Appendix A
Water Quality Management Plan

ESA

City of Temecula
WATER QUALITY MANAGEMENT PLAN (WQMP)

PROJECT NAME & PERMIT Nº: Tentative Tract Map 36483

PROJECT ADDRESS: North west corner of Temecula Parkway and Butterfield Stage Road, Temecula, CA

PROJECT APN: 959-400-001 and 959-400-002

PREPARED BY:

JLC Engineering and Consulting, Inc.
41660 Ivy Street, Suite A
Murrieta, CA 92562

951-304-9552
joe@jlcengineering.com

PREPARED FOR:

Cal-Paseo Del Sol, LLC
4790 Eastgate Mall, Suite 150
San Diego, CA 92121

858-674-1300
Email

DATE OF WQMP: December 10, 2019
Revised: May 17, 2019
Revised: June 6, 2019

APPROVED BY:

APPROVAL DATE:

Applicant's Certification

Project Name: Planning Area 4 of Specific Plan #219
Permit Number: Tentative Tract Map 36483

APPLICANT'S CERTIFICATION

I have read and understand that the City of Temecula has adopted minimum requirements for managing urban runoff, including stormwater, from land development activities, as described in the BMP Design Manual. I certify that this WQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this WQMP by City staff is confined to a review and does not relieve me, as the Applicant, of my responsibilities for project design.

I hereby declare that the design is consistent with the requirements of the City of Temecula BMP Design Manual, which is a design manual for compliance with local City of Temecula Stormwater and Urban Runoff Management and Discharge Controls Ordinance (Chapter 8.28 et seq.) and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100) requirements for stormwater management; as well as the requirements of the City of Temecula Engineering and Construction Manual (Chapter 18) and the City of Temecula Erosion and Sediment Control Ordinance (Chapter 18.18 et seq.).

_____
Applicant's Signature Date:

_____
Print Name

_____
Company

STOP! Before continuing this form review Chapter 1.3 of the BMP Design Manual. If the project type is listed in Table 1-2, permanent stormwater requirements do not apply to your project. Write your exempt project category in the space provided below and skip to Step 3. Do not complete Steps 1, 2, or 4 of this WQMP.

_____
Exempt Project category

Preparation Date: _____ Template Date: October 31st, 2018

Step 1: Source Control BMP Checklist

Source Control BMPs			
All development projects must implement source control BMPs 4.2.1 through 4.2.6 where applicable and feasible. See Chapter 4.2 and Appendix E of the City BMP Design Manual for information to implement source control BMPs shown in this checklist. Answer each category below pursuant to the following: • "Yes" means the project will implement the source control BMP as described in Chapter 4.2 and/or Appendix E of the City BMP Design Manual. Discussion / justification must be provided and **show locations on the project plans**. Select applicable Source Controls in the Source Control BMP summary on the following page. • "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided. • "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification must be provided.			
Source Control Requirement	**Applied?**		
4.2.1 Prevention of Illicit Discharges into the MS4	X Yes	☐No	☐N/A
Discussion / justification: The project site will prevent illicit discharges into the MS4 facilities. Stenciling will be provided at catch basins stating, "Only Rain Down the Drain", and power washes will be prohibited.			
4.2.2 Storm Drain Stenciling or Signage	X Yes	☐No	☐N/A
Discussion / justification: Project will incorporate stenciling at catch basins stating, "Only Rain Down the Drain" or equivalent.			
4.2.3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐Yes	☐No	X N/A
Discussion / justification: Project does not include outdoor materials storage.			
4.2.4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐Yes	☐ No	X N/A
Discussion / justification: The project does not include outdoor work areas.			
4.2.5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	X Yes	☐No	☐N/A
Discussion / justification: Trash receptacles on residential lots will be required to be closed or covered at all times.			
4.2.6 Additional BMPs Based on Potential Sources of Runoff Pollutants	☐Yes	☐No	X N/A

Discussion / justification. Clearly identify which sources of runoff pollutants are discussed: No other BMPs are listed for source control.

