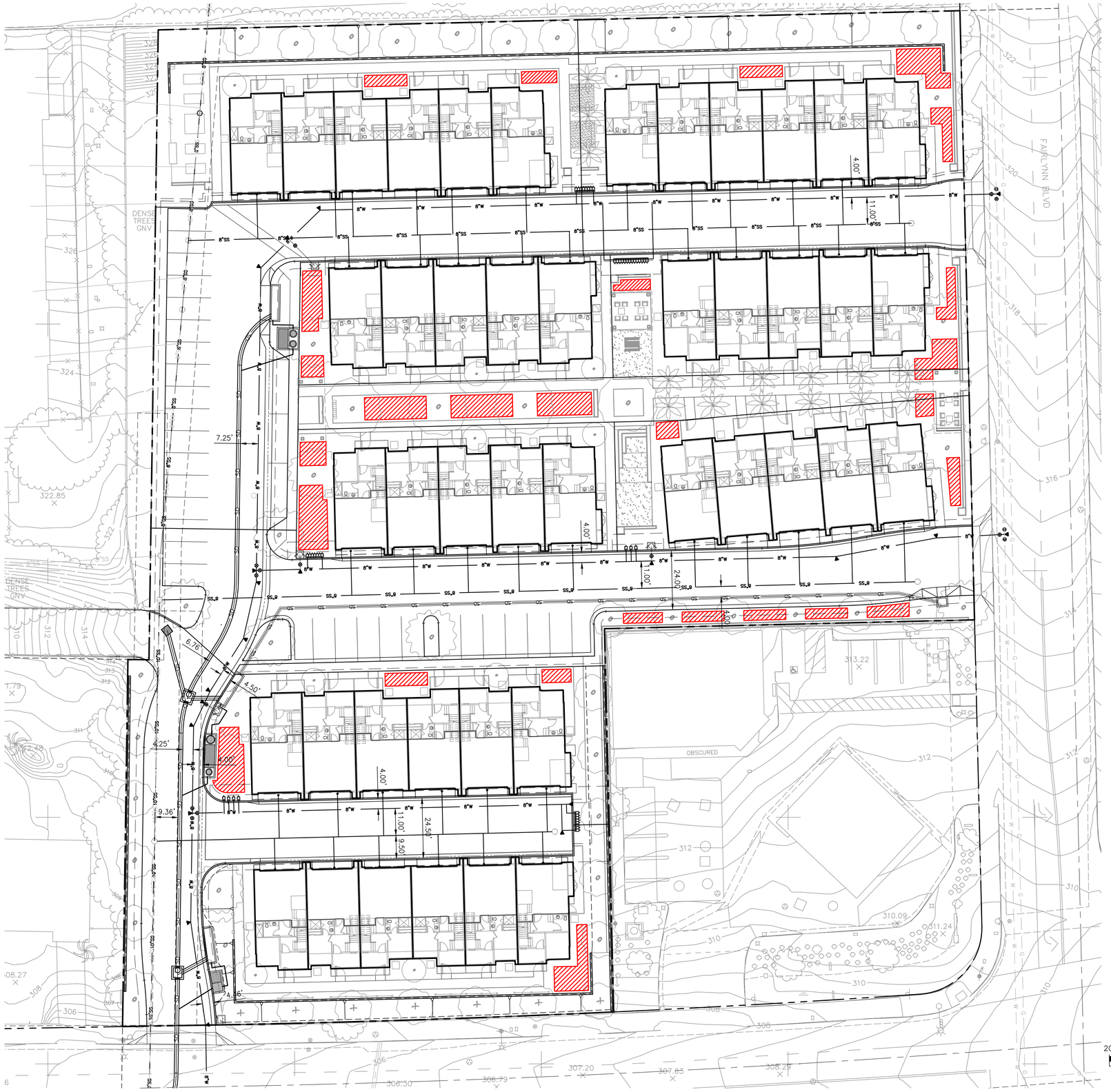
PROJECT OWNER:
ROI ESPERANZA LLC
4199 CAMPUS DRIVE, SUITE 200
IRVINE, CA 92612
(714)342-2502

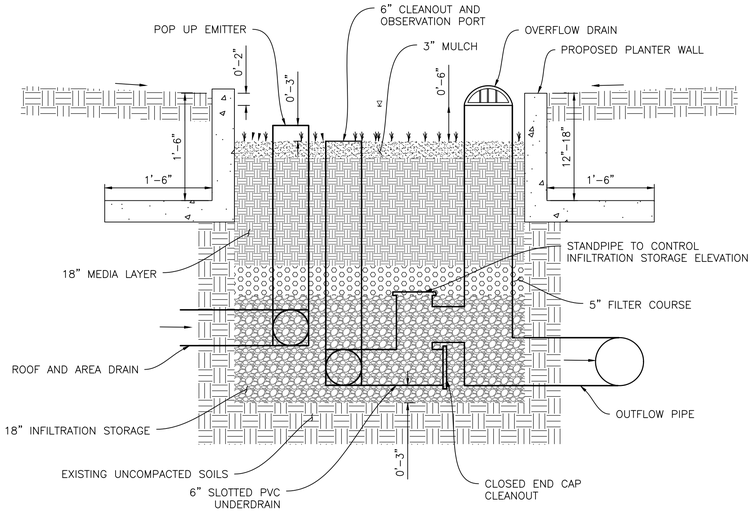
30' 0' 15' 30'
SCALE: 1" = 30'

CONCEPTUAL WQMP
ESPERANZA VILLAGE
6821 FAIRLYNN BLVD.
YORBA LINDA, CA

Exhibit Date: 10/25/2022

FUSCOE ENGINEERING
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 * fax 949.474.5315
www.fuscoe.com





RAIN GARDEN DETAIL

NOT TO SCALE

ESPERANZA - RAIN GARDENS

YORBA LINDA, CA

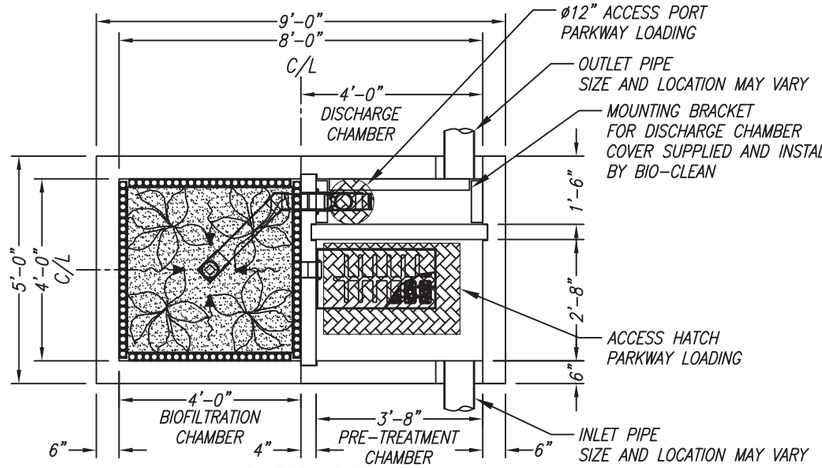
November 28, 2022

FUSCOE ENGINEERING
16795 Von Karman, Suite 100, Irvine, California 92606
tel 949.474.1960 ◦ fax 949.474.5315 ◦ www.fuscoe.com

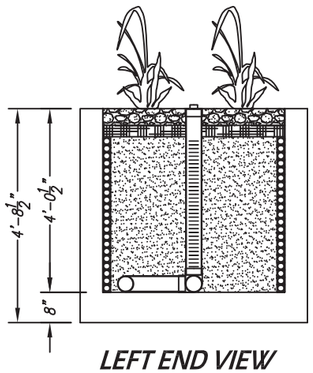
MODULAR WETLAND SYSTEMS - LINEAR 2.0
4-8 VAULT TYPE

FLOW RATES
PEAK TREATMENT FLOW RATE = .116 CFS OR 52.0 GPM
PEAK BYPASS FLOW RATE = OPTIONAL
SPECIFICATIONS
INSTALL AT SURFACE
O.D. DIMENSIONS = 9' X 5' X 4.7'
TOP OF VAULT TO INVERT OUT = 4.13'
SEDIMENT STORAGE CAPACITY = 1000 LBS OR 23.5 CF

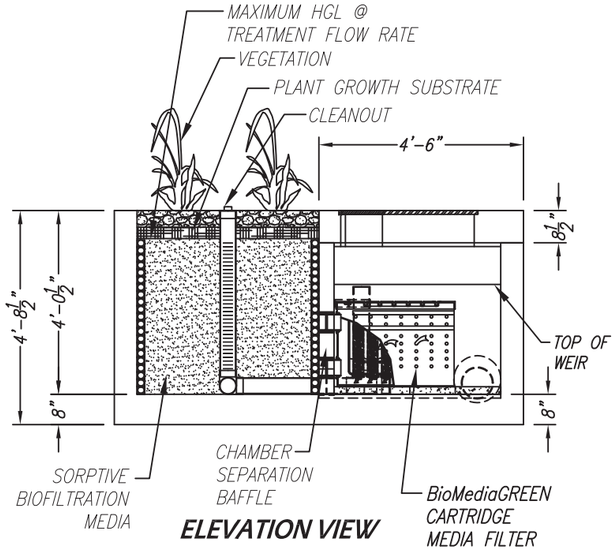
***NOTE:**
MWS UNIT CAN BE CONSTRUCTED WITH INLET ON EITHER SIDE. FOR INLET ON OPPOSITE SIDE ENTIRE UNIT WILL BE MIRRORED.



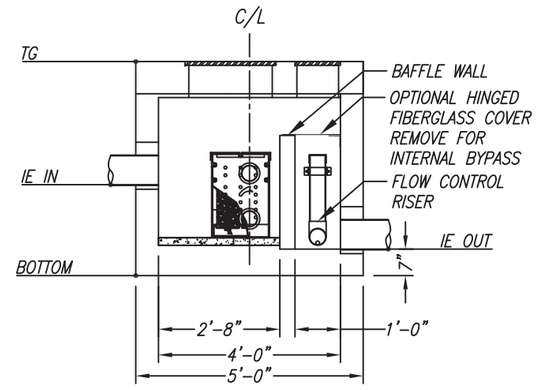
PLAN VIEW



LEFT END VIEW
BIOFILTRATION CHAMBER



ELEVATION VIEW



RIGHT END VIEW
PRETREATMENT/DISCHARGE CHAMBER

BIOFILTRATION CHAMBER SURFACE AREA CALCS
SIDES = 2
3.7' L x 3.4' H = 12.6 SF
SIDE SURFACE AREA = 25.2 SF
ENDS = 2
3.7' L x 3.4' H = 12.6 SF
END SURFACE AREA = 25.2 SF
TOTAL WETLAND MEDIA SURFACE AREA **= 50.4 SF**
WETLAND MEDIA LOADING RATE 52.0 GPM / 50.4 SF **= 1.03 GPM/SF**
PRETREATMENT FILTER SURFACE AREA CALCS
SIDES = 2
0.50' L x 1.67' H = 0.84 SF
SIDE SURFACE AREA = 1.68 SF
ENDS = 2
0.25' L x 1.67' H = 0.42 SF
END SURFACE AREA = 0.84 SF
TOTAL PRETREATMENT SURFACE AREA 2.52 SF x 14 FILTERS **= 35.28 SF**
PRETREATMENT FILTER LOADING RATE 52.0 GPM / 35.28 SF **= 1.47 GPM/SF**

LEGEND

- 2" DRAIN CELL PERIMETER INLET WATER TRANSFER SYSTEM
- WETLAND MEDIA
- PLANT/ROOT MOISTURE RETENTION LAYER
- MANHOLE / ACCESS HATCH

INSTALLATION NOTES:

1. INSTALL UNIT ON LEVEL BED OF GRAVEL OF AT LEAST 6" IN DEPTH.
2. CONCRETE 28 DAY COMPRESSIVE STRENGTH fc=5,000 PSI.
3. REINFORCING: ASTM A-615, GRADE 60.
4. RATED FOR PARKWAY LOADING 300 PSF.
5. JOINT SEALANT: BUTYL RUBBER SS-S-00210
6. PLANTING SUPPLIED AND INSTALLED BY CONTRACTOR PER MANUFACTURES RECOMMENDATIONS UNLESS OTHER WISE STATED ON CONTRACT.

MODULAR WETLAND SYSTEMS INC.
P.O. BOX 869
OCEANSIDE, CA 92049
www.ModularWetlands.com

	NAME	DATE
DRAWN	jrh	1/9/13
REVIEWED		

COMMENTS:

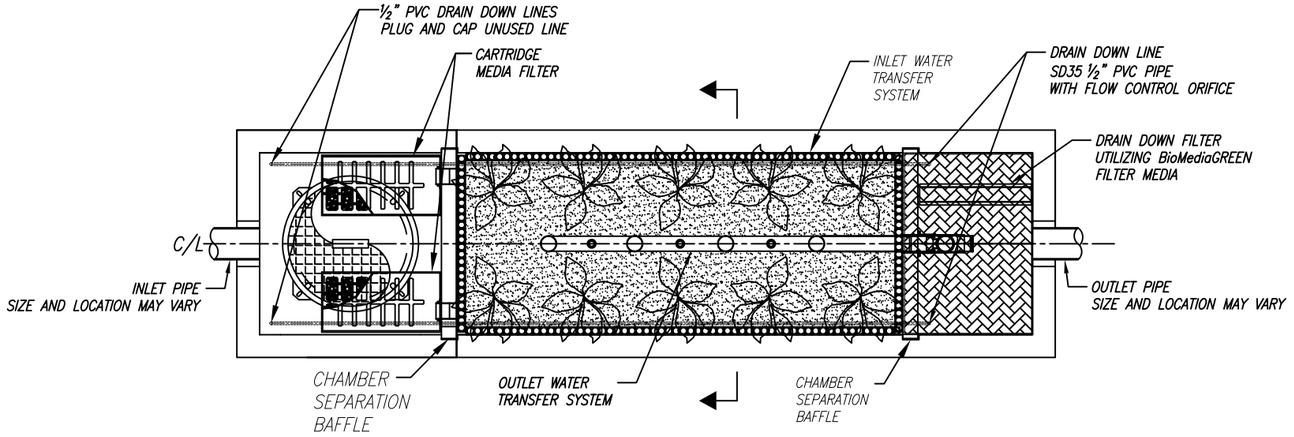
TITLE: MWS LINEAR 2.0 VAULT TYPE

SIZE	DWG. NO.	REV
	MWS-L-4-8-V	

SCALE 1:40 | UNITS = INCHES | SHEET 1 OF 1

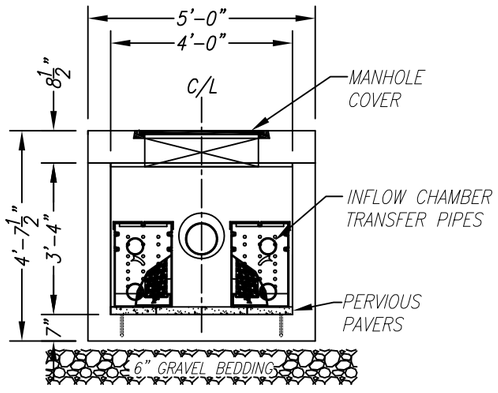
MODULAR WETLAND SYSTEMS - LINEAR 2.0
17' VAULT TYPE

FLOW RATES
PEAK TREATMENT FLOW RATE = .206 CFS OR 92.45 GPM
PEAK BYPASS FLOW RATE = OPTIONAL BYPASS
SPECIFICATIONS
INSTALL AT SURFACE
O.D. DIMENSIONS = 18' X 5' X 4.7'
TOP OF CURB TO INVERT OUT = 4.13'
SEDIMENT STORAGE CAPACITY = 1000 LBS OR 23.5 CF

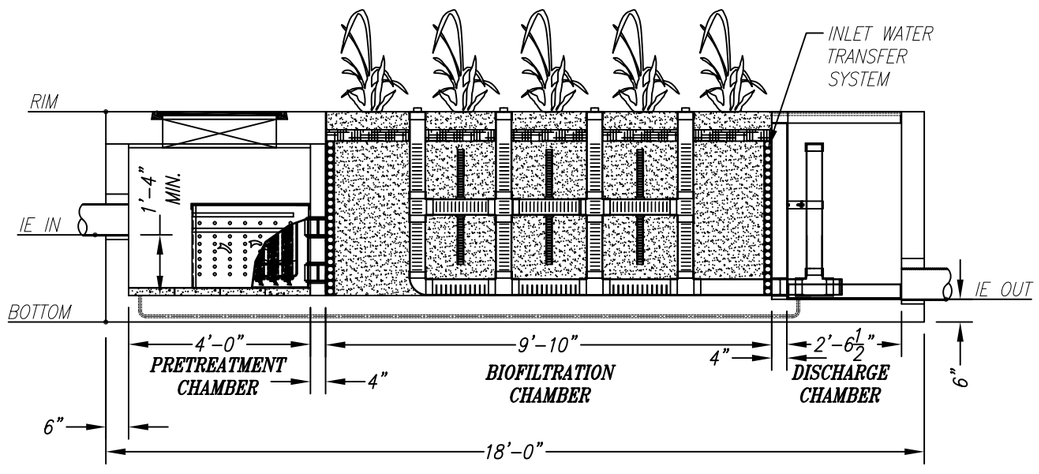


PLAN VIEW

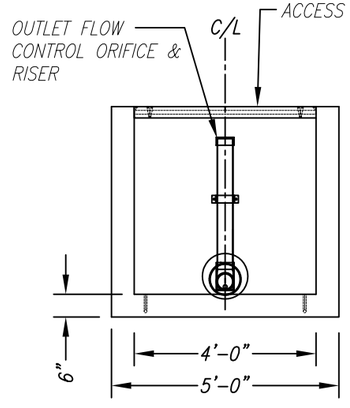
BIOFILTRATION CHAMBER SURFACE AREA CALCS
SIDES = 2
9.5' L x 3.4' H = 32.3 SF
SIDE SURFACE AREA = 64.6 SF
ENDS = 2
3.7' L x 3.4' H = 12.6 SF
END SURFACE AREA = 25.2 SF
TOTAL WETLAND MEDIA SURFACE AREA **= 89.8 SF**
WETLAND MEDIA LOADING RATE 92.45 GPM / 89.8 SF **= 1.03 GPM/SF**
PRETREATMENT FILTER SURFACE AREA CALCS
SIDES = 2
0.50' L x 1.67' H = 0.84 SF
SIDE SURFACE AREA = 1.68 SF
ENDS = 2
0.25' L x 1.67' H = 0.42 SF
END SURFACE AREA = 0.84 SF
TOTAL PRETREATMENT SURFACE AREA 2.52 SF x 28 FILTERS **= 70.56 SF**
PRETREATMENT FILTER LOADING RATE 92.45 GPM / 70.56 SF **= 1.31 GPM/SF**



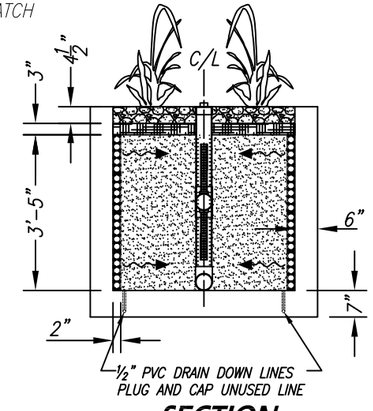
LEFT END VIEW
PRETREATMENT CHAMBER



ELEVATION VIEW



RIGHT END VIEW
DISCHARGE CHAMBER



SECTION
BIOFILTRATION CHAMBER

LEGEND

- 2" DRAIN CELL PERIMETER INLET WATER TRANSFER SYSTEM
- WETLAND MEDIA
- PLANT/ROOT MOISTURE RETENTION LAYER
- MANHOLE / ACCESS HATCH

INSTALLATION NOTES:

1. INSTALL UNIT ON LEVEL BED OF GRAVEL OF AT LEAST 6" IN DEPTH.
2. CONCRETE 28 DAY COMPRESSIVE STRENGTH fc=5,000 PSI.
3. REINFORCING: ASTM A-615, GRADE 60.
4. RATED FOR PARKWAY LOADING 300 PSF.
5. ALL WALLS ARE 6" THICK, BAFFLES ARE 4" THICK, BOTTOM 7" OR 8" THICK, TOP 8.5" THICK.
6. JOINT SEALANT: BUTYL RUBBER SS-S-00210

MODULAR WETLAND SYSTEMS INC.
P.O. BOX 869
OCEANSIDE, CA 92049
www.ModularWetlands.com

	NAME	DATE
DRAWN		
EDITED		

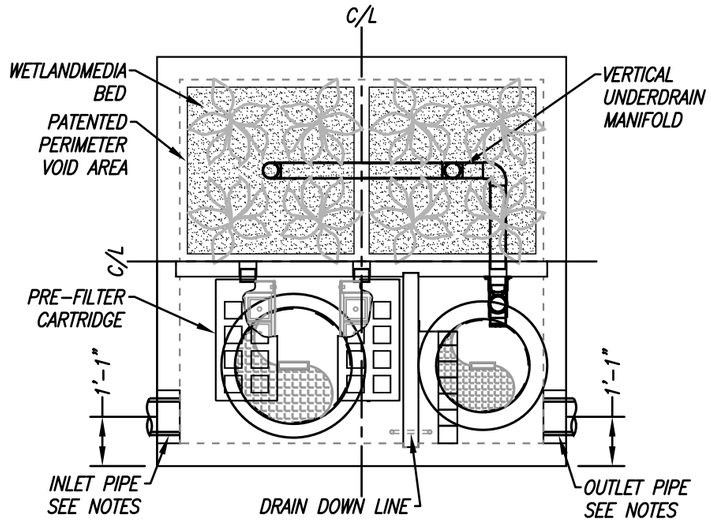
COMMENTS:

TITLE: MWS LINEAR 2.0 VAULT TYPE

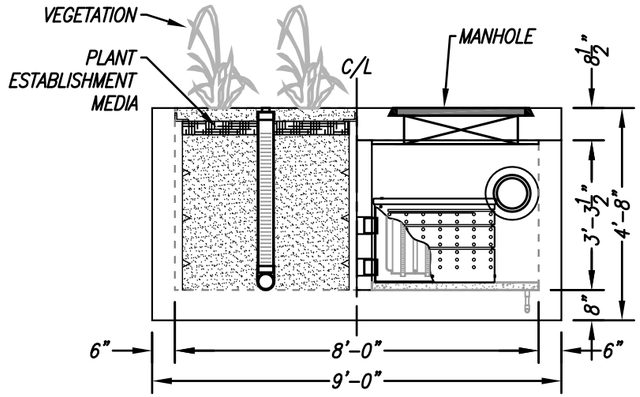
SIZE	DWG. NO.	REV
	MWS-L-4-17-V	

SCALE 1:40 | UNITS = INCHES | SHEET 1 OF 1

SITE SPECIFIC DATA			
PROJECT NUMBER			
ORDER NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			TBD
ORIFICE SIZE (DIA. INCHES)			TBD
NOTES: PRELIMINARY NOT FOR CONSTRUCTION.			