Source Control BMP Summary			
Select all source control BMPs identified for your project in sections 4.2.1 through 4.2.6 above in the coulumn on the left below. Then select "yes" if the BMP has been implemented **and shown on the project plans**, "No" if the BMP has not been implemented, or "N/A" if the BMP is not applicable to your project.			
☐ SC-A. On-site storm drain inlets	X Yes	☐No	☐N/A
☐ SC-B. Interior floor drains and elevator shaft sump pumps	☐Yes	☐No	X N/A
☐ SC-C. Interior parking garages	☐Yes	☐No	X N/A
☐ SC-D1. Need for future indoor & structural pest control	X Yes	☐No	☐N/A
☐ SC-D2. Landscape/outdoor pesticide use	X Yes	☐No	☐N/A
☐ SC-E. Pools, spas, ponds, fountains, and other water features	X Yes	☐No	☐N/A
☐ SC-F. Food service	☐Yes	☐No	X N/A
☐ SC-G. Refuse areas	X Yes	☐No	☐N/A
☐ SC-H. Industrial processes	☐Yes	☐No	X N/A
☐ SC-I. Outdoor storage of equipment or materials	☐Yes	☐No	X N/A
☐ SC-J. Vehicle and equipment cleaning	☐Yes	☐No	X N/A
☐ SC-K. Vehicle/equipment repair and maintenance	☐Yes	☐No	X N/A
☐ SC-L. Fuel dispensing areas	☐Yes	☐No	X N/A
☐ SC-M. Loading docks	☐Yes	☐No	X N/A
☐ SC-N. Fire sprinkler test water	☐Yes	☐No	X N/A
☐ SC-O. Miscellaneous drain or wash water	☐Yes	☐No	X N/A
☐ SC-P. Plazas, sidewalks, and parking lots	X Yes	☐No	☐N/A
☐ SC-Q. Large trash generating facilities	☐Yes	☐No	X N/A
☐ SC-R. Animal facilities	☐Yes	☐No	X N/A
☐ SC-S. Plant nurseries and garden centers	☐Yes	☐No	X N/A
☐ SC-T. Automotive facilities	☐Yes	☐No	X N/A

Note: Show all source control measures applied above on the plan sheets.

Step 2: Site Design BMP Checklist

Site Design BMPs
All development projects must implement site design BMPs SD-A through SD-H where applicable and feasible. See Chapter 4.3 and Appendix E of the City BMP Design Manual for information to implement site design BMPs shown in this checklist. Answer each category below pursuant to the following: • "Yes" means the project will implement the site design BMP as described in Chapter 4.3 and/or Appendix E of the City BMP Design Manual. Discussion / justification must be provided and **show locations on the project plans**. • "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided. • "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification must be provided.

Site Design Requirement	Applied?		
4.3.1 Maintain Natural Drainage Pathways and Hydrologic Features	X Yes	☐No	☐N/A
Discussion / justification: The project site will construct an earthen channel that will preserve the natural flow paths traversing the project site.			
4.3.2 Conserve Natural Areas, Soils, and Vegetation	☐Yes	X No	☐N/A
Discussion / justification: The project site does not conserve natural areas.			
4.3.3 Minimize Impervious Area	X Yes	☐No	☐N/A
Discussion / justification: The project site minimizes impervious areas by constructing a park within the project site, utilizing the minimum streets widths and sidewalk widths, and by constructing landscaping within the right-of-way of the streets surrounding the project site.			
4.3.4 Minimize Soil Compaction	X Yes	☐No	☐N/A
Discussion / justification: The project site will minimize soil compaction within the biofiltration area, channel area, and other landscaped areas, where feasible.			
4.3.5 Impervious Area Dispersion	X Yes	☐No	☐N/A
Discussion / justification: Roof runoff shall be conveyed through adjacent landscaping, where feasible, prior to discharging into the streets. The outer streets will discharge the proposed sidewalk into the adjacent landscaping.			
4.3.6 Runoff Collection	X Yes	☐No	☐N/A
Discussion / justification: The project site will collect runoff via storm drain.			