PLAN VIEW



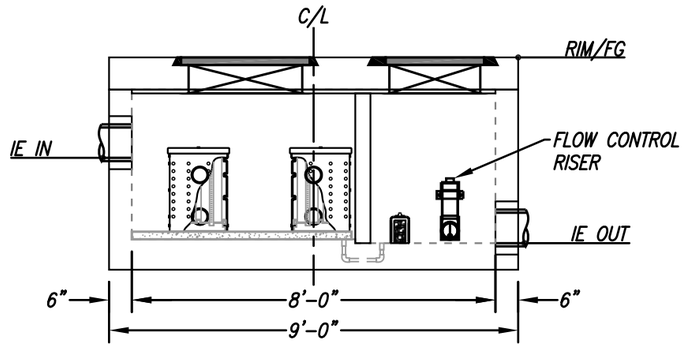
LEFT END VIEW

INSTALLATION NOTES

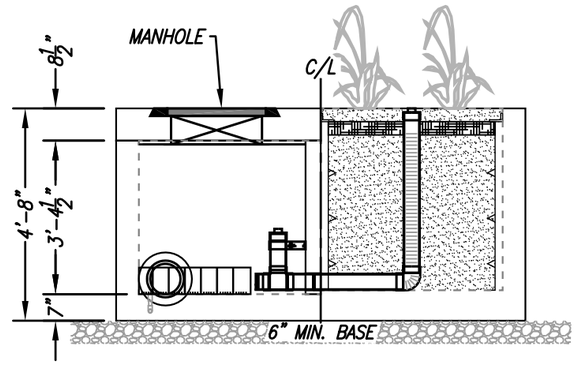
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.



ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.231
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-8-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

SECTION VII EDUCATIONAL MATERIALS

The educational materials included in this WQMP 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 Appendix C of this WQMP and are listed below.

EDUCATION MATERIALS			
Residential Materials (http://www.ocwatersheds.com)	**Check If Attached**	**Business Materials (http://www.ocwatersheds.com)**	**Check If Attached**
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 Materials (http://www.ocwatersheds.com) (https://www.casqa.org/resources/bmp-handbooks)**	**Check If Attached**
Proper Disposal of Household Hazardous Waste	☒		
Recycle at Your Local Used Oil Collection Center (North County)	☒	DF-1 Drainage System Operation & Maintenance	☒
Recycle at Your Local Used Oil Collection Center (Central County)	☐	R-1 Automobile Repair & Maintenance	☐
Recycle at Your Local Used Oil Collection Center (South County)	☐	R-2 Automobile Washing	☐
Tips for Maintaining Septic Tank Systems	☐	R-3 Automobile Parking	☒
Responsible Pest Control	☒	R-4 Home & Garden Care Activities	☒
Sewer Spill	☐	R-5 Disposal of Pet Waste	☒
Tips for the Home Improvement Projects	☒	R-6 Disposal of Green Waste	☒
Tips for Horse Care	☐	R-7 Household Hazardous Waste	☒
Tips for Landscaping and Gardening	☒	R-8 Water Conservation	☒
Tips for Pet Care	☒	SD-10 Site Design & Landscape Planning	☒
Tips for Pool Maintenance	☐	SD-11 Roof Runoff Controls	☒
Tips for Residential Pool, Landscape and Hardscape Drains	☐	SD-12 Efficient Irrigation	☒
Tips for Projects Using Paint	☐	SD-13 Storm Drain Signage	☒
Tips for Protecting Your Watershed	☐	SD-31 Maintenance Bays & Docs	☐
Other: Children's Brochure	☐	SD-32 Trash Storage Areas	☐

APPENDICES

APPENDIX A

SUPPORTING CALCULATIONS

Worksheet B: Simple Design Capture Volume Sizing Method

Project: Esperanza Village

Date: 6/3/2021

		DMA =	A1	A2	A3	A4	A5	A6	
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=	0.90	0.90	0.90	0.90	0.90	0.90	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	0	0	0	0	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.90	0.90	0.90	0.90	0.90	0.90	inches
Step 2: Calculate the DCV									
1	Enter Project area tributary to BMP(s), *A* (acres)	A=	0.515	0.588	0.188	0.141	0.600	0.540	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	%
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.750	0.750	0.750	0.750	0.750	0.750	
4	Calculate runoff volume, $V_{design} = (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	1,261.9	1,440.7	460.6	345.5	1,470.2	1,323.1	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV									
Step 3a: Determine design infiltration rate									
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	*Infeasible due to type D soils and low infiltration rates.*						in/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=							
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=							in/hr
Step 3b: Determine minimum BMP footprint									
4	Enter drawdown time, *T* (max 48 hours)	T=	*See Worksheet D*						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

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

Project: Esperanza Village

Date: 6/3/2021

			A1+A2	A3+A4+A5	A6	
Step 1: Determine the design capture storm depth used for calculating volume						
1	Enter the time of concentration, T_c (min) (See Appendix IV.2)	T_c=	5.0	5.0	5.0	min
2	Using Figure III.4, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.26	0.26	0.26	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	0	0	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	0%	0%	0%	%
5	Using Figure III.4, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency (Y_2), I_2	I_2=	0	0	0	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design} = I_1 - I_2$	I_{design}=	0.26	0.26	0.26	in/hr
Step 2: Calculate the design flowrate						
1	Enter Project area tributary to BMP(s), *A* (acres)	A=	1.103	0.929	0.540	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	80.0%	80.0%	80.0%	%
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	C=	0.750	0.750	0.750	
4	Calculate design flowrate, $Q_{design} = (C \times i_{design} \times A)$	Q_{design}=	0.215	0.181	0.105	cfs
Supporting Calculations						

Describe System:

Proprietary BioTreatment (BIO-7):				
Unit Size / Model =	*MWS-L-8-8-V*	*MWS-L-4-17-V*	*MWS-L-4-8-V*	
Unit Size / Model Treatment Capacity =	*0.231*	*0.206*	*0.115*	cfs
Number of Units Needed =	*1*	*1*	*1*	
Total Bio-treatment Provided =	*0.231*	*0.206*	*0.115*	cfs

Provide time of concentration assumptions:

Assumed = 5 minutes for conservative estimate. Pending final design.

Figure III.4. Capture Efficiency Nomograph for Off-line Flow-based Systems in Orange County

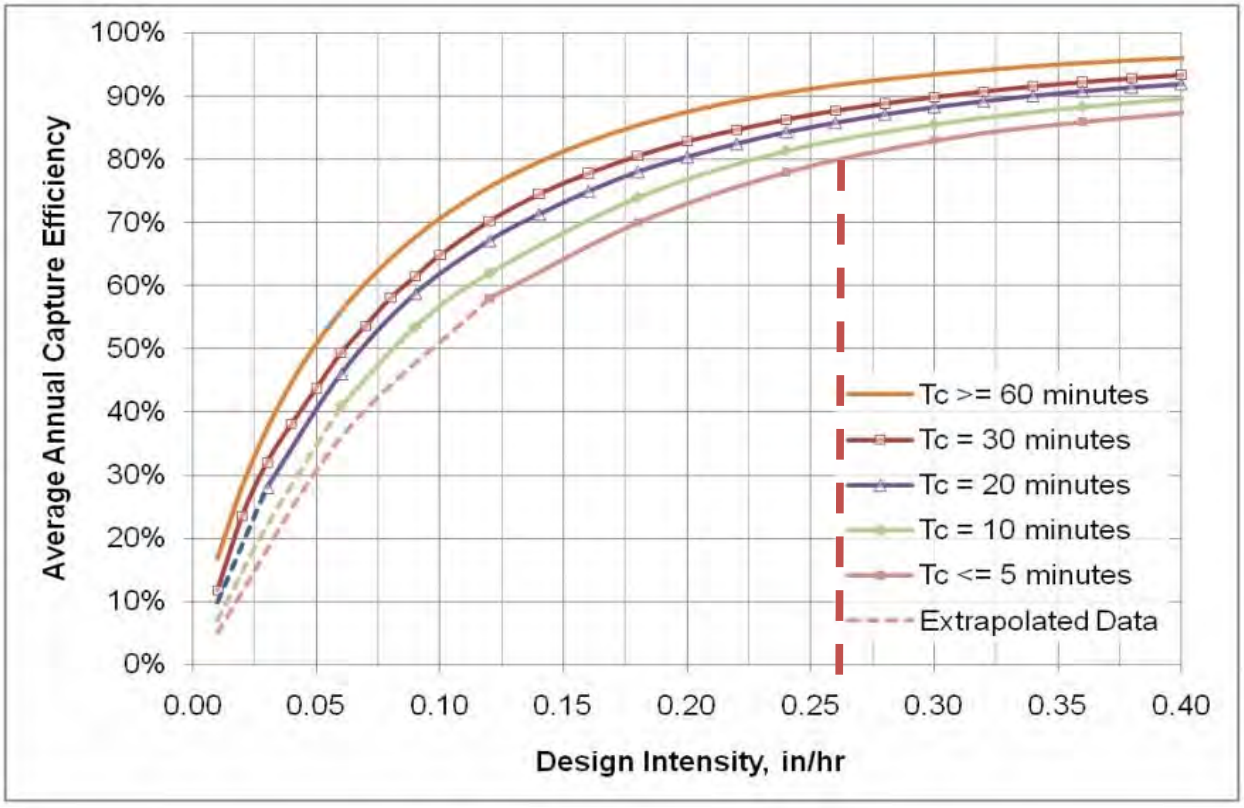


Table 2.7: Infiltration BMP Feasibility Worksheet

	Infeasibility Criteria	*Yes*	*No*
1	**Would Infiltration BMPs pose significant risk for groundwater related concerns?** Refer to Appendix VII (Worksheet I) for guidance on groundwater-related infiltration feasibility criteria.		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
2	Would Infiltration BMPs **pose significant risk of increasing risk of geotechnical hazards that cannot be mitigated to an acceptable level**? (Yes if the answer to any of the following questions is yes, as established by a geotechnical expert): The BMP can only be located less than 50 feet away from slopes steeper than 15 percent The BMP can only be located less than eight feet from building foundations or an alternative setback. A study prepared by a geotechnical professional or an available watershed study substantiates that stormwater infiltration would potentially result in significantly increased risks of geotechnical hazards that cannot be mitigated to an acceptable level.		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
3	Would infiltration of the DCV from drainage area **violate downstream water rights**?		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

	Partial Infeasibility Criteria	***Yes***	***No***
4	Is proposed infiltration facility **located on HSG D soils** or the site geotechnical investigation identifies presence of soil characteristics which support categorization as D soils?	X	
Provide basis: *See Figure XVI-2b in Appendix A.* Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
5	Is **measured infiltration rate below proposed facility less than 0.3 inches per hour**? This calculation shall be based on the methods described in Appendix VII.	X	
Provide basis: *Infiltration rates area 0.1 in/hr.* Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
6	Would **reduction of over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?**		X
Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
7	Would **an increase in infiltration over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?**		X
Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

Infiltration Screening Results (check box corresponding to result):		
8	Is there substantial evidence that infiltration from the project would result in a significant increase in I&I to the sanitary sewer that cannot be sufficiently mitigated? (See Appendix XVII) Provide narrative discussion and supporting evidence: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.	X
9	If any answer from row 1-3 is yes: infiltration of any volume is **not feasible** within the DMA or equivalent. Provide basis: Summarize findings of infeasibility screening	
10	If any answer from row 4-7 is yes, infiltration is **permissible but is not presumed to be feasible for the entire DCV.** Criteria for designing biotreatment BMPs to achieve the maximum feasible infiltration and ET shall apply. Provide basis: *Infiltration is not feasible.* Summarize findings of infeasibility screening	X
11	If all answers to rows 1 through 11 are no, infiltration of the full DCV is potentially feasible, BMPs must be designed to infiltrate the full DCV to the maximum extent practicable.	

Harvest & Reuse Irrigation Demand Calculations

6/3/2021

Storm Water Design Caputre Volume (SQDV)

Drainage Area / Land Use Type	Impervious Area (ac)	Irrigated Area (ac)	% impervious	Runoff Coefficient	Design Storm Depth (in)	Drainage Area (acres)	DCV (ft^3)	DCV (gal)
Total onsite	2.06	0.52	80%	0.750	0.90	2.580	**6,321.6**	**47,286**
				0.750			**0.0**	**0**
				0.750			**0.0**	**0**
				0.750			**0.0**	**0**
				0.150			**0.0**	**0**
				0.750			**0.0**	**0**

	Eto
Irvine	3.00
Laguna Beach	2.75
Santa Ana	2.93

Modified

$$\text{EAWU} = \frac{\text{Eto x KL x LA x 0.015}}{\text{IE}}$$

$$\text{EIATA} = \frac{\text{LA x KL}}{\text{(IE x Tributary Imp. Area)}}$$

High-use Turf Landscaping

Drainage Area / Land Use Type	Total Area (ac)	Total Area (sf)	% Impervious	Impervious (sf)	Pervious / LA (sf)	Eto	KL	Modified EAWU	EAWU/ Impervious Acre	Minimum EAWU/ Impervious Acre (Table X.6)	Feasible?	EIATA	Minimum EIATA (Table X.8)	Drawdown (days)	Drawdown (hours)	% Capture (Fig. III.2)
Total onsite	2.5800	112,385	80%	89,908	22,477	2.93	0.7	768.34	372.26	730	no	0.19	0.51	61.5	1,477	
0	0.0000	0	0%	0	0		0.7	0.00	#DIV/0!			#DIV/0!		#DIV/0!	#DIV/0!	
0	0.0000	0	0%	0	0		0.7	0.00	#DIV/0!			#DIV/0!		#DIV/0!	#DIV/0!	
0	0.0000	0	0%	0	0		0.7	0.00	#DIV/0!			#DIV/0!		#DIV/0!	#DIV/0!	
0	0.0000	0	0%	0	0		0.7	0.00	#DIV/0!			#DIV/0!		#DIV/0!	#DIV/0!	
0	0.0000	0	0%	0	0		0.7	0.00	#DIV/0!			#DIV/0!		#DIV/0!	#DIV/0!	

Low Water Use Landscaping

Drainage Area / Land Use Type	Total Area (ac)	Total Area (sf)	% Impervious	Impervious (sf)	Pervious / LA (sf)	Eto	KL	Modified EAWU	EAWU/ Impervious Acre	Minimum EAWU/ Impervious Acre (Table X.6)	Feasible?	EIATA	Minimum EIATA (Table X.8)	Drawdown (days)	Drawdown (hours)	% Capture (Fig. III.2)
Total onsite	2.580	112,385	80%	89,908	22,477	2.93	0.35	384.17	186.13	730	no	0.10	1.01	123.1	2,954	
0	0.000	0	0%	0	0		0.35	0.00	#DIV/0!			#DIV/0!		#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.35	0.00	#DIV/0!			#DIV/0!		#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.35	0.00	#DIV/0!			#DIV/0!		#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.35	0.00	#DIV/0!			#DIV/0!		#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.35	0.00	#DIV/0!			#DIV/0!		#DIV/0!	#DIV/0!	

Blend of High-Use and Low-Use Landscaping

Drainage Area / Land Use Type	Total Area (ac)	Total Area (sf)	% Impervious	Impervious (sf)	Pervious / LA (sf)	Eto	KL	Modified EAWU	EAWU/ Impervious Acre	Minimum EAWU/ Impervious Acre (Table X.6)	Feasible?	EIATA	Minimum EIATA (interpo-lated)	Drawdown (days)	Drawdown (hours)	% Capture (Fig. III.2)
Total onsite	2.580	112,385	80%	89,908	22,477	2.93	0.55	603.69	292.49	730	no	0.15	0.76	78.3	1,880	
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!			#DIV/0!	0.00	#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!			#DIV/0!	0.00	#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!			#DIV/0!	0.00	#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!			#DIV/0!	0.00	#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!			#DIV/0!	0.00	#DIV/0!	#DIV/0!	

TABLE X.6: HARVESTED WATER DEMAND THRESHOLDS FOR MINIMUM PARTIAL CAPTURE

Design Capture Storm Depth, inches	Wet Season Demand Required for Minimum Partial Capture, gpd per impervious acre
0.60	490
0.65	530
0.70	570
0.75	610
0.80	650
0.85	690
0.90	730
0.95	770
1.00	810

TABLE X.8: MINIMUM IRRIGATED AREA FOR POTENTIAL PARTIAL CAPTURE FEASIBILITY

General Landscape Type	Conservation Design: KL = 0.35			Active Turf Areas: KL = 0.7		
Closest ET Station	Irvine	Santa Ana	Laguna	Irvine	Santa Ana	Laguna
Design Capture Storm Depth, inches	Minimum Required Irrigated Area per Tributary Impervious Acre for Potential Partial Capture, ac/ac					
0.60	0.66	0.68	0.72	0.33	0.34	0.36
0.65	0.72	0.73	0.78	0.36	0.37	0.39
0.70	0.77	0.79	0.84	0.39	0.39	0.42
0.75	0.83	0.84	0.9	0.41	0.42	0.45
0.80	0.88	0.9	0.96	0.44	0.45	0.48
0.85	0.93	0.95	1.02	0.47	0.48	0.51
0.90	0.99	1.01	1.08	0.49	0.51	0.54
0.95	1.04	1.07	1.14	0.52	0.53	0.57
1.00	1.1	1.12	1.2	0.55	0.56	0.6

Source: Technical Guidance Document for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (WQMPs). March 22, 2011. Appendix X.