4.3.7 Landscaping with Native or Drought Tolerant Species	X Yes	☐No	☐N/A
Discussion / justification: The project site will utilize native or drought tolerant species where feasible.			
4.3.8 Harvesting and Using Precipitation	☐Yes	X No	☐N/A
Discussion / justification: The project does not utilize harvest and use BMPs. The project utilizes biofiltration with partial infiltration and Filterra units.			

Step 3: Construction Stormwater BMP Checklist

Minimum Required Standard Construction Stormwater BMPs		
If you answer "Yes" to any of the questions below, your project is subject to Table 1 on the following page (Minimum Required Standard Construction Stormwater BMPs). As noted in Table 1, please select at least the minimum number of required BMPs[1], or as many as are feasible for your project. If no BMP is selected, an explanation must be given in the box provided. The following questions are intended to aid in determining construction BMP requirements for your project. **Note: All selected BMPs below must be included on the BMP plan incorporated into the construction plan sets.**		
1. Will there be soil disturbing activities that will result in exposed soil areas? (This includes minor grading and trenching.) **Reference Table 1 Items A, B, D, and E** Note: Soil disturbances NOT considered significant include, but are not limited to, change in use, mechanical/electrical/plumbing activities, signs, temporary trailers, interior remodeling, and minor tenant improvement.	X Yes	☐No
2. Will there be asphalt paving, including patching? **Reference Table 1 Items D and F**	X Yes	☐No
3. Will there be slurries from mortar mixing, coring, or concrete saw cutting? **Reference Table 1 Items D and F**	X Yes	☐No
4. Will there be solid wastes from concrete demolition and removal, wall construction, or form work? **Reference Table 1 Items D and F**	X Yes	☐No
5. Will there be stockpiling (soil, compost, asphalt, concrete, solid waste) for over 24 hours? **Reference Table 1 Items D and F**	X Yes	☐No
6. Will there be dewatering operations? **Reference Table 1 Items C and D**	☐Yes	X No
7. Will there be temporary on-site storage of construction materials, including mortar mix, raw landscaping and soil stabilization materials, treated lumber, rebar, and plated metal fencing materials? **Reference Table 1 Items E and F**	X Yes	☐No
8. Will trash or solid waste product be generated from this project? **Reference Table 1 Item F**	X Yes	☐No
9. Will construction equipment be stored on site (e.g.: fuels, oils, trucks, etc.?) **Reference Table 1 Item F**	☐Yes	X No
10. Will Portable Sanitary Services ("Porta-potty") be used on the site? **Reference Table 1 Item F**	X Yes	☐No

[1] Minimum required BMPs are those necessary to comply with the City of Temecula Erosion and Sediment Control Ordinance (Chapter 18.18 et seq.) and the City of Temecula Engineering and Construction Manual (Chapter 18).

Table 1. Construction Stormwater BMP Checklist

Minimum Required Best Management Practices (BMPs)	CALTRANS SW Handbook[2] Detail	✔ BMP Selected	Reference sheet No.'s where each selected BMP is shown on the plans. If no BMP is selected, an explanation must be provided.
A. Select Erosion Control Method for Disturbed Slopes (choose at least one for the appropriate season)			
Vegetation Stabilization Planting[3] (Summer)	SS-2, SS-4	☐	
Hydraulic Stabilization Hydroseeding[2] (Summer)	SS-4	X	
Bonded Fiber Matrix or Stabilized Fiber Matrix[4] (Winter)	SS-3	X	
Physical Stabilization Erosion Control Blanket[3] (Winter)	SS-7	☐	
B. Select erosion control method for disturbed flat areas (slope < 5%) (choose at least one)			
Will use erosion control measures from Item A on flat areas also	SS-3, 4, 7	☐	Fiber rolls shall be utilized
Sediment Desilting Basin (must treat all site runoff)	SC-2	☐	
Mulch, straw, wood chips, soil application	SS-6, SS-8	☐	

2 State of California Department of Transportation (Caltrans). 2003. Storm Water Quality Handbooks, Construction Site Best Management Practices (BMPs) Manual. March. Available online at: http://www.dot.ca.gov/hq/construc/stormwater/manuals.htm.