Worksheet J: Summary of Harvested Water Demand and Feasibility

Project: Esperanza Village

Date: 6/3/2021

1	What demands for harvested water exist in the tributary area (check all that apply):			
2	Toilet and urinal flushing			
3	Landscape irrigation		✓	
4	Other: _____			
5	What is the design capture storm depth? (Figure III.1)	d	0.90	inches
6	What is the project size?	A	2.58	ac
7	What is the acreage of impervious area?	IA	2.06	ac
For projects with multiple types of demand (toilet flushing, irrigation demand, and/or other demand)				
8	What is the minimum use required for partial capture? (Table X.6)		N/A	gpd
9	What is the project estimated wet season total daily use (Section X.2)?		N/A	gpd
10	Is partial capture potentially feasible? (Line 9 > Line 8?)		N/A	
For projects with only toilet flushing demand				
11	What is the minimum TUTIA for partial capture? (Table X.7)		N/A	
12	What is the project estimated TUTIA?		N/A	
13	Is partial capture potentially feasible? (Line 12 > Line 11?)		N/A	
For projects with only irrigation demand				
14	What is the minimum irrigation area required based on conservation landscape design? (Table X.8)		2.04	ac
15	What is the proposed project irrigated area? (multiply conservation landscaping by 1; multiply active turf by 2)		0.77	ac
16	Is partial capture potentially feasible? (Line 15 > Line 14?)		No	

Provide supporing assumptions and citations for controlling demand calculation:

Minimum EIATA for Active Turf per Table X.8 =	*0.51*	*ac/ac*
Minimum EIATA for Conservation-Type Landscaping per Table X.8 =	*1.01*	*ac/ac*
Minimum Irrigated Area = Project Impervious Area ÷ EIATA		
Minimum Irrigated Area for 100% Active Turf Landscaping =	*4.05*	*ac*
Minimum Irrigated Area for 100% Conservation Landscaping =	*2.04*	*ac*
Proposed Landscaping Type =	*50% Turf; 50% Conservation*	
Total Proposed Irrigated Area for Active Turf Type =	*0.255*	*ac*
Total Proposed Irrigated Area for Conservation Type =	*0.255*	*ac*

TABLE X.6: HARVESTED WATER DEMAND THRESHOLDS FOR MINIMUM PARTIAL CAPTURE

Design Capture Storm Depth, inches	Wet Season Demand Required for Minimum Partial Capture, gpd per impervious acre
0.60	490
0.65	530
0.70	570
0.75	610
0.80	650
0.85	690
0.90	730
0.95	770
1.00	810

TABLE X.7: MINIMUM TUTIA FOR MINIMUM PARTIAL CAPTURE

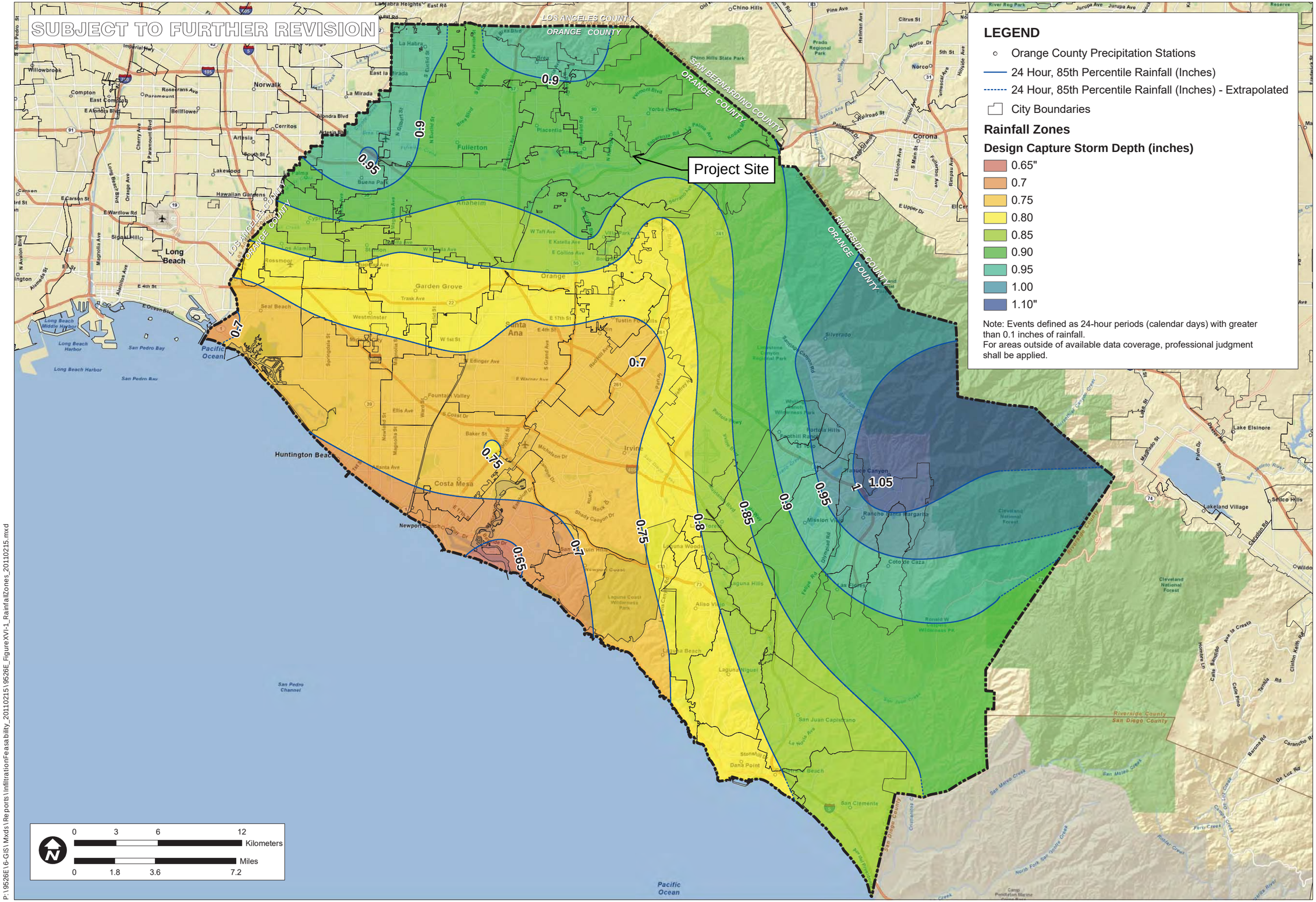
Project Type	Residential	Retail and Office Commercial	Industrial	Schools[1]
Basis of Toilet User Calculation	*Resident*	*Employee (non-visitor)*	*Employee (non-visitor)*	*Employee (non-student)*
Design Capture Storm Depth, inches	**Minimum TUTIA Ratio Required for Minimum Partial Capture (toilet users/impervious acre)**			
0.60	74	98	125	21
0.65	80	106	135	23
0.70	86	114	145	24
0.75	92	122	155	26
0.80	98	130	165	28
0.85	104	138	176	30
0.90	110	146	186	31
0.95	117	154	196	33
1.00	123	162	206	35

1 - Based on employees only; assumes approximately 5 students per employee.

TABLE X.8: MINIMUM IRRIGATED AREA FOR POTENTIAL PARTIAL CAPTURE FEASIBILITY

General Landscape Type	Conservation Design: KL = 0.35			Active Turf Areas: KL = 0.7		
Closest ET Station	**Irvine**	**Santa Ana**	**Laguna**	**Irvine**	**Santa Ana**	**Laguna**
Design Capture Storm Depth, inches	**Minimum Required Irrigated Area per Tributary Impervious Acre for Potential Partial Capture, ac/ac**					
0.60	0.66	0.68	0.72	0.33	0.34	0.36
0.65	0.72	0.73	0.78	0.36	0.37	0.39
0.70	0.77	0.79	0.84	0.39	0.39	0.42
0.75	0.83	0.84	0.9	0.41	0.42	0.45
0.80	0.88	0.9	0.96	0.44	0.45	0.48
0.85	0.93	0.95	1.02	0.47	0.48	0.51
0.90	0.99	1.01	1.08	0.49	0.51	0.54
0.95	1.04	1.07	1.14	0.52	0.53	0.57
1.00	1.1	1.12	1.2	0.55	0.56	0.6

SUBJECT TO FURTHER REVISION



TITLE
RAINFALL ZONES

JOB
ORANGE COUNTY
TECHNICAL GUIDANCE
DOCUMENT
ORANGE CO. CA

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

PACE
Advanced Water Engineering

FIGURE
XVI-1

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-1_RainfallZones_20110215.mxd

SUBJECT TO FURTHER REVISION

Project Site

LEGEND

City Boundaries

Hydrologic Soil Groups

D Soils

Source:
D Soils: Natural Resources Conservation Service (NRCS)
Soil Survey - soil_ca678, Orange County & Western Riverside
Date of publication: 2006-02-08
http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

0 2.5 5 10 Kilometers

0 1.8 3.6 7.2 Miles

TITLE: HYDROLOGIC SOIL GROUP TYPE D NRCS SOIL SURVEY

ORANGE COUNTY INFILTRATION STUDY

CA

JOB: ORANGE CO.

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

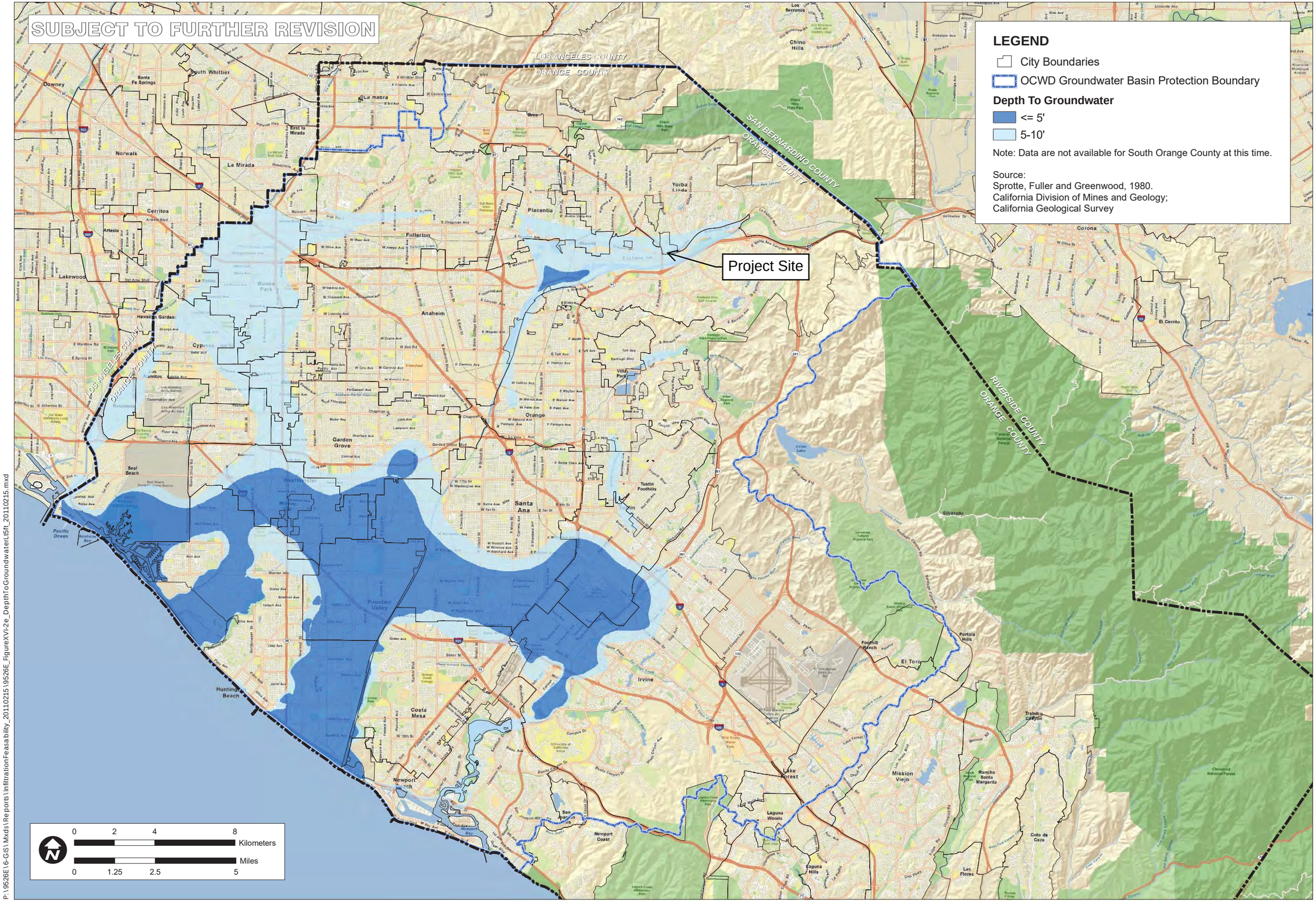
PACE Advanced Water Engineering

FIGURE

XVI-2b

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2b_D-Soils_20110215.mxd

SUBJECT TO FURTHER REVISION



LEGEND

- City Boundaries
- OCWD Groundwater Basin Protection Boundary

Depth To Groundwater

- <= 5'
- 5-10'

Note: Data are not available for South Orange County at this time.

Source:
Sprotte, Fuller and Greenwood, 1980.
California Division of Mines and Geology;
California Geological Survey

TITLE

NORTH ORANGE COUNTY
MAPPED SHALLOW GROUNDWATER

ORANGE COUNTY
INFILTRATION STUDY

CA

JOB

ORANGE CO.

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

PACE
Advanced Water Engineering

FIGURE

XVI-2e

P:\9526E\16-GIS\Mxds\Reports\Infiltration\Feasability_20110215\9526E_FigureXVI-2e_DepthToGroundwaterLt5ft_20110215.mxd

Susceptibility

Potential Areas of Erosion, Habitat, & Physical Structure Susceptibility

Channel Type

Earth (Unstable)
Earth (Stabilized)
Stabilized

Tidel Influence

<= Mean High Water Line (4.28')

Water Body

Basin
Dam
Lake
Reservoir

Forest Areas

Cleveland National Forest

Federal Lands

Amarus Salt Marsh

San Gabriel-Coyote Creek Watershed

San Bernardino County

Riverside County

South Orange County

Newport Bay Watershed

AnaheimBay-HuntingtonHarbor Watershed

Carbon Canyon

Yorba Linda Reservoir

Miller Retarding Basin

Anaheim Lake

Warner Basin

Kraemer Basin

Project Site

Walnut Canyon Reservoir

Olive Hills

Fletcher Retarding Basin

Villa Park Dam

Peters Canyon Reservoir

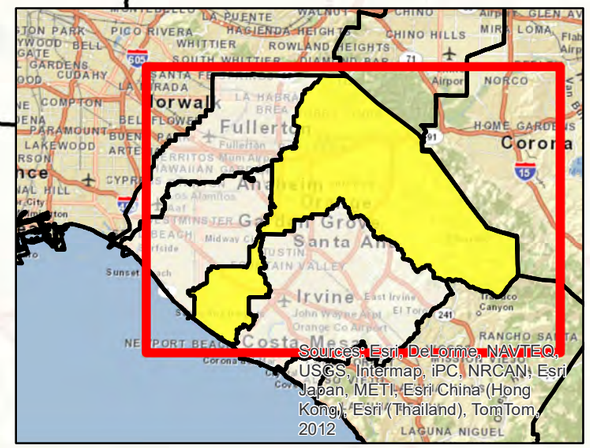
Irvine Lake

Cleveland National Forest

Stabilized by Grade Control Structure

SOUTHPARK PUMP STATION

Bartlett Retarding Basin



0 12,000 24,000 Feet

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

P:\9526E\16-GIS\Mxds\SuceptabilityMaps_20100505\9526E_SantaAnaRiverSusceptibility_20100430.mxd

TITLE: SUSCEPTIBILITY ANALYIS SANTA ANA RIVER

JOB: ORANGE COUNTY WATERSHED MASTER PLANNING ORANGE CO. CA

SCALE	1" = 12000'
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/30/10
JOB NO.	9526-E

PACE Advanced Water Engineering

FIGURE 3

Appendix B

Notice of Transfer of Responsibility

NOTICE OF TRANSFER OF RESPONSIBILITY

WATER QUALITY MANAGEMENT PLAN

Esperanza Village
VTTM 19161

Submission of this Notice Of Transfer of Responsibility constitutes notice to the City of Yorba Linda that responsibility for the Water Quality Management Plan ("WQMP") for the subject property identified below, and implementation of that plan, is being transferred from the Previous Owner (and his/her agent) of the site (or a portion thereof) to the New Owner, as further described below.

I. Previous Owner/ Previous Responsible Party Information

Company/ Individual Name:		Contact Person:	
Street Address:		Title:	
City:	State:	ZIP:	Phone:

II. Information about Site Transferred

Name of Project (if applicable):	
Title of WQMP Applicable to site:	
Street Address of Site (if applicable):	
Planning Area (PA) and/ or Tract Number(s) for Site:	Lot Numbers (if Site is a portion of a tract):
Date WQMP Prepared (and revised if applicable):	

III. New Owner/ New Responsible Party Information

Company/ Individual Name:		Contact Person:	
Street Address:		Title:	
City:	State:	ZIP:	Phone:

IV. Ownership Transfer Information

General Description of Site Transferred to New Owner:	General Description of Portion of Project/ Parcel Subject to WQMP Retained by Owner (if any):

Lot/ Tract Numbers of Site Transferred to New Owner:
Remaining Lot/ Tract Numbers Subject to WQMP Still Held by Owner (if any):
Date of Ownership Transfer:

Note: When the Previous Owner is transferring a Site that is a portion of a larger project/ parcel addressed by the WQMP, as opposed to the entire project/parcel addressed by the WQMP, the General Description of the Site transferred and the remainder of the project/ parcel no transferred shall be set forth as maps attached to this notice. These maps shall show those portions of a project/ parcel addressed by the WQMP that are transferred to the New Owner (the Transferred Site), those portions retained by the Previous Owner, and those portions previously transferred by Previous Owner. Those portions retained by Previous Owner shall be labeled as "Previously Transferred".

V. Purpose of Notice of Transfer

The purposes of this Notice of Transfer of Responsibility are: 1) to track transfer of responsibility for implementation and amendment of the WQMP when property to which the WQMP is transferred from the Previous Owner to the New Owner, and 2) to facilitate notification to a transferee of property subject to a WQMP that such New Order is now the Responsible Party of record for the WQMP for those portions of the site that it owns.

VI. Certifications

A. Previous Owner

I certify under penalty of law that I am no longer the owner of the Transferred Site as described in Section II above. I have provided the New Owner with a copy of the WQMP applicable to the Transferred Site that the New Owner is acquiring from the Previous Owner.

Printed Name of Previous Owner Representative:	Title:
Signature of Previous Owner Representative:	Date:

B. New Owner

I certify under penalty of law that I am the owner of the Transferred Site, as described in Section II above, that I have been provided a copy of the WQMP, and that I have informed myself and understand the New Owner's responsibilities related to the WQMP, its implementation, and Best Management Practices associated with it. I understand that by signing this notice, the New Owner is accepting all ongoing responsibilities for implementation and amendment of the WQMP for the Transferred Site, which the New Owner has acquired from the Previous Owner.

Printed Name of New Owner Representative:	Title:
Signature:	Date:

APPENDIX C
EDUCATIONAL MATERIALS

Copies of educational materials listed in Section VII will be provided in the Final WQMP.

APPENDIX D

BMP MAINTENANCE SUPPLEMENT / O&M PLAN

OPERATIONS AND MAINTENANCE (O&M) PLAN

Water Quality Management Plan

For

Esperanza Village

TTM 19161

6821 Fairlynn Blvd.
Yorba Linda, CA 92886

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BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable? Yes/No	**BMP Name and BMP Implementation, Maintenance and Inspection Procedures**	**Implementation, Maintenance, and Inspection Frequency and Schedule**	**Person or Entity with Operation & Maintenance Responsibility**
NON-STRUCTURAL SOURCE CONTROL BMPs			
Yes	N1. Education for Property Owners, Tenants and Occupants	Educational materials will be provided to tenants annually. Materials to be distributed are found in Appendix C. Tenants will be provided these materials by the HOA prior to occupancy and periodically thereafter. Frequency: Annually	Owner/HOA
Yes	N2. Activity Restrictions	The owner and/or developer will prescribe activity restrictions to protect surface water quality, through lease terms or other equally effective measure, for the property. Restrictions include, but are not limited to, prohibiting vehicle maintenance or vehicle washing. Frequency: Ongoing	Owner/HOA
Yes	N3. Common Area Landscape Management	Maintenance shall be consistent with City requirements. Fertilizer and/or pesticide usage shall be consistent with County Management Guidelines for Use of Fertilizers (OC DAMP Section 5.5) as well as local requirements. 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 to prevent exposure of erodible surfaces. Trimmings, clippings, and other landscape wastes shall be properly disposed of in accordance with local	Owner/HOA

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
		regulations. Materials temporarily stockpiled during maintenance activities shall be placed away from water courses and storm drain inlets. Frequency: Monthly	
Yes	N4. BMP Maintenance	Maintenance of structural BMPs implemented at the project site shall be performed at the frequency prescribed in the O&M Plan included in this WQMP (Appendix D). Records of inspections and BMP maintenance shall be kept by the owner/developer and shall be available for review upon request. Frequency: Ongoing	Owner/HOA
No	N5. Title 22 CCR Compliance (How development will comply)	Not Applicable	
No	N6. Local Industrial Permit Compliance	Not Applicable	
No	N7. Spill Contingency Plan	Not Applicable	
No	N8. Underground Storage Tank Compliance	Not Applicable	
No	N9. Hazardous Materials Disclosure Compliance	Not Applicable	
No	N10. Uniform Fire Code Implementation	Not Applicable	
Yes	N11. Common Area Litter Control	Litter patrol, violations investigations, reporting and other litter control activities shall be performed on a weekly basis and in conjunction with routine maintenance activities.	Owner/HOA

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable? Yes/No	**BMP Name and BMP Implementation, Maintenance and Inspection Procedures**	**Implementation, Maintenance, and Inspection Frequency and Schedule**	**Person or Entity with Operation & Maintenance Responsibility**
		Frequency: Weekly	
Yes	N12. Employee Training	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 on an as needed basis. Frequency: Annually	Owner/HOA
No	N13. Housekeeping of Loading Docks	Not Applicable	
Yes	N14. Common Area Catch Basin Inspection	Catch basin inlets and other drainage facilities shall be inspected after each storm event and once per year. Storm drain inlets and other drainage facilities shall be cleaned prior to the rainy season, by October 1 each year. Frequency: Annually	Owner/HOA
Yes	N15. Street Sweeping Private Streets and Parking Lots	Private streets will be swept on a quarterly basis, at minimum. Frequency: Quarterly	Owner/HOA
No	N16. Retail Gasoline Outlets	Not Applicable	
STRUCTURAL SOURCE CONTROL BMPs			
Yes	S1. Provide storm drain system stenciling and signage	Storm drain stencils shall be inspected for legibility, at minimum, once prior to the storm season, no later than October 1 each year. Those determined to be illegible will be re-stenciled as soon as possible.	Owner/HOA

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable? Yes/No	**BMP Name and BMP Implementation, Maintenance and Inspection Procedures**	**Implementation, Maintenance, and Inspection Frequency and Schedule**	**Person or Entity with Operation & Maintenance Responsibility**
		Frequency: Annually	
No	S2. Design and construct outdoor material storage areas to reduce pollution introduction	Not Applicable	
No	S3. Design and construct trash and waste storage areas to reduce pollution introduction	Not Applicable	
Yes	S4. Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	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, and day or night time temperatures. System testing shall occur twice per year. Water from testing/flushing shall be collected and properly disposed to the sewer system and shall not discharge to the storm drain system. Frequency:	Owner/HOA
Yes	S5. Protect slopes and channels and provide energy dissipation	To be performed in conjunction with maintenance activities. Maintain vegetative cover and/or mulch to eliminate exposed soils. Any eroded surfaces to be repaired immediately. Inspections to be performed twice each year (spring and fall) and after major storm events to check for signs of erosion, gullies, and sloughing. Frequency: Monthly	Owner/HOA

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
No	S6. Dock areas	Not Applicable	
No	S7. Maintenance bays	Not Applicable	
No	S8. Vehicle wash areas	Not Applicable	
No	S9. Outdoor processing areas	Not Applicable	
No	S10. Equipment wash areas	Not Applicable	
No	S11. Fueling areas	Not Applicable	
No	S12. Hillside landscaping	Not Applicable	
No	S13. Wash water control for food preparation areas	Not Applicable	
No	S14. Community car wash racks	Not Applicable	

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX		
BMP Name and BMP Implementation, Maintenance and Inspection Procedures	**Implementation, Maintenance, and Inspection Frequency and Schedule**	**Person or Entity with Operation & Maintenance Responsibility**
LOW IMPACT DEVELOPMENT BMPs		
Impervious Area Dispersion & Self-Treating Areas	In conjunction with routine landscaping maintenance activities, maintain vegetative cover and/or mulch to eliminate exposed soils. Any eroded surfaces to be repaired immediately. Inspections to be performed twice each year (spring and fall) and after major storm events to check for signs of erosion, gullies, excess sediment build-up and sloughing. Frequency: Monthly	Owner/HOA
Rain Gardens	Inspect BMPs semi-annually or after major storm events to check for maintenance needs and function. Routine maintenance shall be performed in conjunction with routine maintenance activities to ensure consistently high performance and extend facility life. Routine maintenance activities include: ▪ Maintain vegetation and media to perpetuate a robust vegetative and microbial community (thin/trim vegetation, replace spent media and mulch). ▪ Periodically remove dead vegetative biomass to prevent export of nutrients or clogging of the system. ▪ Remove accumulated sediment before it significantly interferes with system function. ▪ Conduct maintenance to prevent surface clogging (surface scarring, raking, mulch replacement, etc.). ▪ Maintain splash blocks/energy dissipation and scour-protection as required based on facility inspection.	Owner/HOA

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX		
BMP Name and BMP Implementation, Maintenance and Inspection Procedures	**Implementation, Maintenance, and Inspection Frequency and Schedule**	**Person or Entity with Operation & Maintenance Responsibility**
	▪ Routinely remove accumulated sediment at the inlet and outlet and trash and debris from the area. ▪ Repair torn or broken liners as necessary. Major maintenance shall be provided when the performance of the facility declines significantly and cannot be restored through routine maintenance. Frequency: 2x per year	
Biotreatment BMP # 1: Modular Wetland Systems	The Modular Wetland units shall be maintained in accordance with manufacturer's specifications. The system shall be inspected at a minimum of once every six months, prior to the start of the rainy season (October 1) each year, and after major storm events. Typical maintenance includes: ▪ Removing trash & debris from the catch basin screening filter (by hand, 2x per year at a minimum). ▪ Removal of sediment and solids in the settlement chamber (vacuum truck, once per year at a minimum). ▪ Replacement of the BioMediaGREEN™ filter cartridge and drain-down filter (if equipped, once per year at a minimum) ▪ Trim plants within the wetland chamber as needed in conjunction with routine landscape maintenance activities (typically 2x per year). No fertilizer shall be used. Wetland chamber should be inspected during rain events to verify flow through the system. If little to no flow is observed from the lower valve or orifice plate, the wetland media may require replacement. If prior treatment stages are properly maintained, the life of the wetland media can be up to 20 years. Frequency: 2x per year	Owner/HOA

Required Permits

Permits are not required for the implementation, operation, and maintenance of the BMPs.

Forms to Record BMP Implementation, Maintenance, and Inspection

The form that will be used to record implementation, maintenance, and inspection of BMPs is attached.

Recordkeeping

All records must be maintained for at least five (5) years and must be made available for review upon request.

Waste Management

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.

RECORD OF BMP IMPLEMENTATION, MAINTENANCE, AND INSPECTION

Today's Date: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

RECORD OF BMP IMPLEMENTATION, MAINTENANCE, AND INSPECTION

Today's Date: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

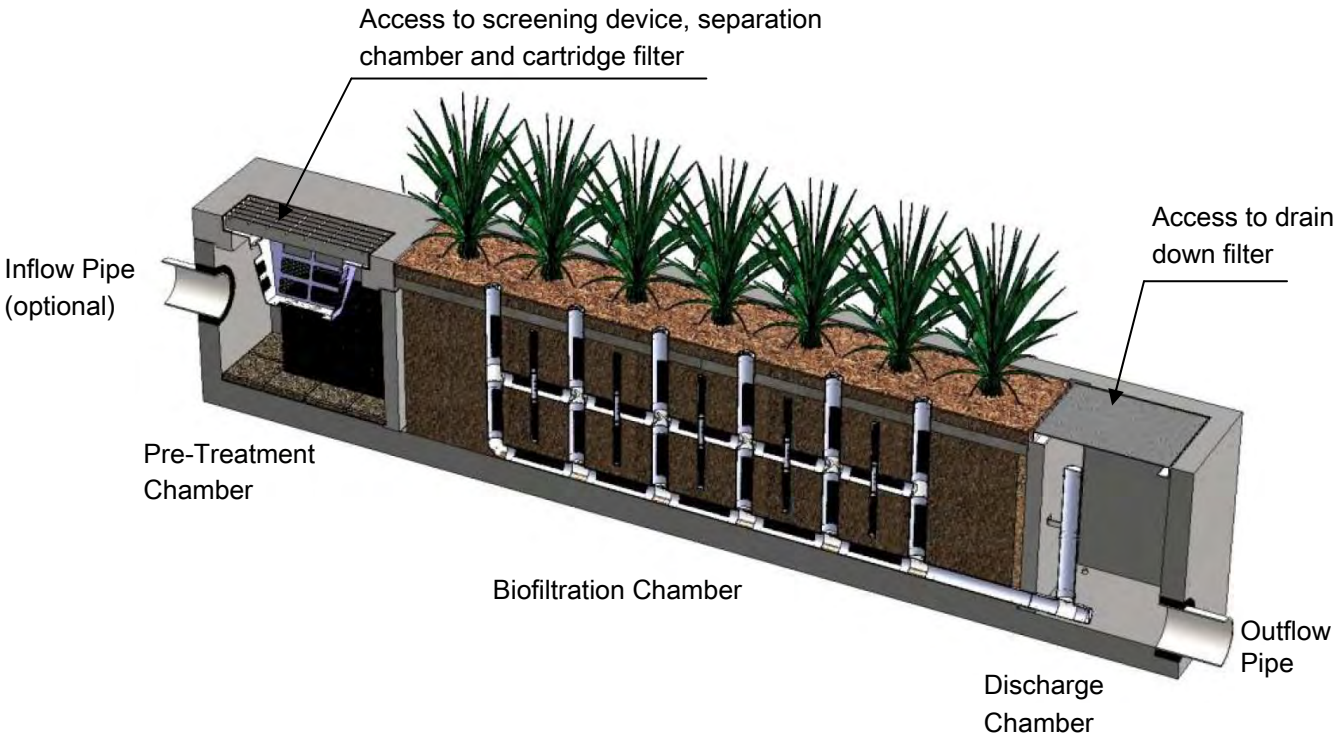
BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

Maintenance Guidelines for Modular Wetland System - Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

Maintenance Procedure Illustration

Screening Device

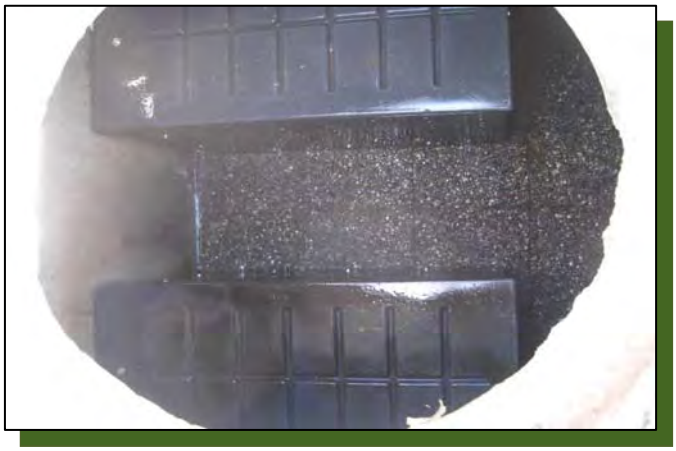
The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.

Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.

Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.



Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.

Inspection Form

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Inspection Report
Modular Wetlands System

Project Name _____

Project Address _____ (city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ___/___/___ Time _____ AM / PM

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

Structural Integrity:	**Yes**	**No**	**Comments**
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	**Yes**	**No**
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: _____

2972 San Luis Rey Road, Oceanside, CA 92058 P (760) 433-7640 F (760) 433-3176

Maintenance Report

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

2972 San Luis Rey Road, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

APPENDIX E

CONDITIONS OF APPROVAL

APPENDIX F

INFILTRATION TEST RESULTS

Project No. W1249-88-01
March 31, 2021

Mr. Alex Wong
Red Oak Investments, LLC
4199 Campus Drive, #200
Irvine, California 92612

Subject: PERCOLATION TEST RESULTS
6821 FAIRLYNN BOULEVARD
YORBA LINDA, CALIFORNIA

References: *Preliminary Geotechnical Investigation, Proposed Residential Development, 6821 Fairlynn Boulevard, Yorba Linda, California,* prepared by Geocon West, Inc. dated November 20, 2020.

Dear Mr. Wong:

In accordance with your authorization of our proposal dated February 23, 2021, this letter has been prepared to present the results of the percolation testing performed at 6821 Fairlynn Boulevard in the City of Yorba Linda, California.

At the request of the project team, we performed percolation testing to evaluate the feasibility of onsite stormwater infiltration at the location provided to us by the civil engineer. Groundwater was encountered during our prior site exploration in boring B3 at a depth of approximately 21 feet below the ground surface. Based on these considerations, the proposed percolation boring was limited to a depth of 10 feet in order to maintain a 10-foot offset from known groundwater elevations.

Supplemental site exploration was performed on March 16, 2021 by excavating two 3¼ inch diameter borings to depths of approximately 4 and 10½ feet below ground surface with a hand auger and manual digging equipment. Boring P1 encountered refusal at a depth of approximately 4 feet. Boring P1A was performed approximately 5 feet north of P1 and excavated to a depth of approximately 10½ feet. The location of the borings are indicated on the Site Plan (see Figure 1) and logs of the borings are provided herein as Figures 2 and 3. Groundwater was encountered not encountered during our supplemental site exploration borings excavated to depth of approximately 10½ feet below the ground surfaces.

Subsequent to the boring excavation, slotted casing was placed in each percolation boring and the annular space between the casing and excavation was filled with filter pack. The boring was then filled with water to pre-saturate the soils. On March 17, 2021, the casings were refilled with water, and percolation test readings were performed after repeated flooding of the cased excavation.

Based on the test results, the average infiltration rate (adjusted percolation rate), for the earth materials encountered, is provided in the following table. The field-measured percolation rate has been adjusted to infiltration rates in accordance with the *County of Orange Technical Guidance Document for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (December 2013)*. The percolation test results are provided on Figure 4.

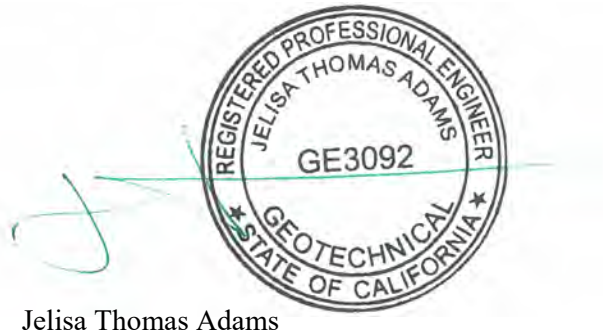
Boring	Soil Type	Infiltration Depth (ft)	Average Infiltration Rate (in / hour)
P1A	SP-SM, CL	5-10	0.1

The results of the percolation testing indicate that the infiltration rate within the alluvial soils is less than the generally accepted minimally required infiltration rate of 0.3 inches per hour. Therefore, based on these considerations, a stormwater infiltration system is not recommended for this development. It is suggested that stormwater be retained, filtered and discharged in accordance with the requirements of the local governing agency.

Should you have any questions regarding this letter, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON WEST, INC.



John Stapleton
Staff Engineer

Jelisa Thomas Adams
GE 3092

Attachments: Figure 1, Site Plan
Figures 2 and 3, Boring Logs
Figure 4, Percolation Test Data Sheet

LEGEND

P1A — Approximate Location of Percolation Boring (2021)

B6 — Approximate Location of Prior Boring (2020)

Approximate Limits of Proposed Development

0 50' 100'

GEOCON WEST, INC.

ENVIRONMENTAL GEOTECHNICAL MATERIALS
15520 ROCKFIELD BLVD. - SUITE J - IRVINE, CA 92618
PHONE (949) 491-6570 - FAX (949) 299-4550

DRAFTED BY: JS	CHECKED BY: JTA

SITE PLAN

6821 FAIRLYNN BOULEVARD
YORBA LINDA, CALIFORNIA

MARCH 2021	PROJECT NO. W1249-88-01	FIG. 1

PROJECT NO. W1249-88-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING P1** ELEV. (MSL.) -- DATE COMPLETED **3/16/2021** EQUIPMENT **HAND AUGER** BY: **JS** MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT)*	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**AC: 3.25" BASE: 8"** **ARTIFICIAL FILL** Sandy Clay, firm, moist, reddish brown, fine- to medium-grained			
2	P1@2.5			SP	**ALLUVIUM** Sand with Gravel, dense, slightly moist, dark yellowish brown, medium- to course-grained sand, fine- to medium-grained gravel			
4					Total depth of boring: 4 feet (refusal) Fill to 2.7 feet No groundwater encountered Backfilled with soil cuttings and tamped Surface Patched NOTE: The stratification lines presented herein represent the appoximate boundary between earth types; the transitions may be gradual.			

W1249-88-01 BORING LOGS.GPJ

Figure 2,
Log of Boring P1, Page 1 of 1

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. W1249-88-01

BORING P1A

ELEV. (MSL.) -- DATE COMPLETED **3/16/2021**

EQUIPMENT **HAND AUGER** BY: **JS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT)*	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**AC: 3" BASE: 8"**			
					ARTIFICIAL FILL			
2					Sandy Clay, firm, moist, reddish brown, fine- to medium-grained			
	P1A@3'			SP	**ALLUVIUM** Sand with Gravel, dense, slightly moist, dark yellowish brown, medium- to course-grained sand, fine gravel			
4								
				SP-SM	Sand with Silt, medium dense, moist, brown, fine- to -medium grained			
6					Sandy Clay, firm to stiff, slightly moist, dark yellowish brown, fine-grained			
				CL				
8								
10	P1A@10'							
					Total depth of boring: 10.5 feet Fill to 2.5 feet No groundwater encountered Percolation testing performed Backfill with soil cuttings and tamped Surface Patched NOTE: The stratification lines presented herein represent the appoximate boundary between earth types; the transitions may be gradual.			

W1249-88-01 BORING LOGS.GPJ

Figure 3,
Log of Boring P1A, Page 1 of 1

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PERCOLATION TEST DATA SHEET

Project:	Red Oak - Esperanza	Project No:	W1249-88-01	Date:	3/17/2021
Test Hole No:	P1A	Tested By:	JS		
Depth of Test Hole, D_T:	10	USCS Soil Classification:	SP-SM/CL		
Test Hole Dimensions (inches)			Length	Width	
Diameter (if round) =	3.25	Sides (if rectangular) =	---	---	

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Δt Time Interval (min)	D_0 Initial Depth to Water (in)	D_f Final Depth to Water (in)	ΔD Change in Water Level (in)	Greater than or Equal to 6"? (y/n)
1	7:09	7:34	25	67.2	71.5	4.3	n
2	7:35	8:00	25	67.2	70.0	2.8	n

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements, taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min)	D_0 Initial Depth to Water (in)	D_f Final Depth to Water (in)	ΔD Change in Water Level (in)	Percolation Rate (min/in)
1	8:01	8:31	30	70.0	75.6	5.6	7660
2	8:31	9:01	30	69.4	74.4	5.0	8571
3	9:01	9:31	30	69.8	74.3	4.4	9730
4	9:31	10:01	30	70.2	74.4	4.2	10286
5	10:01	10:31	30	68.6	73.0	4.3	10000
6	10:31	11:01	30	70.3	73.3	3.0	14400
7							
8							

Infiltration Rate Calculation:

Time Interval, Δt =	30	minutes	Ho =	49.7	inches
Final Depth to Water, Df =	73.3	inches	Hf =	46.7	inches
Test Hole Radius, r =	1.625	inches	ΔH =	3.0	inches
Initial Depth to Water, Do =	70.3	inches	Havg =	48.2	inches
Total Depth of Test Hole, DT =	120.0	inches			

$$I_t = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Infiltration Rate, It = **0.10** inches/hour

Figure 4

FUSCOE
ENGINEERING

PRELIMINARY HYDROLOGY AND HYDRAULICS REPORT

Esperanza Village

Yorba Linda, California
County of Orange

Prepared for

Red Oak Investment, LLC
4199 Campus Drive
Irvine, CA 92612

Prepared by

Fuscoe Engineering, Inc.
16795 Von Karman, Suite 100
Irvine, California 92606
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REGISTERED PROFESSIONAL ENGINEER
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CIVIL
STATE OF CALIFORNIA

Project Manager:
Trevor Dodson, PE

Date Prepared: June, 2021

Job Number: 724.012.02

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PRELIMINARY
HYDROLOGY AND HYDRAULIC REPORT

Esperanza Village
City of Yorba Linda, California

PREPARED FOR

ROI Esperanza LLC
4199 Campus Drive, Suite 200
Irvine, CA 92612

PREPARED BY

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16795 VON KARMAN AVE
IRVINE, CA 92606
949.474.1960

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 GEOGRAPHIC SETTING

The project area consists of 2.58 acres± and is located north of Riverside Freeway 91 and east of Imperial Highway 90 in southeastern Orange County. It is at the corner intersection of Esperanza Road and Fairlynn Boulevard in the City of Yorba Linda.

1.2 PURPOSE OF THIS REPORT

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

To determine the storm water discharges generated within the project (see Appendix 1).

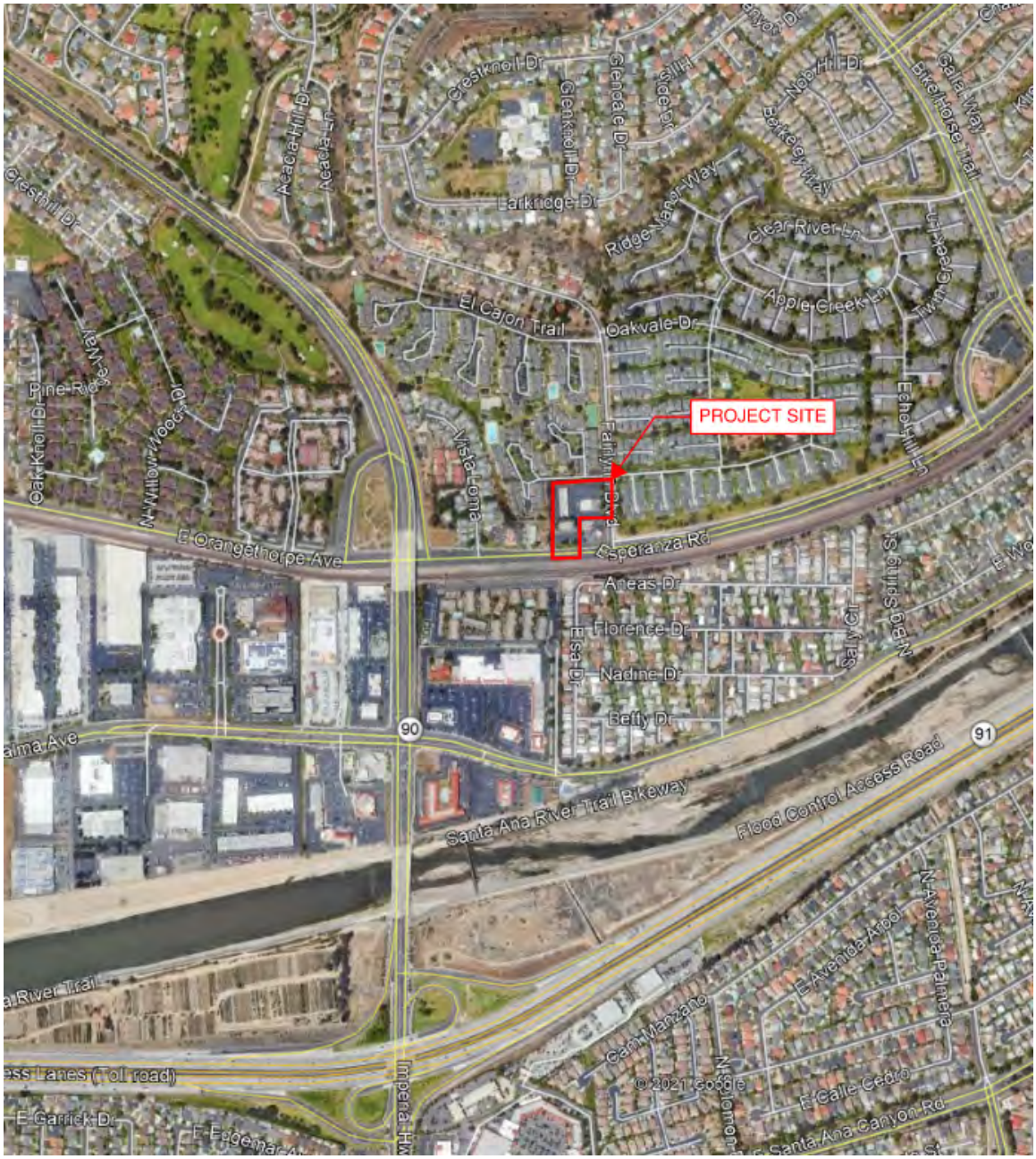
To support the design of local storm drains using the 25 year storm event. (see Appendix 2).