3 If Vegetation Stabilization (Planting or Hydroseeding) is proposed for erosion control it may be installed between May 1st and August 15th. Slope irrigation is in place and needs to be operable for slopes >3 feet. Vegetation must be watered and established prior to October 1st. The owner must implement a contingency physical BMP by August 15th if vegetation establishment does not occur by that date. If landscaping is proposed, erosion control measures must also be used while landscaping is being established. Established vegetation must have a subsurface mat of intertwined mature roots with a uniform vegetative coverage of 70 percent of the natural vegetative coverage or more on all disturbed areas.

4 All slopes over three feet must have established vegetative cover prior to final permit approval.

Table 1. Construction Stormwater BMP Checklist (continued)

Minimum Required Best Management Practices (BMPs)	CALTRANS SW Handbook Detail	✔ BMP Selected	Reference sheet No.'s where each selected BMP is shown on the plans. If no BMP is selected, an explanation must be provided.
C. If runoff or dewatering operation is concentrated, velocity must be controlled using an energy dissipater			
Energy Dissipater Outlet Protection[5]	SS-10	☐	
D. Select sediment control method for all disturbed areas (choose at least one)			
Silt Fence	SC-1	X	
Fiber Rolls (Straw Wattles)	SC-5	X	
Gravel & Sand Bags	SC-6 & 8	X	
Dewatering Filtration	NS-2	☐	
Storm Drain Inlet Protection	SC-10	X	
Engineered Desilting Basin (sized for 10-year flow)	SC-2	X	
E. Select method for preventing offsite tracking of sediment (choose at least one)			
Stabilized Construction Entrance	TC-1	X	
Construction Road Stabilization	TC-2	X	
Entrance/Exit Tire Wash	TC-3	X	
Entrance/Exit Inspection & Cleaning Facility	TC-1	☐	
Street Sweeping and Vacuuming	SC-7	X	
F. Select the general site management BMPs			
F.1 Materials Management			
Material Delivery & Storage	WM-1	☐	
Spill Prevention and Control	WM-4	X	
F.2 Waste Management[6]			
Waste Management Concrete Waste Management	WM-8	☐	
Solid Waste Management	WM-5	X	
Sanitary Waste Management	WM-9	☐	
Hazardous Waste Management	WM-6	☐	

Note: The Construction General Permit (Order No. 2009-0009-DWQ) also requires all projects not subject to the BMP Design Manual to comply with runoff reduction requirements through the implementation of post-construction BMPs as described in Section XIII of the order.

5 Regional Standard Drawing D-40 – Rip Rap Energy Dissipater is also acceptable for velocity reduction.

6 Not all projects will have every waste identified. The applicant is responsible for identifying wastes that will be onsite and applying the appropriate BMP. For example, if concrete will be used, BMP WM-8 must be selected.

Step 4: Project type determination (Standard or Priority Development Project)

Is the project part of another Priority Development Project (PDP)? ☐ Yes X No If so, Standard and PDP requirements apply. Go to Step 4.1 and select "PDP"			
The project is (select one): X New Development ☐ Redevelopment[7]			
The total proposed newly created or replaced impervious area is: 1,002,833 ft²			
The total existing (pre-project) impervious area is: 0 ft²			
The total area disturbed by the project is: 1,652,231 ft²			
If the total area disturbed by the project is 1 acre (43,560 sq. ft.) or more OR the project is part of a larger common plan of development disturbing 1 acre or more, a Waste Discharger Identification (WDID) number must be obtained from the State Water Resources Control Board. **WDID:** _____			
Is the project in any of the following categories, (a) through (f)?[8]			
Yes X	No ☐	(a)	New development projects that create 10,000 square feet or more of impervious surfaces [9](collectively over the entire project site). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
Yes ☐	No X	(b)	Redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
Yes X	No ☐	(c)	New and redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site), and support one or more of the following uses: (i) Restaurants. This category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (Standard Industrial Classification (SIC) code 5812). (ii) Hillside development projects. This category includes development on any natural slope that is twenty-five percent or greater. (iii) Parking lots. This category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce. (iv) Streets, roads, highways, freeways, and driveways. This category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles.