This report is for entitlement purposes to be updated during the construction document phase.

1.3 REFERENCES

- Orange County Hydrology Manual
- Orange County Local Drainage Manual

1.4 PROJECT SITE LOCATION MAP



2.0 EXISTING TOPOGRAPHIC CONDITIONS

2.1 EXISTING TOPOGRAPHY

The project site at its current condition is a commercial center comprising of 3 single story buildings with a parking lot surrounding it and a gas station. The gas station is not-a -part of the development and will remain.

2.2 EXISTING STORM DRAIN FACILITIES

The existing storm drain pipe running along Esperanza Road is a 112" WSP and a 54" RCP pipe which continues north to Fairlynn Boulevard. There is an existing catch basin on the north side of the curb at Esperanza Road approximately 250 ft westerly from the intersection of Fairlynn Boulevard and Esperanza Road. The storm drain lateral, assuming it to be 18" RCP, from the catch basin connects southerly to the existing 54" RCP.

3.0 PROPOSED STORM DRAIN FACILITIES

The private storm drain systems proposed for this project will have four (4) collection points with catch basins. The first one is located at the southeasterly curb entry at Fairlynn Boulevard designated as CB #1, the second one is at the northwesterly curb of the drive aisle designated as CB#2, the third one is 110 ft from the entry at Esperanza Road designated as CB #3 and the last one is at the entry at Esperanza Road designated as CB #4.

All these catch basins are connected via an 18" RCP pipe that runs north to south of the drive aisle and terminates to a junction structure connected to the existing 112" WSP at Esperanza Road.

4.0 HYDROLOGY

4.1 STORM FREQUENCY

This study is intended to determine local discharges for use in the design of storm drains and catch basins. A 25-year storm frequency was used as the minimum design criteria for sump conditions and hydraulics of the reinforced concrete pipes.

4.2 METHODOLOGY

This study was prepared in conformance with the Orange County Hydrology Manual. A.E.S. Computer Software was utilized to compile the hydrologic data and to determine the peak discharges. Peak discharges have been coordinated with the offsite storm drain plans.

5.0 HYDRAULICS

5.1 HYDROLOGY

The discharges for this analysis were determined by a hydrology study included in this report as Appendix 1.

5.2 STORM FREQUENCY

Consistent with the design criteria set forth in Section 4.1 of this report, a storm frequency of 25 year was used to size the pipe system.

5.3 METHODOLOGY

The hydraulic analysis includes catch basin sizing, street flow capacity calculation, and pipe flow analysis all using hydraulic elements – I program package by Advance Engineering Software (AES) and Bentley Flow Master.

6.0 DESIGN CRITERIA

The proposed storm drain systems will be designed to be consistent with the following goals and guidelines:

All buildings shall be protected from flooding during a 100-year frequency storm.

Onsite design storm is based on a 25-year frequency in sump conditions for catch basins and the connecting storm drain pipes also use a 25-year frequency.

Velocity should not exceed 20 FPS in a standard wall R.C.P.

Where velocity exceeds 20 FPS, a special wall R.C.P. with a minimum of 1½-inch steel clearance on the inside surface shall be used.

Maximum velocity in special cover R.C.P. shall be 45 FPS.

Maximum W.S. in CB's for design conditions shall be 0.5' below inlet (FL.) elevation.

Once water is picked up in a storm drain, it should remain in the system.

Pipe size may not be decreased downstream without County's approval.

7.0 RESULTS AND CONCLUSIONS

As a result of site development, it is our opinion that the proposed storm drain systems, designed to a Q25 Storm Frequency, will not have an adverse effect on any of the existing or proposed improvements within the project or adjacent public streets. In addition, all design criteria outlined above have been met.

8.0 APPENDICES

Appendix 1	*10, 25 & 100 Year Hydrology Study*
Appendix 2	*Proposed 25 Year Hydrology Map*
Appendix 3	*Hydraulic Studies*
Appendix 4	*Reference Plans*

APPENDIX 1

10 Year Storm Event

```
**************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
          (c) Copyright 1983-2014 Advanced Engineering Software (aes)
              Ver. 21.0  Release Date: 06/01/2014  License ID 1355

                           Analysis prepared by:

                              Fuscoe Engineering
                           16795 Von Karman Suite 100
                                  Irvine, CA
                                    92606

 ************************* DESCRIPTION OF STUDY *************************
* ESPERANZA VILLAGE                                                     *
* 10 YEAR STORM EVENT                                                   *
* JN #774.012  DEVELOPER: RED OAK INVESTMENT, LLC                       *
 ************************************************************************

  FILE NAME: EV10.DAT
  TIME/DATE OF STUDY: 14:16 06/02/2021
==========================================================================
  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   24.0     19.0    0.010/0.010/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 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) =   145.00
  ELEVATION DATA: UPSTREAM(FEET) =    319.10  DOWNSTREAM(FEET) =    317.55

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.879
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.700
  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        0.51      0.30     0.200    56    5.88
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      1.67
  TOTAL AREA(ACRES) =      0.51   PEAK FLOW RATE(CFS) =      1.67

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  317.55  DOWNSTREAM ELEVATION(FEET) =  316.60
  STREET LENGTH(FEET) =   150.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 24.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  19.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.010
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.010

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.51
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =   16.95
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.61
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.50
  STREET FLOW TRAVEL TIME(MIN.) =   1.56   Tc(MIN.) =    7.44
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.234
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.59      0.30     0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.59      SUBAREA RUNOFF(CFS) =    1.69
  EFFECTIVE AREA(ACRES) =      1.10    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       3.14

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  18.73
  FLOW VELOCITY(FEET/SEC.) =  1.67   DEPTH*VELOCITY(FT*FT/SEC.) =   0.55
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =     295.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     20.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   311.00  DOWNSTREAM(FEET) =   307.50
  FLOW LENGTH(FEET) =   160.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   6.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.73
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.14
  PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =    7.83
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     20.00 =     455.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     20.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.83
  RAINFALL INTENSITY(INCH/HR) =   3.14
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       1.10
  TOTAL STREAM AREA(ACRES) =       1.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.14

****************************************************************************
  FLOW PROCESS FROM NODE     18.00 TO NODE     19.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   305.00
  ELEVATION DATA: UPSTREAM(FEET) =    329.50  DOWNSTREAM(FEET) =    316.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.957
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.672
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  APARTMENTS                 B        0.37      0.30     0.200    56    5.96
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      1.20
  TOTAL AREA(ACRES) =      0.37   PEAK FLOW RATE(CFS) =      1.20
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     19.00 TO NODE     20.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   313.50  DOWNSTREAM(FEET) =   307.50
  FLOW LENGTH(FEET) =    23.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   2.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.39
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.20
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    5.99
  LONGEST FLOWPATH FROM NODE     18.00 TO NODE     20.00 =     328.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     20.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.99
  RAINFALL INTENSITY(INCH/HR) =   3.66
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.37
  TOTAL STREAM AREA(ACRES) =       0.37
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.20

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        3.14    7.83    3.139  0.30( 0.06) 0.20       1.1      10.00
      2        1.20    5.99    3.662  0.30( 0.06) 0.20       0.4      18.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.01    5.99    3.662  0.30( 0.06) 0.20       1.2      18.00
      2        4.17    7.83    3.139  0.30( 0.06) 0.20       1.5      10.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       4.17    Tc(MIN.) =     7.83
  EFFECTIVE AREA(ACRES) =       1.47   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        1.5
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     20.00 =     455.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   307.50  DOWNSTREAM(FEET) =   306.90
  FLOW LENGTH(FEET) =    34.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   9.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.49
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.17
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    7.92
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     21.00 =     489.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     21.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     15.00 TO NODE     16.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    51.00
  ELEVATION DATA: UPSTREAM(FEET) =    315.60  DOWNSTREAM(FEET) =    314.90

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  4.060
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.14      0.30     0.200    56    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.50
  TOTAL AREA(ACRES) =      0.14   PEAK FLOW RATE(CFS) =      0.50

****************************************************************************
  FLOW PROCESS FROM NODE     16.00 TO NODE     14.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   310.00  DOWNSTREAM(FEET) =   307.10
  FLOW LENGTH(FEET) =   330.00   MANNING'S N =  0.010
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   4.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.62
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.50
  PIPE TRAVEL TIME(MIN.) =   1.52    Tc(MIN.) =    6.52
  LONGEST FLOWPATH FROM NODE     15.00 TO NODE     14.00 =     381.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.52
  RAINFALL INTENSITY(INCH/HR) =   3.49
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.14
  TOTAL STREAM AREA(ACRES) =       0.14
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.50

****************************************************************************
  FLOW PROCESS FROM NODE     15.00 TO NODE     17.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   247.00
  ELEVATION DATA: UPSTREAM(FEET) =    315.60  DOWNSTREAM(FEET) =    314.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.259
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.045
  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        0.60      0.30     0.200    56    8.26
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      1.61
  TOTAL AREA(ACRES) =      0.60   PEAK FLOW RATE(CFS) =      1.61

****************************************************************************
  FLOW PROCESS FROM NODE     17.00 TO NODE     14.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  314.20  DOWNSTREAM ELEVATION(FEET) =  312.80
  STREET LENGTH(FEET) =    35.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 24.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  19.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.010
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.010

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.86
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.24
    HALFSTREET FLOOD WIDTH(FEET) =    9.82
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.05
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.73
```

```
  STREET FLOW TRAVEL TIME(MIN.) =   0.19   Tc(MIN.) =    8.45
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.005
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.19      0.30     0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.19      SUBAREA RUNOFF(CFS) =    0.50
  EFFECTIVE AREA(ACRES) =      0.79    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       2.09

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.25   HALFSTREET FLOOD WIDTH(FEET) =  10.42
  FLOW VELOCITY(FEET/SEC.) =  3.12   DEPTH*VELOCITY(FT*FT/SEC.) =   0.76
  LONGEST FLOWPATH FROM NODE     15.00 TO NODE     14.00 =     282.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.45
  RAINFALL INTENSITY(INCH/HR) =   3.01
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.79
  TOTAL STREAM AREA(ACRES) =       0.79
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.09

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        0.50    6.52    3.487  0.30( 0.06) 0.20       0.1      15.00
      2        2.09    8.45    3.005  0.30( 0.06) 0.20       0.8      15.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        2.38    6.52    3.487  0.30( 0.06) 0.20       0.7      15.00
      2        2.53    8.45    3.005  0.30( 0.06) 0.20       0.9      15.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       2.53    Tc(MIN.) =     8.45
  EFFECTIVE AREA(ACRES) =       0.93   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.9
  LONGEST FLOWPATH FROM NODE     15.00 TO NODE     14.00 =     381.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     21.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   307.10  DOWNSTREAM(FEET) =   306.90
  FLOW LENGTH(FEET) =    13.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   6.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.58
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.53
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    8.49
  LONGEST FLOWPATH FROM NODE     15.00 TO NODE     21.00 =     394.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     21.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        2.38    6.56    3.475  0.30( 0.06) 0.20       0.7      15.00
      2        2.53    8.49    2.997  0.30( 0.06) 0.20       0.9      15.00
  LONGEST FLOWPATH FROM NODE     15.00 TO NODE     21.00 =     394.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.01    6.07    3.631  0.30( 0.06) 0.20       1.2      18.00
      2        4.17    7.92    3.119  0.30( 0.06) 0.20       1.5      10.00
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     21.00 =     489.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        6.32    6.07    3.631  0.30( 0.06) 0.20       1.9      18.00
      2        6.44    6.56    3.475  0.30( 0.06) 0.20       2.0      15.00
      3        6.65    7.92    3.119  0.30( 0.06) 0.20       2.3      10.00
      4        6.53    8.49    2.997  0.30( 0.06) 0.20       2.4      15.00
    TOTAL AREA(ACRES) =         2.4

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =        6.65  Tc(MIN.) =    7.920
  EFFECTIVE AREA(ACRES) =      2.35  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        2.4
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     21.00 =     489.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     21.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   306.90  DOWNSTREAM(FEET) =   299.00
  FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.64
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.65
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    8.03
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     22.00 =     579.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     22.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.03
  RAINFALL INTENSITY(INCH/HR) =   3.09
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       2.35
  TOTAL STREAM AREA(ACRES) =       2.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       6.65

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     13.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    93.00
  ELEVATION DATA: UPSTREAM(FEET) =    312.80  DOWNSTREAM(FEET) =    305.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  4.060
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.51      0.30     0.200    56    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      1.84
  TOTAL AREA(ACRES) =      0.51   PEAK FLOW RATE(CFS) =      1.84
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     22.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   299.50  DOWNSTREAM(FEET) =   299.30
  FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   5.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.90
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.84
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =    5.05
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     22.00 =     108.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     22.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.05
  RAINFALL INTENSITY(INCH/HR) =   4.04
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.51
  TOTAL STREAM AREA(ACRES) =       0.51
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.84

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        6.32    6.18    3.594  0.30( 0.06) 0.20       1.9      18.00
      1        6.44    6.67    3.442  0.30( 0.06) 0.20       2.0      15.00
      1        6.65    8.03    3.094  0.30( 0.06) 0.20       2.3      10.00
      1        6.53    8.60    2.975  0.30( 0.06) 0.20       2.4      15.00
      2        1.84    5.05    4.036  0.30( 0.06) 0.20       0.5      14.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        7.64    5.05    4.036  0.30( 0.06) 0.20       2.1      14.00
      2        7.95    6.18    3.594  0.30( 0.06) 0.20       2.4      18.00
      3        8.00    6.67    3.442  0.30( 0.06) 0.20       2.5      15.00
      4        8.06    8.03    3.094  0.30( 0.06) 0.20       2.9      10.00
      5        7.88    8.60    2.975  0.30( 0.06) 0.20       2.9      15.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       8.06    Tc(MIN.) =     8.03
  EFFECTIVE AREA(ACRES) =       2.86   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        2.9
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     22.00 =     579.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     23.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   299.30  DOWNSTREAM(FEET) =   299.10
  FLOW LENGTH(FEET) =    53.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.33
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.06
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =    8.23
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     23.00 =     632.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        2.9  TC(MIN.) =      8.23
  EFFECTIVE AREA(ACRES) =      2.86  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.200
  PEAK FLOW RATE(CFS)   =       8.06

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        7.64    5.26    3.945  0.30( 0.06) 0.20       2.1      14.00
      2        7.95    6.39    3.527  0.30( 0.06) 0.20       2.4      18.00
      3        8.00    6.87    3.383  0.30( 0.06) 0.20       2.5      15.00
      4        8.06    8.23    3.050  0.30( 0.06) 0.20       2.9      10.00
      5        7.88    8.80    2.935  0.30( 0.06) 0.20       2.9      15.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

25 Year Storm Event

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

                             Fuscoe Engineering
                          16795 Von Karman Suite 100
                                 Irvine, CA
                                   92606

 ************************** DESCRIPTION OF STUDY **************************
* ESPERANZA VILLAGE                                                      *
* 25 YEAR HYDROLOGY CALC                                                 *
* JN# 774.012 DEVELOPER: RED OAK INVESTMENTS                             *
 **************************************************************************

  FILE NAME: EV25.DAT
  TIME/DATE OF STUDY: 10:38 06/01/2021
==========================================================================
  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   24.0     19.0    0.010/0.010/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 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) =   145.00
  ELEVATION DATA: UPSTREAM(FEET) =    319.10  DOWNSTREAM(FEET) =    317.55

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.879
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.401
```

```
  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        0.51      0.30     0.200    56    5.88
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      1.99
  TOTAL AREA(ACRES) =      0.51   PEAK FLOW RATE(CFS) =      1.99

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  317.55  DOWNSTREAM ELEVATION(FEET) =  316.60
  STREET LENGTH(FEET) =   150.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 24.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  19.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.010
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.010

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.00
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =   18.29
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.67
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.54
  STREET FLOW TRAVEL TIME(MIN.) =   1.50   Tc(MIN.) =    7.38
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.870
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.59      0.30     0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.59      SUBAREA RUNOFF(CFS) =    2.02
  EFFECTIVE AREA(ACRES) =      1.10    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       3.77

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  20.07
  FLOW VELOCITY(FEET/SEC.) =  1.76   DEPTH*VELOCITY(FT*FT/SEC.) =   0.60
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =     295.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     20.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   311.00  DOWNSTREAM(FEET) =   307.50
  FLOW LENGTH(FEET) =   160.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.00
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.77
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =    7.76
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     20.00 =     455.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     20.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.76
  RAINFALL INTENSITY(INCH/HR) =   3.76
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       1.10
  TOTAL STREAM AREA(ACRES) =       1.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.77

****************************************************************************
  FLOW PROCESS FROM NODE     18.00 TO NODE     19.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   305.00
  ELEVATION DATA: UPSTREAM(FEET) =    329.50  DOWNSTREAM(FEET) =    316.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.957
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.368
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  APARTMENTS                 B        0.37      0.30     0.200    56    5.96
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      1.43
  TOTAL AREA(ACRES) =      0.37   PEAK FLOW RATE(CFS) =      1.43
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     19.00 TO NODE     20.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   313.50  DOWNSTREAM(FEET) =   307.50
  FLOW LENGTH(FEET) =    23.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   3.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.00
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.43
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    5.98
  LONGEST FLOWPATH FROM NODE     18.00 TO NODE     20.00 =     328.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     20.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.98
  RAINFALL INTENSITY(INCH/HR) =   4.36
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.37
  TOTAL STREAM AREA(ACRES) =       0.37
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.43

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        3.77    7.76    3.762  0.30( 0.06) 0.20       1.1      10.00
      2        1.43    5.98    4.357  0.30( 0.06) 0.20       0.4      18.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.81    5.98    4.357  0.30( 0.06) 0.20       1.2      18.00
      2        5.01    7.76    3.762  0.30( 0.06) 0.20       1.5      10.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       5.01    Tc(MIN.) =     7.76
  EFFECTIVE AREA(ACRES) =       1.47   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        1.5
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     20.00 =     455.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   307.50  DOWNSTREAM(FEET) =   306.90
 FLOW LENGTH(FEET) =    34.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  15.0 INCH PIPE IS   8.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.98
 ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       5.01
 PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    7.84
 LONGEST FLOWPATH FROM NODE     10.00 TO NODE     21.00 =     489.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     21.00 TO NODE     21.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE     15.00 TO NODE     16.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    51.00
 ELEVATION DATA: UPSTREAM(FEET) =    315.60  DOWNSTREAM(FEET) =    314.90

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.824
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "11+ DWELLINGS/ACRE"       B        0.14      0.30     0.200    56    5.00
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA RUNOFF(CFS) =      0.60
 TOTAL AREA(ACRES) =      0.14   PEAK FLOW RATE(CFS) =      0.60

****************************************************************************
 FLOW PROCESS FROM NODE     16.00 TO NODE     14.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   310.00  DOWNSTREAM(FEET) =   307.10
 FLOW LENGTH(FEET) =   330.00   MANNING'S N =  0.010
 DEPTH OF FLOW IN   6.0 INCH PIPE IS   4.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.74
 ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       0.60
 PIPE TRAVEL TIME(MIN.) =   1.47    Tc(MIN.) =    6.47
 LONGEST FLOWPATH FROM NODE     15.00 TO NODE     14.00 =     381.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    6.47
 RAINFALL INTENSITY(INCH/HR) =   4.17
 AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.30
 AREA-AVERAGED Ap =  0.20
 EFFECTIVE STREAM AREA(ACRES) =       0.14
 TOTAL STREAM AREA(ACRES) =       0.14
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.60

****************************************************************************
 FLOW PROCESS FROM NODE     15.00 TO NODE     17.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   247.00
 ELEVATION DATA: UPSTREAM(FEET) =    315.60  DOWNSTREAM(FEET) =    314.20

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.259
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.631
 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        0.60      0.30     0.200    56    8.26
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA RUNOFF(CFS) =      1.93
 TOTAL AREA(ACRES) =      0.60   PEAK FLOW RATE(CFS) =      1.93

****************************************************************************
 FLOW PROCESS FROM NODE     17.00 TO NODE     14.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  314.20  DOWNSTREAM ELEVATION(FEET) =  312.80
 STREET LENGTH(FEET) =    35.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 24.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  19.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.010
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.010

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.23
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.25
   HALFSTREET FLOOD WIDTH(FEET) =   10.71
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.17
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.79
```

```
  STREET FLOW TRAVEL TIME(MIN.) =   0.18   Tc(MIN.) =    8.44
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.586
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.19      0.30     0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.19      SUBAREA RUNOFF(CFS) =    0.60
  EFFECTIVE AREA(ACRES) =      0.79    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       2.51

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.25   HALFSTREET FLOOD WIDTH(FEET) =  11.31
  FLOW VELOCITY(FEET/SEC.) =  3.26   DEPTH*VELOCITY(FT*FT/SEC.) =   0.83
  LONGEST FLOWPATH FROM NODE     15.00 TO NODE     14.00 =     282.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.44
  RAINFALL INTENSITY(INCH/HR) =   3.59
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.79
  TOTAL STREAM AREA(ACRES) =       0.79
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.51

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        0.60    6.47    4.168  0.30( 0.06) 0.20       0.1      15.00
      2        2.51    8.44    3.586  0.30( 0.06) 0.20       0.8      15.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        2.84    6.47    4.168  0.30( 0.06) 0.20       0.7      15.00
      2        3.02    8.44    3.586  0.30( 0.06) 0.20       0.9      15.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       3.02    Tc(MIN.) =     8.44
  EFFECTIVE AREA(ACRES) =       0.93   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.9
  LONGEST FLOWPATH FROM NODE     15.00 TO NODE     14.00 =     381.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     21.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   307.10  DOWNSTREAM(FEET) =   306.90
  FLOW LENGTH(FEET) =    13.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.81
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.02
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    8.48
  LONGEST FLOWPATH FROM NODE     15.00 TO NODE     21.00 =     394.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     21.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        2.84    6.51    4.155  0.30( 0.06) 0.20       0.7      15.00
      2        3.02    8.48    3.577  0.30( 0.06) 0.20       0.9      15.00
  LONGEST FLOWPATH FROM NODE     15.00 TO NODE     21.00 =     394.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.81    6.07    4.324  0.30( 0.06) 0.20       1.2      18.00
      2        5.01    7.84    3.740  0.30( 0.06) 0.20       1.5      10.00
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     21.00 =     489.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        7.57    6.07    4.324  0.30( 0.06) 0.20       1.9      18.00
      2        7.70    6.51    4.155  0.30( 0.06) 0.20       2.0      15.00
      3        7.97    7.84    3.740  0.30( 0.06) 0.20       2.3      10.00
      4        7.81    8.48    3.577  0.30( 0.06) 0.20       2.4      15.00
    TOTAL AREA(ACRES) =         2.4

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =        7.97  Tc(MIN.) =    7.840
  EFFECTIVE AREA(ACRES) =      2.34  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        2.4
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     21.00 =     489.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE     21.00 TO NODE     21.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   306.90  DOWNSTREAM(FEET) =   299.00
 FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  12.0 INCH PIPE IS   8.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  14.16
 ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       7.97
 PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    7.95
 LONGEST FLOWPATH FROM NODE     10.00 TO NODE     22.00 =     579.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     22.00 TO NODE     22.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.95
 RAINFALL INTENSITY(INCH/HR) =   3.71
 AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.30
 AREA-AVERAGED Ap =  0.20
 EFFECTIVE STREAM AREA(ACRES) =       2.34
 TOTAL STREAM AREA(ACRES) =       2.40
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       7.97

****************************************************************************
 FLOW PROCESS FROM NODE     14.00 TO NODE     13.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    93.00
 ELEVATION DATA: UPSTREAM(FEET) =    312.80  DOWNSTREAM(FEET) =    305.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.824
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "11+ DWELLINGS/ACRE"       B        0.51      0.30     0.200    56    5.00
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA RUNOFF(CFS) =      2.19
 TOTAL AREA(ACRES) =      0.51   PEAK FLOW RATE(CFS) =      2.19
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     22.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   299.50  DOWNSTREAM(FEET) =   299.30
  FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   6.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.11
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.19
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =    5.05
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     22.00 =     108.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     22.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.05
  RAINFALL INTENSITY(INCH/HR) =   4.80
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.51
  TOTAL STREAM AREA(ACRES) =       0.51
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.19

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        7.57    6.17    4.281  0.30( 0.06) 0.20       1.9      18.00
      1        7.70    6.62    4.117  0.30( 0.06) 0.20       2.0      15.00
      1        7.97    7.95    3.711  0.30( 0.06) 0.20       2.3      10.00
      1        7.81    8.59    3.552  0.30( 0.06) 0.20       2.4      15.00
      2        2.19    5.05    4.797  0.30( 0.06) 0.20       0.5      14.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        9.13    5.05    4.797  0.30( 0.06) 0.20       2.1      14.00
      2        9.52    6.17    4.281  0.30( 0.06) 0.20       2.4      18.00
      3        9.57    6.62    4.117  0.30( 0.06) 0.20       2.5      15.00
      4        9.66    7.95    3.711  0.30( 0.06) 0.20       2.9      10.00
      5        9.42    8.59    3.552  0.30( 0.06) 0.20       2.9      15.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       9.66    Tc(MIN.) =     7.95
  EFFECTIVE AREA(ACRES) =       2.85   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        2.9
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     22.00 =     579.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     23.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   299.30  DOWNSTREAM(FEET) =   299.10
  FLOW LENGTH(FEET) =    53.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.58
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.66
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =    8.14
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     23.00 =     632.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        2.9  TC(MIN.) =      8.14
  EFFECTIVE AREA(ACRES) =      2.85  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.200
  PEAK FLOW RATE(CFS)   =       9.66

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        9.13    5.25    4.692  0.30( 0.06) 0.20       2.1      14.00
      2        9.52    6.37    4.207  0.30( 0.06) 0.20       2.4      18.00
      3        9.57    6.81    4.050  0.30( 0.06) 0.20       2.5      15.00
      4        9.66    8.14    3.661  0.30( 0.06) 0.20       2.9      10.00
      5        9.42    8.78    3.507  0.30( 0.06) 0.20       2.9      15.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

100 Year Storm Event

```
**************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 21.0  Release Date: 06/01/2014  License ID 1355

                           Analysis prepared by:

                              Fuscoe Engineering
                           16795 Von Karman Suite 100
                                  Irvine, CA
                                    92606

 ************************* DESCRIPTION OF STUDY *************************
* ESPERANZA VILLAGE                                                     *
* 100 YEAR STORM EVENT                                                  *
* JN #774.012  DEVELOPER: RED OAK INVESTMENT, LLC                       *
 ************************************************************************

  FILE NAME: EV100.DAT
  TIME/DATE OF STUDY: 13:51 06/02/2021
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

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

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   24.0     19.0    0.010/0.010/0.020   0.50    1.50 0.0312 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 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) =   145.00
  ELEVATION DATA: UPSTREAM(FEET) =    319.10  DOWNSTREAM(FEET) =    317.55

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.879
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.639
  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        0.51      0.30     0.200    56    5.88
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      2.56
  TOTAL AREA(ACRES) =      0.51   PEAK FLOW RATE(CFS) =      2.56

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  317.55  DOWNSTREAM ELEVATION(FEET) =  316.60
  STREET LENGTH(FEET) =   150.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 24.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  19.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.010
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.010

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.87
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
    HALFSTREET FLOOD WIDTH(FEET) =   20.36
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.76
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.61
  STREET FLOW TRAVEL TIME(MIN.) =   1.42   Tc(MIN.) =    7.30
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.980
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.59      0.30     0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.59      SUBAREA RUNOFF(CFS) =    2.61
  EFFECTIVE AREA(ACRES) =      1.10    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       4.87

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  22.29
  FLOW VELOCITY(FEET/SEC.) =  1.86   DEPTH*VELOCITY(FT*FT/SEC.) =   0.68
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =     295.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     20.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   311.00  DOWNSTREAM(FEET) =   307.50
  FLOW LENGTH(FEET) =   160.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   9.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.26
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.87
  PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =    7.67
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     20.00 =     455.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     20.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.67
  RAINFALL INTENSITY(INCH/HR) =   4.84
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       1.10
  TOTAL STREAM AREA(ACRES) =       1.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       4.87

****************************************************************************
  FLOW PROCESS FROM NODE     18.00 TO NODE     19.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   305.00
  ELEVATION DATA: UPSTREAM(FEET) =    329.50  DOWNSTREAM(FEET) =    316.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.957
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.596
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  APARTMENTS                 B        0.37      0.30     0.200    56    5.96
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      1.84
  TOTAL AREA(ACRES) =      0.37   PEAK FLOW RATE(CFS) =      1.84
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     19.00 TO NODE     20.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   313.50  DOWNSTREAM(FEET) =   307.50
  FLOW LENGTH(FEET) =    23.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   3.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.90
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.84
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    5.98
  LONGEST FLOWPATH FROM NODE     18.00 TO NODE     20.00 =     328.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     20.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.98
  RAINFALL INTENSITY(INCH/HR) =   5.58
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.37
  TOTAL STREAM AREA(ACRES) =       0.37
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.84

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.87    7.67    4.842  0.30( 0.06) 0.20       1.1      10.00
      2        1.84    5.98    5.583  0.30( 0.06) 0.20       0.4      18.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        6.23    5.98    5.583  0.30( 0.06) 0.20       1.2      18.00
      2        6.47    7.67    4.842  0.30( 0.06) 0.20       1.5      10.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       6.47    Tc(MIN.) =     7.67
  EFFECTIVE AREA(ACRES) =       1.47   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        1.5
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     20.00 =     455.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   307.50  DOWNSTREAM(FEET) =   306.90
  FLOW LENGTH(FEET) =    34.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  15.0 INCH PIPE IS  10.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.36
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.47
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    7.75
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     21.00 =     489.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     21.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     15.00 TO NODE     16.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    51.00
  ELEVATION DATA: UPSTREAM(FEET) =    315.60  DOWNSTREAM(FEET) =    314.90

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.187
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.14      0.30     0.200    56    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      0.77
  TOTAL AREA(ACRES) =      0.14   PEAK FLOW RATE(CFS) =      0.77

****************************************************************************
  FLOW PROCESS FROM NODE     16.00 TO NODE     14.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   310.00  DOWNSTREAM(FEET) =   307.10
  FLOW LENGTH(FEET) =   330.00   MANNING'S N =  0.010
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   4.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.10
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.77
  PIPE TRAVEL TIME(MIN.) =   1.34    Tc(MIN.) =    6.34
  LONGEST FLOWPATH FROM NODE     15.00 TO NODE     14.00 =     381.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.34
  RAINFALL INTENSITY(INCH/HR) =   5.40
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.14
  TOTAL STREAM AREA(ACRES) =       0.14
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.77

****************************************************************************
  FLOW PROCESS FROM NODE     15.00 TO NODE     17.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   247.00
  ELEVATION DATA: UPSTREAM(FEET) =    315.60  DOWNSTREAM(FEET) =    314.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.259
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.641
  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        0.60      0.30     0.200    56    8.26
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      2.47
  TOTAL AREA(ACRES) =      0.60   PEAK FLOW RATE(CFS) =      2.47

****************************************************************************
  FLOW PROCESS FROM NODE     17.00 TO NODE     14.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  314.20  DOWNSTREAM ELEVATION(FEET) =  312.80
  STREET LENGTH(FEET) =    35.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 24.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  19.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.010
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.010

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.86
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.26
    HALFSTREET FLOOD WIDTH(FEET) =   12.05
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.34
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.88
```

```
  STREET FLOW TRAVEL TIME(MIN.) =   0.17   Tc(MIN.) =    8.43
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.586
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.19      0.30     0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.19      SUBAREA RUNOFF(CFS) =    0.77
  EFFECTIVE AREA(ACRES) =      0.79    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       3.22

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =  12.64
  FLOW VELOCITY(FEET/SEC.) =  3.46   DEPTH*VELOCITY(FT*FT/SEC.) =   0.93
  LONGEST FLOWPATH FROM NODE     15.00 TO NODE     14.00 =     282.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.43
  RAINFALL INTENSITY(INCH/HR) =   4.59
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.79
  TOTAL STREAM AREA(ACRES) =       0.79
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.22

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        0.77    6.34    5.399  0.30( 0.06) 0.20       0.1      15.00
      2        3.22    8.43    4.586  0.30( 0.06) 0.20       0.8      15.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        3.63    6.34    5.399  0.30( 0.06) 0.20       0.7      15.00
      2        3.87    8.43    4.586  0.30( 0.06) 0.20       0.9      15.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       3.87    Tc(MIN.) =     8.43
  EFFECTIVE AREA(ACRES) =       0.93   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        0.9
  LONGEST FLOWPATH FROM NODE     15.00 TO NODE     14.00 =     381.00 FEET.
```

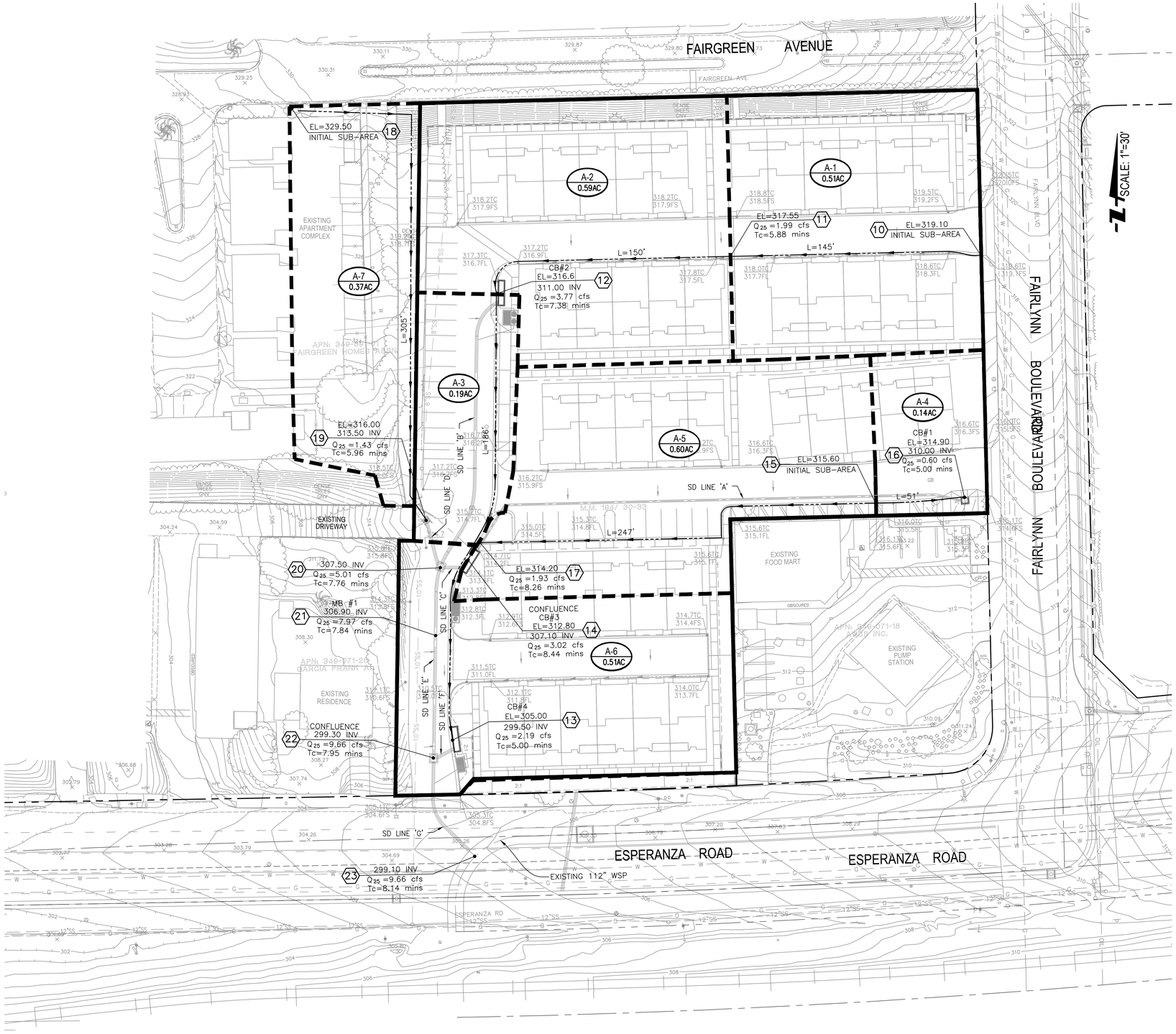
```
****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     21.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   307.10  DOWNSTREAM(FEET) =   306.90
  FLOW LENGTH(FEET) =    13.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   9.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.06
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.87
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    8.47
  LONGEST FLOWPATH FROM NODE     15.00 TO NODE     21.00 =     394.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     21.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        3.63    6.38    5.381  0.30( 0.06) 0.20       0.7      15.00
      2        3.87    8.47    4.575  0.30( 0.06) 0.20       0.9      15.00
  LONGEST FLOWPATH FROM NODE     15.00 TO NODE     21.00 =     394.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        6.23    6.06    5.542  0.30( 0.06) 0.20       1.2      18.00
      2        6.47    7.75    4.815  0.30( 0.06) 0.20       1.5      10.00
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     21.00 =     489.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        9.78    6.06    5.542  0.30( 0.06) 0.20       1.9      18.00
      2        9.90    6.38    5.381  0.30( 0.06) 0.20       2.0      15.00
      3       10.25    7.75    4.815  0.30( 0.06) 0.20       2.3      10.00
      4       10.01    8.47    4.575  0.30( 0.06) 0.20       2.4      15.00
    TOTAL AREA(ACRES) =         2.4

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       10.25  Tc(MIN.) =    7.746
  EFFECTIVE AREA(ACRES) =      2.33  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        2.4
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     21.00 =     489.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE     21.00 TO NODE     21.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   306.90  DOWNSTREAM(FEET) =   299.00
 FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  15.0 INCH PIPE IS   8.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  15.25
 ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      10.25
 PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    7.84
 LONGEST FLOWPATH FROM NODE     10.00 TO NODE     22.00 =     579.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     22.00 TO NODE     22.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.84
 RAINFALL INTENSITY(INCH/HR) =   4.78
 AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.30
 AREA-AVERAGED Ap =  0.20
 EFFECTIVE STREAM AREA(ACRES) =       2.33
 TOTAL STREAM AREA(ACRES) =       2.40
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      10.25

****************************************************************************
 FLOW PROCESS FROM NODE     14.00 TO NODE     13.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    93.00
 ELEVATION DATA: UPSTREAM(FEET) =    312.80  DOWNSTREAM(FEET) =    305.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.187
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "11+ DWELLINGS/ACRE"       B        0.51      0.30     0.200    56    5.00
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA RUNOFF(CFS) =      2.81
 TOTAL AREA(ACRES) =      0.51   PEAK FLOW RATE(CFS) =      2.81
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     22.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   299.50  DOWNSTREAM(FEET) =   299.30
  FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.41
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.81
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =    5.05
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     22.00 =     108.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     22.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.05
  RAINFALL INTENSITY(INCH/HR) =   6.15
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =       0.51
  TOTAL STREAM AREA(ACRES) =       0.51
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.81

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        9.78    6.16    5.488  0.30( 0.06) 0.20       1.9      18.00
      1        9.90    6.48    5.332  0.30( 0.06) 0.20       2.0      15.00
      1       10.25    7.84    4.780  0.30( 0.06) 0.20       2.3      10.00
      1       10.01    8.57    4.543  0.30( 0.06) 0.20       2.4      15.00
      2        2.81    5.05    6.155  0.30( 0.06) 0.20       0.5      14.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       11.80    5.05    6.155  0.30( 0.06) 0.20       2.1      14.00
      2       12.29    6.16    5.488  0.30( 0.06) 0.20       2.4      18.00
      3       12.34    6.48    5.332  0.30( 0.06) 0.20       2.5      15.00
      4       12.43    7.84    4.780  0.30( 0.06) 0.20       2.8      10.00
      5       12.08    8.57    4.543  0.30( 0.06) 0.20       2.9      15.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      12.43    Tc(MIN.) =     7.84
  EFFECTIVE AREA(ACRES) =       2.84   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        2.9
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     22.00 =     579.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     23.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   299.30  DOWNSTREAM(FEET) =   299.10
  FLOW LENGTH(FEET) =    53.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.77
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.43
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =    8.03
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     23.00 =     632.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        2.9  TC(MIN.) =      8.03
  EFFECTIVE AREA(ACRES) =      2.84  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.200
  PEAK FLOW RATE(CFS)   =      12.43

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       11.80    5.23    6.028  0.30( 0.06) 0.20       2.1      14.00
      2       12.29    6.35    5.396  0.30( 0.06) 0.20       2.4      18.00
      3       12.34    6.67    5.247  0.30( 0.06) 0.20       2.5      15.00
      4       12.43    8.03    4.716  0.30( 0.06) 0.20       2.8      10.00
      5       12.08    8.76    4.488  0.30( 0.06) 0.20       2.9      15.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

APPENDIX 2



LEGEND:

- MAIN WATERSHED BOUNDARY
- SUB-WATERSHED BOUNDARY
- A-1 / 0.45AC — COMPONENT AREA NUMBER / COMPONENT AREA ACREAGE
- FLOW DIRECTION
- Q=1.00 CFS / TC=1.0 MIN. — FLOW RATE Q / TIME OF CONCENTRATION
- (1) — HYDROLOGY NODE

DEVELOPER:

RED OAK INVESTMENTS

FUSCOE ENGINEERING
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 fax 949.474.5315
www.fuscoe.com

REGISTERED PROFESSIONAL ENGINEER — TREVOR S. DODSON — NO. C42029 — CIVIL — STATE OF CALIFORNIA

Tentative Tract Map No. 19161

Proposed Condition Hydrology Map
Esperanza Village

Yorba Linda, California

PLAN SET: A

Hydrology Map - Esperanza Village
Tentative Tract Map No. 19161

06/02/2021

APPENDIX 3

```
************************************************************************
                HYDRAULIC ELEMENTS - I  PROGRAM PACKAGE
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                          Analysis prepared by:

                             Fuscoe Engineering
                          16795 Von Karman Suite 100
                                 Irvine, CA
                                   92606

------------------------------------------------------------------------
  TIME/DATE OF STUDY: 14:27 06/02/2021
========================================================================
 Problem Descriptions:
  ESPERANZA VILLAGE
  CB #1 STREET FLOW CALC
  JN #724.012
************************************************************************
>>>>STREETFLOW MODEL INPUT INFORMATION<<<<
------------------------------------------------------------------------
    CONSTANT STREET GRADE(FEET/FEET) = 0.027000
    CONSTANT STREET FLOW(CFS) =    0.60
    AVERAGE STREETFLOW FRICTION FACTOR(MANNING) = 0.015000
    CONSTANT SYMMETRICAL STREET HALF-WIDTH(FEET) =   24.00
    DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   22.50
    INTERIOR STREET CROSSFALL(DECIMAL) = 0.010000
    OUTSIDE  STREET CROSSFALL(DECIMAL) = 0.010000
    CONSTANT SYMMETRICAL CURB HEIGHT(FEET) =   0.50
    CONSTANT SYMMETRICAL GUTTER-WIDTH(FEET) =   1.50
    CONSTANT SYMMETRICAL GUTTER-LIP(FEET) =  0.03125
    CONSTANT SYMMETRICAL GUTTER-HIKE(FEET) =  0.12500
    FLOW ASSUMED TO FILL STREET ON ONE SIDE, AND THEN SPLITS
========================================================================
    STREET FLOW MODEL RESULTS:
------------------------------------------------------------------------
    STREET FLOW DEPTH(FEET) =  0.19
    HALFSTREET FLOOD WIDTH(FEET) =    5.02
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.35
    PRODUCT OF DEPTH&VELOCITY =    0.45
========================================================================
```

```
**************************************************************************
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                          16795 Von Karman Suite 100
                                 Irvine, CA
                                   92606

--------------------------------------------------------------------------
  TIME/DATE OF STUDY: 15:03 06/02/2021
==========================================================================
 Problem Descriptions:
  ESPERANZA VILLAGE
  CB #1 FLOW-BY SIZING
  JN #774.012
**************************************************************************
>>>>FLOWBY CATCH BASIN INLET CAPACITY INPUT INFORMATION<<<<
--------------------------------------------------------------------------


    Curb Inlet Capacities are approximated based on the Bureau of
    Public Roads nomograph plots for flowby basins and sump basins.


    STREETFLOW(CFS) =    0.60
    GUTTER FLOWDEPTH(FEET) =  0.19
    BASIN LOCAL DEPRESSION(FEET) =  0.33

--------------------------------------------------------------------------
         FLOWBY BASIN ANALYSIS RESULTS:

       BASIN WIDTH     FLOW INTERCEPTION
            0.34            0.08
            0.50            0.11
            1.00            0.22
            1.50            0.32
            2.00            0.41
            2.50            0.48
            3.00            0.55
            3.42            0.60

            THEREFORE USE L = 3.50'
==========================================================================
```

```
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                          Analysis prepared by:

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                                 Irvine, CA
                                   92606

------------------------------------------------------------------------------
  TIME/DATE OF STUDY: 14:33 06/02/2021
==============================================================================
 Problem Descriptions:
  ESPERANZA VILLAGE
  CB #2 STREET FLOW CALC
  JN #774.012
******************************************************************************
>>>>STREETFLOW MODEL INPUT INFORMATION<<<<
------------------------------------------------------------------------------
    CONSTANT STREET GRADE(FEET/FEET) = 0.005000
    CONSTANT STREET FLOW(CFS) =    3.77
    AVERAGE STREETFLOW FRICTION FACTOR(MANNING) = 0.015000
    CONSTANT SYMMETRICAL STREET HALF-WIDTH(FEET) =   24.00
    DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   22.50
    INTERIOR STREET CROSSFALL(DECIMAL) = 0.010000
    OUTSIDE  STREET CROSSFALL(DECIMAL) = 0.010000
    CONSTANT SYMMETRICAL CURB HEIGHT(FEET) =   0.50
    CONSTANT SYMMETRICAL GUTTER-WIDTH(FEET) =   1.50
    CONSTANT SYMMETRICAL GUTTER-LIP(FEET) =  0.03125
    CONSTANT SYMMETRICAL GUTTER-HIKE(FEET) =  0.12500
    FLOW ASSUMED TO FILL STREET ON ONE SIDE, AND THEN SPLITS
==============================================================================
    STREET FLOW MODEL RESULTS:
------------------------------------------------------------------------------
    STREET FLOW DEPTH(FEET) =  0.35
    HALFSTREET FLOOD WIDTH(FEET) =   20.48
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.69
    PRODUCT OF DEPTH&VELOCITY =    0.59
==============================================================================
```

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

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                                   92606

--------------------------------------------------------------------------
  TIME/DATE OF STUDY: 15:06 06/02/2021
==========================================================================
 Problem Descriptions:
  ESPERANZA VILLAGE
  CB #2 FLOW-BY SIZING
  JN #774.012
**************************************************************************
>>>>FLOWBY CATCH BASIN INLET CAPACITY INPUT INFORMATION<<<<
--------------------------------------------------------------------------


    Curb Inlet Capacities are approximated based on the Bureau of
    Public Roads nomograph plots for flowby basins and sump basins.


    STREETFLOW(CFS) =    3.77
    GUTTER FLOWDEPTH(FEET) =  0.35
    BASIN LOCAL DEPRESSION(FEET) =  0.33

--------------------------------------------------------------------------
         FLOWBY BASIN ANALYSIS RESULTS:

       BASIN WIDTH     FLOW INTERCEPTION
            1.13            0.54
            1.50            0.71
            2.00            0.93
            2.50            1.16
            3.00            1.38
            3.50            1.59
            4.00            1.80
            4.50            1.98
            5.00            2.15
            5.50            2.32
            6.00            2.48
            6.50            2.64
            7.00            2.79
            7.50            2.91
            8.00            3.04
            8.50            3.16
            9.00            3.27
            9.50            3.38
           10.00            3.49
           10.50            3.60
           11.00            3.70
           11.34            3.77

             THEREFORE USE L = 14'
==========================================================================
```

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

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                          16795 Von Karman Suite 100
                                 Irvine, CA
                                   92606

------------------------------------------------------------------------------
  TIME/DATE OF STUDY: 14:39 06/02/2021
==============================================================================
 Problem Descriptions:
  ESPERANZA VILLAGE
  CB #3 STREET FLOW CALC
  JN #774.012
******************************************************************************
>>>>STREETFLOW MODEL INPUT INFORMATION<<<<
------------------------------------------------------------------------------
    CONSTANT STREET GRADE(FEET/FEET) = 0.054000
    CONSTANT STREET FLOW(CFS) =    3.02
    AVERAGE STREETFLOW FRICTION FACTOR(MANNING) = 0.015000
    CONSTANT SYMMETRICAL STREET HALF-WIDTH(FEET) =   24.00
    DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   22.50
    INTERIOR STREET CROSSFALL(DECIMAL) = 0.035000
    OUTSIDE  STREET CROSSFALL(DECIMAL) = 0.035000
    CONSTANT SYMMETRICAL CURB HEIGHT(FEET) =   0.50
    CONSTANT SYMMETRICAL GUTTER-WIDTH(FEET) =   1.50
    CONSTANT SYMMETRICAL GUTTER-LIP(FEET) =  0.03125
    CONSTANT SYMMETRICAL GUTTER-HIKE(FEET) =  0.12500
    FLOW ASSUMED TO FILL STREET ON ONE SIDE, AND THEN SPLITS
==============================================================================
    STREET FLOW MODEL RESULTS:
------------------------------------------------------------------------------
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    5.19
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.27
    PRODUCT OF DEPTH&VELOCITY =    1.50
==============================================================================
```

```
**************************************************************************
                HYDRAULIC ELEMENTS - I  PROGRAM PACKAGE
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            Ver. 21.0  Release Date: 06/01/2014  License ID 1355

                          Analysis prepared by:

                             Fuscoe Engineering
                          16795 Von Karman Suite 100
                                 Irvine, CA
                                   92606

--------------------------------------------------------------------------
  TIME/DATE OF STUDY: 15:08 06/02/2021
==========================================================================
 Problem Descriptions:
  ESPERANZA VILLAGE
  CB #3 FLOW-BY SIZING
  JN #774.012
**************************************************************************
>>>>FLOWBY CATCH BASIN INLET CAPACITY INPUT INFORMATION<<<<
--------------------------------------------------------------------------


    Curb Inlet Capacities are approximated based on the Bureau of
    Public Roads nomograph plots for flowby basins and sump basins.


    STREETFLOW(CFS) =    3.02
    GUTTER FLOWDEPTH(FEET) =  0.29
    BASIN LOCAL DEPRESSION(FEET) =  0.33

--------------------------------------------------------------------------
         FLOWBY BASIN ANALYSIS RESULTS:

       BASIN WIDTH     FLOW INTERCEPTION
            1.11            0.42
            1.50            0.56
            2.00            0.74
            2.50            0.92
            3.00            1.09
            3.50            1.27
            4.00            1.44
            4.50            1.58
            5.00            1.72
            5.50            1.86
            6.00            1.99
            6.50            2.12
            7.00            2.23
            7.50            2.34
            8.00            2.44
            8.50            2.54
            9.00            2.63
            9.50            2.73
           10.00            2.82
           10.50            2.92
           11.00            3.01
           11.07            3.02

             THEREFORE USE L = 14'
==========================================================================
```

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

                             Fuscoe Engineering
                          16795 Von Karman Suite 100
                                 Irvine, CA
                                   92606

------------------------------------------------------------------------------
  TIME/DATE OF STUDY: 14:43 06/02/2021
==============================================================================
 Problem Descriptions:
  ESPERANZA VILLAGE
  CB #4 STREET FLOW CALC
  JN #774.012
******************************************************************************
>>>>STREETFLOW MODEL INPUT INFORMATION<<<<
------------------------------------------------------------------------------
    CONSTANT STREET GRADE(FEET/FEET) = 0.092000
    CONSTANT STREET FLOW(CFS) =    2.20
    AVERAGE STREETFLOW FRICTION FACTOR(MANNING) = 0.015000
    CONSTANT SYMMETRICAL STREET HALF-WIDTH(FEET) =   24.00
    DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   22.50
    INTERIOR STREET CROSSFALL(DECIMAL) = 0.010000
    OUTSIDE  STREET CROSSFALL(DECIMAL) = 0.010000
    CONSTANT SYMMETRICAL CURB HEIGHT(FEET) =   0.50
    CONSTANT SYMMETRICAL GUTTER-WIDTH(FEET) =   1.50
    CONSTANT SYMMETRICAL GUTTER-LIP(FEET) =  0.03125
    CONSTANT SYMMETRICAL GUTTER-HIKE(FEET) =  0.12500
    FLOW ASSUMED TO FILL STREET ON ONE SIDE, AND THEN SPLITS
==============================================================================
    STREET FLOW MODEL RESULTS:
------------------------------------------------------------------------------
    STREET FLOW DEPTH(FEET) =  0.23
    HALFSTREET FLOOD WIDTH(FEET) =    9.23
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.96
    PRODUCT OF DEPTH&VELOCITY =    0.92
==============================================================================
```

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

                             Fuscoe Engineering
                          16795 Von Karman Suite 100
                                 Irvine, CA
                                   92606

--------------------------------------------------------------------------
  TIME/DATE OF STUDY: 15:10 06/02/2021
==========================================================================
 Problem Descriptions:
  ESPERANZA VILLAGE
  CB #4 FLOW-BY SIZING
  JN #774.012
**************************************************************************
>>>>FLOWBY CATCH BASIN INLET CAPACITY INPUT INFORMATION<<<<
--------------------------------------------------------------------------


    Curb Inlet Capacities are approximated based on the Bureau of
    Public Roads nomograph plots for flowby basins and sump basins.


    STREETFLOW(CFS) =    2.20
    GUTTER FLOWDEPTH(FEET) =  0.23
    BASIN LOCAL DEPRESSION(FEET) =  0.33

--------------------------------------------------------------------------
         FLOWBY BASIN ANALYSIS RESULTS:

       BASIN WIDTH     FLOW INTERCEPTION
            1.03            0.29
            1.50            0.42
            2.00            0.56
            2.50            0.69
            3.00            0.83
            3.50            0.96
            4.00            1.08
            4.50            1.19
            5.00            1.30
            5.50            1.41
            6.00            1.51
            6.50            1.60
            7.00            1.68
            7.50            1.77
            8.00            1.85
            8.50            1.93
            9.00            2.00
            9.50            2.08
           10.00            2.16
           10.30            2.20

            THEREFORE USE L = 14'
==========================================================================
```

Storm Drain 'A' Calculation

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.010 ft/ft
Diameter	12.0 in
Discharge	0.60 cfs

Results	
Normal Depth	2.9 in
Flow Area	0.1 ft²
Wetted Perimeter	1.0 ft
Hydraulic Radius	1.7 in
Top Width	0.86 ft
Critical Depth	3.9 in
Percent Full	24.3 %
Critical Slope	0.003 ft/ft
Velocity	4.07 ft/s
Velocity Head	0.26 ft
Specific Energy	0.50 ft
Froude Number	1.728
Maximum Discharge	4.98 cfs
Discharge Full	4.63 cfs
Slope Full	0.000 ft/ft
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	24.3 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.9 in
Critical Depth	3.9 in
Channel Slope	0.010 ft/ft
Critical Slope	0.003 ft/ft

Storm Drain 'B' Calculation

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.010 ft/ft
Diameter	18.0 in
Discharge	3.77 cfs

Results	
Normal Depth	6.5 in
Flow Area	0.6 ft²
Wetted Perimeter	1.9 ft
Hydraulic Radius	3.6 in
Top Width	1.44 ft
Critical Depth	8.9 in
Percent Full	35.9 %
Critical Slope	0.003 ft/ft
Velocity	6.60 ft/s
Velocity Head	0.68 ft
Specific Energy	1.22 ft
Froude Number	1.848
Maximum Discharge	14.69 cfs
Discharge Full	13.65 cfs
Slope Full	0.001 ft/ft
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	35.9 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	6.5 in
Critical Depth	8.9 in
Channel Slope	0.010 ft/ft
Critical Slope	0.003 ft/ft

Storm Drain 'C' Calculation

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.010 ft/ft
Diameter	18.0 in
Discharge	3.02 cfs

Results	
Normal Depth	5.8 in
Flow Area	0.5 ft²
Wetted Perimeter	1.8 ft
Hydraulic Radius	3.2 in
Top Width	1.40 ft
Critical Depth	7.9 in
Percent Full	32.0 %
Critical Slope	0.003 ft/ft
Velocity	6.21 ft/s
Velocity Head	0.60 ft
Specific Energy	1.08 ft
Froude Number	1.855
Maximum Discharge	14.69 cfs
Discharge Full	13.65 cfs
Slope Full	0.000 ft/ft
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	32.0 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	5.8 in
Critical Depth	7.9 in
Channel Slope	0.010 ft/ft
Critical Slope	0.003 ft/ft

Storm Drain 'D' Calculation

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.224 ft/ft
Diameter	18.0 in
Discharge	1.43 cfs

Results	
Normal Depth	1.9 in
Flow Area	0.1 ft²
Wetted Perimeter	1.0 ft
Hydraulic Radius	1.2 in
Top Width	0.91 ft
Critical Depth	5.4 in
Percent Full	10.3 %
Critical Slope	0.003 ft/ft
Velocity	14.92 ft/s
Velocity Head	3.46 ft
Specific Energy	3.62 ft
Froude Number	8.114
Maximum Discharge	69.52 cfs
Discharge Full	64.63 cfs
Slope Full	0.000 ft/ft
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	10.3 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.9 in
Critical Depth	5.4 in
Channel Slope	0.224 ft/ft
Critical Slope	0.003 ft/ft

Storm Drain 'E' Calculation

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.076 ft/ft
Diameter	18.0 in
Discharge	7.97 cfs

Results	
Normal Depth	5.6 in
Flow Area	0.5 ft²
Wetted Perimeter	1.8 ft
Hydraulic Radius	3.2 in
Top Width	1.39 ft
Critical Depth	13.1 in
Percent Full	31.2 %
Critical Slope	0.004 ft/ft
Velocity	16.90 ft/s
Velocity Head	4.44 ft
Specific Energy	4.91 ft
Froude Number	5.117
Maximum Discharge	40.49 cfs
Discharge Full	37.64 cfs
Slope Full	0.003 ft/ft
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	31.2 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	5.6 in
Critical Depth	13.1 in
Channel Slope	0.076 ft/ft
Critical Slope	0.004 ft/ft

Storm Drain 'F' Calculation

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.015 ft/ft
Diameter	18.0 in
Discharge	2.19 cfs

Results	
Normal Depth	4.4 in
Flow Area	0.3 ft²
Wetted Perimeter	1.6 ft
Hydraulic Radius	2.6 in
Top Width	1.29 ft
Critical Depth	6.7 in
Percent Full	24.4 %
Critical Slope	0.003 ft/ft
Velocity	6.55 ft/s
Velocity Head	0.67 ft
Specific Energy	1.03 ft
Froude Number	2.265
Maximum Discharge	17.99 cfs
Discharge Full	16.72 cfs
Slope Full	0.000 ft/ft
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	24.4 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	4.4 in
Critical Depth	6.7 in
Channel Slope	0.015 ft/ft
Critical Slope	0.003 ft/ft

Storm Drain 'G' Calculation

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

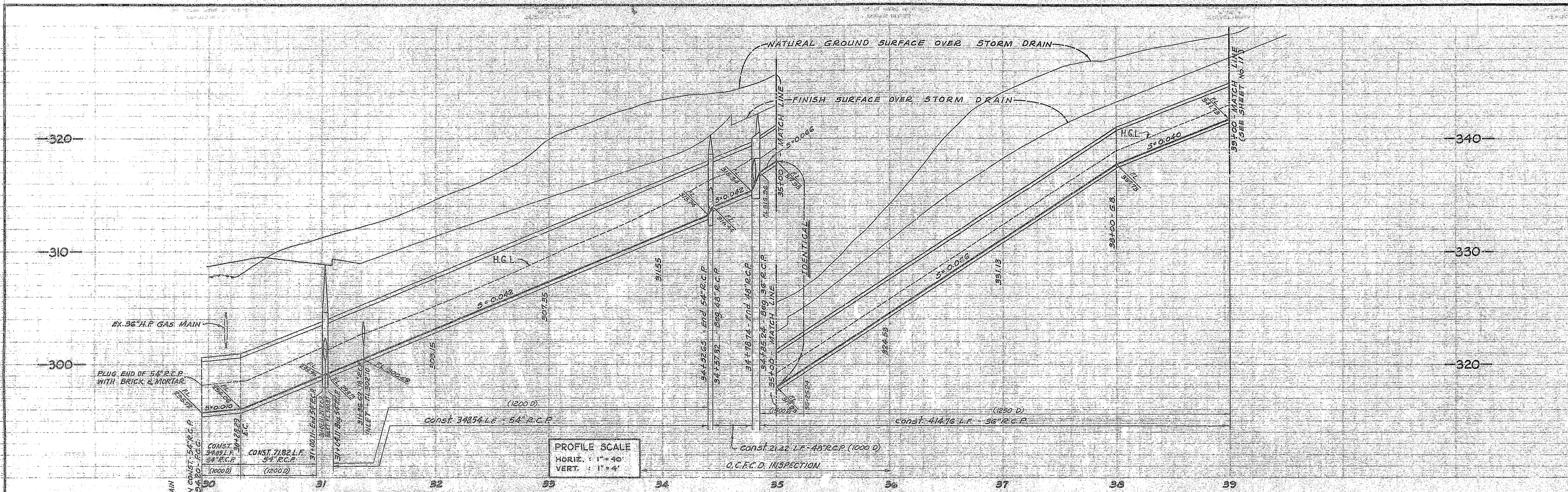
Input Data	
Roughness Coefficient	0.010
Channel Slope	0.005 ft/ft
Diameter	18.0 in
Discharge	9.66 cfs

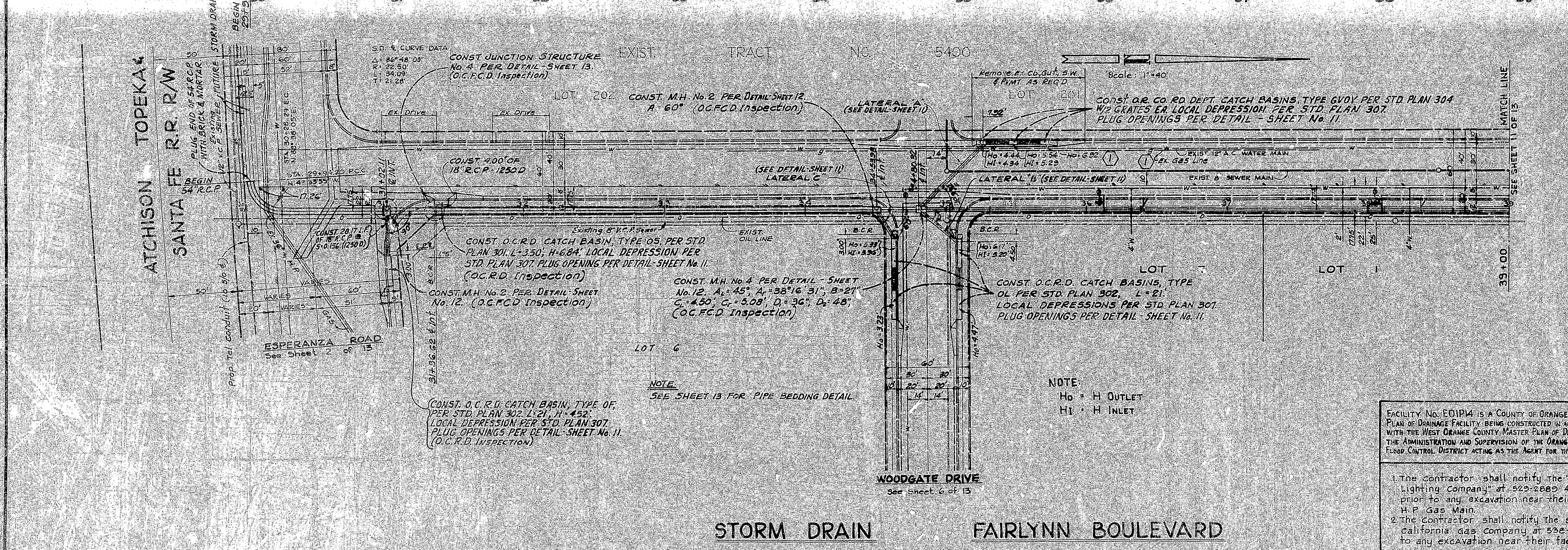
Results	
Normal Depth	14.8 in
Flow Area	1.6 ft²
Wetted Perimeter	3.4 ft
Hydraulic Radius	5.5 in
Top Width	1.15 ft
Critical Depth	14.4 in
Percent Full	82.0 %
Critical Slope	0.005 ft/ft
Velocity	6.23 ft/s
Velocity Head	0.60 ft
Specific Energy	1.83 ft
Froude Number	0.947
Maximum Discharge	10.39 cfs
Discharge Full	9.66 cfs
Slope Full	0.005 ft/ft
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	32.4 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	14.8 in
Critical Depth	14.4 in
Channel Slope	0.005 ft/ft
Critical Slope	0.005 ft/ft

APPENDIX 4





HYDRAULIC DATA

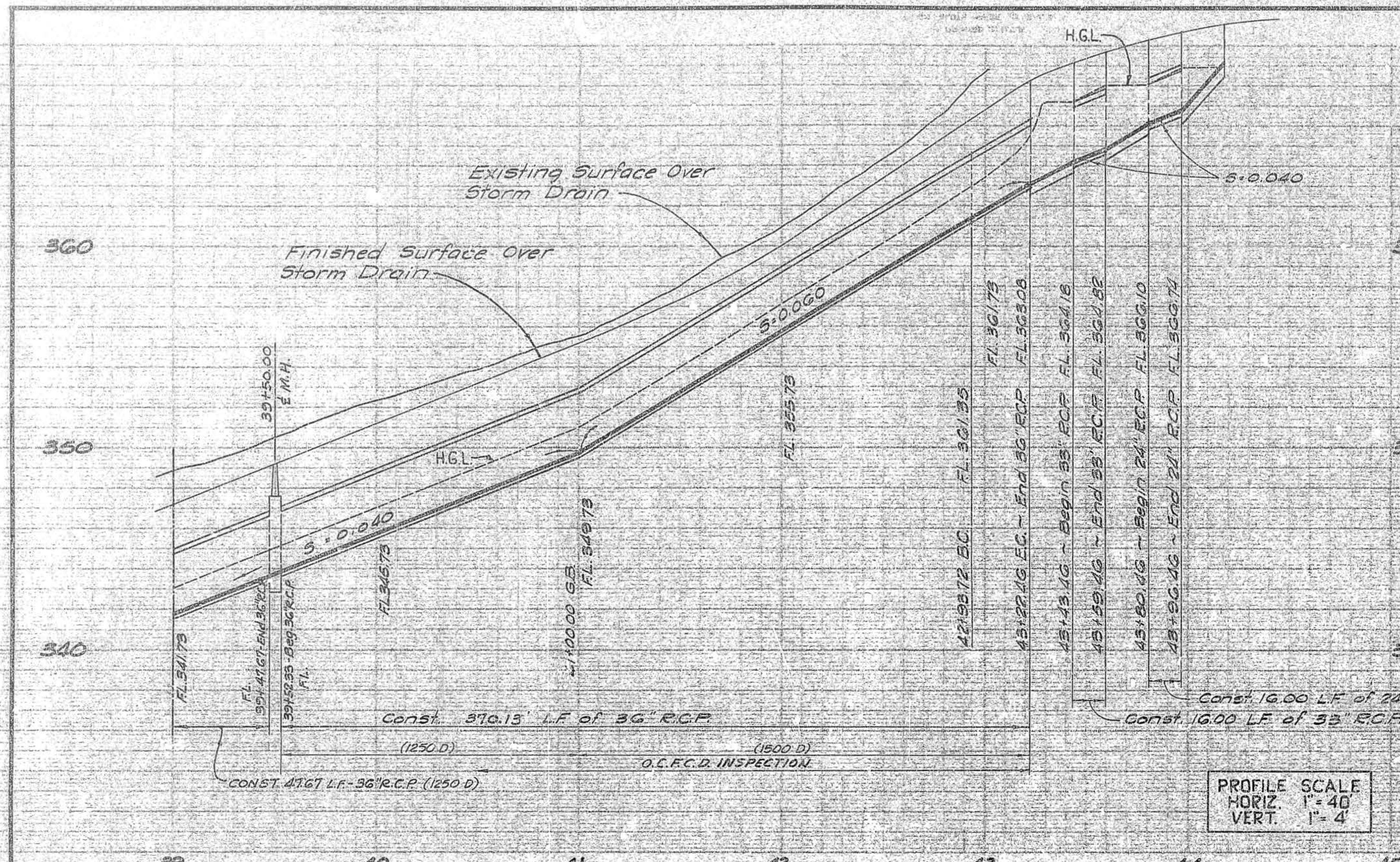
STA. TO STA.	Q_{10}	Φ	S_I	n=0.013 Y_N	n=0.013 V_N	n=0.014 Y_N	n=0.014 V_N	Y_C	V_C
29+94.20 - 30+32.29	180.6	54"	0.010	3.40	14.01	-	-	3.89	12.35
30+32.29 - 31+01.36	180.6	54"	0.042	2.11	24.66	-	-	3.89	12.35
31+02.86 - 31+35.87	165.8	54"	0.042	2.01	24.12	2.10	22.78	3.75	11.71
31+37.37 - 34+52.65	158.5	54"	0.042	1.96	23.83	2.05	22.47	3.68	11.38
34+57.32 - 34+78.74	128.2	48"	0.042	1.85	22.55	-	-	3.38	11.32
34+85.24 - 38+00.00	56.7	36"	0.066	1.19	21.72	1.24	20.56	2.44	9.21
38+00.00 - 39+00.00	56.7	36"	0.040	1.37	18.03	1.43	17.06	2.44	9.21

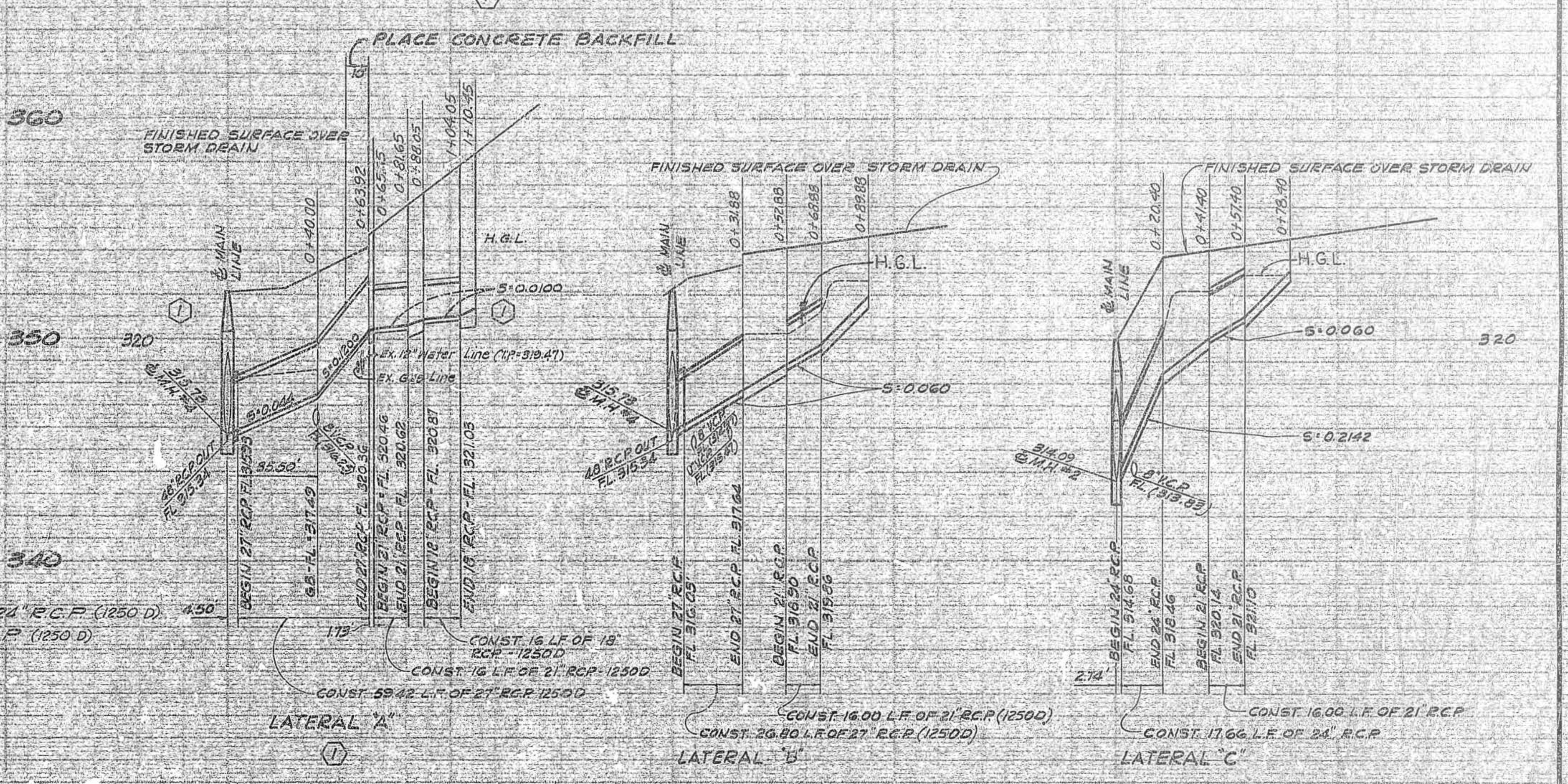
FACILITY No. E01P14 IS A COUNTY OF ORANGE MASTER PLAN OF DRAINAGE FACILITY BEING CONSTRUCTED IN ACCORDANCE WITH THE WEST ORANGE COUNTY MASTER PLAN OF DRAINAGE UNDER THE ADMINISTRATION AND SUPERVISION OF THE ORANGE COUNTY FLOOD CONTROL DISTRICT ACTING AS THE AGENT FOR THE COUNTY.

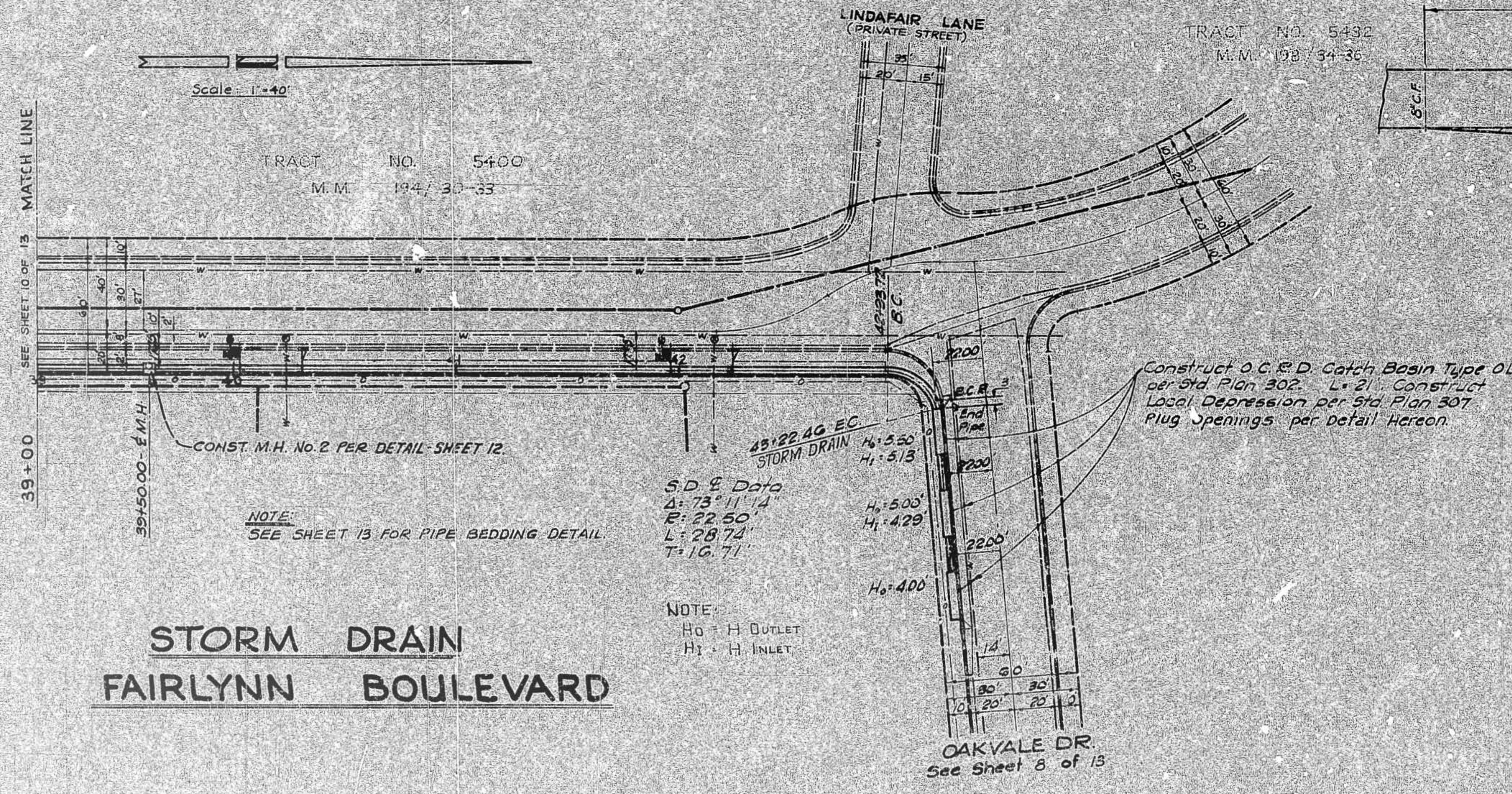
1. The contractor shall notify the "Pacific Lighting Company" at 529-2889 48 hours prior to any excavation near their 36" H.P. Gas Main.
2. The contractor shall notify the Southern California Gas Company at 532-0211 prior to any excavation near their facilities.

PLAN AND PROFILE OF
STORM DRAIN IMPROVEMENTS IN
TRACT NO. 7413
ORANGE COUNTY, CALIFORNIA

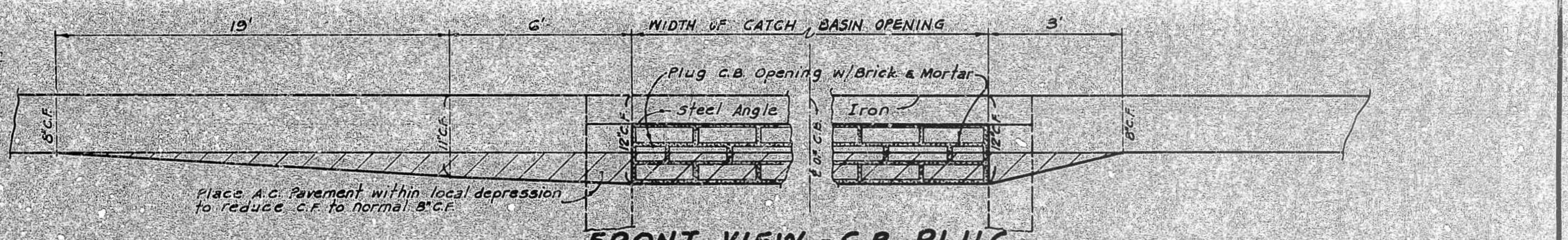
Tract Imp. #7413



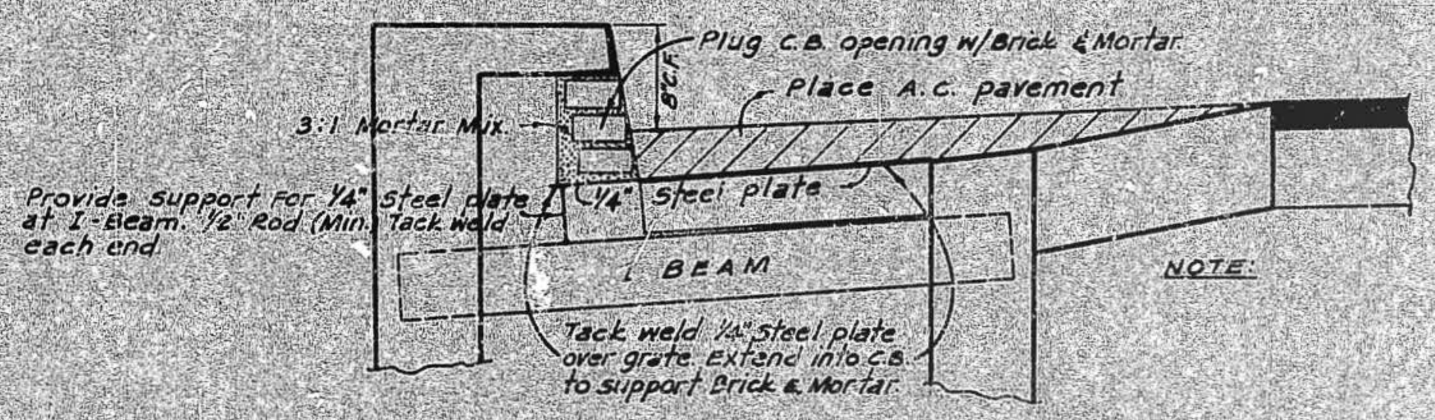




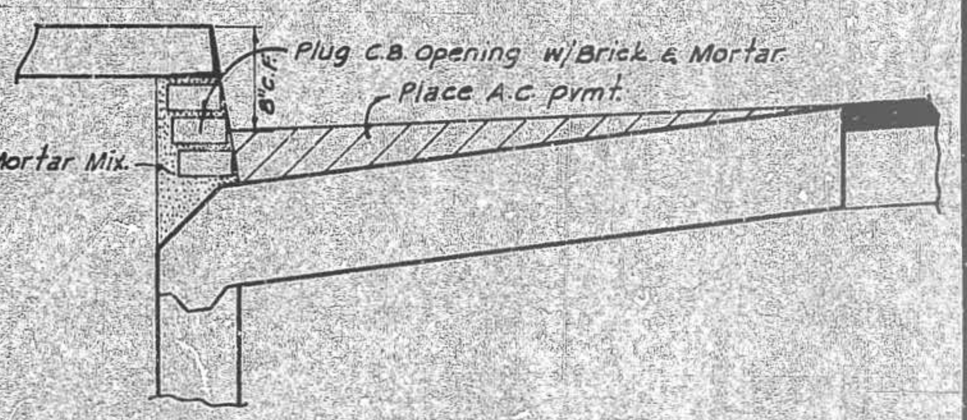
STORM DRAIN
FAIRLYNN BOULEVARD



FRONT VIEW - C.B. PLUG



DETAIL - C.B. PLUG FOR GVOV TYPE C.B.
SCALE: 1" = 1'



DETAIL - C.B. PLUG FOR OL TYPE C.B.
SCALE: 1" = 1'

HYDRAULIC DATA

STA. TO STA.	Q_{10}	ϕ	S_I	n = 0.013		n = 0.014		Y_C	V_C
				Y_N	V_N	Y_N	V_N		
39+00.00 - 41+00.00	56.7	36"	0.040	1.37	18.03	1.43	17.06	2.44	9.21
41+00.00 - 43+22.46	56.7	36"	0.060	1.22	21.01	1.27	19.92	2.44	9.21

TRACT IMPROVEMENT #7413
Sheet 11 of 13
Red. 22.5:1
Linen

PLAN AND PROFILE OF
STORM DRAIN IMPROVEMENTS IN
TRACT NO. 7413
ORANGE COUNTY, CALIFORNIA

Tract Imp. #7413