[7] Redevelopment is defined as: The creation and/or replacement of impervious surface on an already developed site. Examples include the expansion of a building footprint, road widening, the addition to or replacement of a structure, and creation or addition of impervious surfaces. Replacement of impervious surfaces includes any activity that is not part of a routine maintenance activity where impervious material(s) are removed, exposing underlying soil during construction. Redevelopment does not include routine maintenance activities, such as trenching and resurfacing associated with utility work; pavement grinding; resurfacing existing roadways; new sidewalks construction; pedestrian ramps; or bike lanes on existing roads; and routine replacement of damaged pavement, such as pothole repair.

[8] Applicants should note that any development project that will create and/or replace 10,000 square feet or more of impervious surface (collectively over the entire project site) is considered a new development.

Project type determination (continued)

Yes ☐	No X	(d)	New or redevelopment projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and discharging directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands). *Note: ESAs are areas that include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Board and San Diego Water Board; State Water Quality Protected Areas; water bodies designated with the RARE beneficial use by the State Water Board and San Diego Water Board; and any other equivalent environmentally sensitive areas which have been identified by the Copermittees. See BMP Design Manual Chapter 1.4.2 for additional guidance.*
Yes ☐	No X	(e)	New development projects, or redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface, that support one or more of the following uses: (i) Automotive repair shops. This category is defined as a facility that is categorized in any one of the following SIC codes: 5013, 5014, 5541, 7532-7534, or 7536-7539. (ii) Retail gasoline outlets (RGOs). This category includes RGOs that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.
Yes X	No ☐	(f)	New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction. *Note: See BMP Design Manual Chapter 1.4.2 for additional guidance.*

Does the project meet the definition of one or more of the Priority Development Project categories (a) through (f) listed above?

☐ No – the project is not a Priority Development Project (Standard Project).

X Yes – the project is a Priority Development Project (PDP).

Further guidance may be found in Chapter 1 and Table 1-2 of the BMP Design Manual.

The following is for **redevelopment PDPs only**:

The area of existing (pre-project) impervious area at the project site is: _____ ft^2 (A)

The total proposed newly created or replaced impervious area is _____ ft^2 (B)

Percent impervious surface created or replaced (B/A)*100: _____ %

The percent impervious surface created or replaced is (select one based on the above calculation):

☐ less than or equal to fifty percent (50%) – **only newly created or replaced impervious areas are considered a PDP and subject to stormwater requirements**

OR

☐ greater than fifty percent (50%) – **the entire project site is considered a PDP and subject to stormwater requirements**

Step 4.1: Water Quality Management Plan requirements

Step	Answer	Progression
Is the project a Standard Project, Priority Development Project (PDP), or exception to PDP definitions? To answer this item, complete Step 4 Project Type Determination Checklist, and see PDP exemption information below. For further guidance, see Chapter 1.4 of the BMP Design Manual *in its entirety*.	☐ Standard Project	Standard Project requirements apply, **STOP, you have satisfied stormwater requirements.**
	X PDP	Standard and PDP requirements apply. **Complete Exhibit A "PDP Requirements." http://temeculaca.gov/wqmpa2**
	☐ PDP Exemption	**Go to Step 4.2 below.**

Step 4.2: Exemption to PDP definitions

Is the project exempt from PDP definitions based on either of the following:	If so:
☐ Projects that are only new or retrofit paved sidewalks, bicycle lanes, or trails that meet the following criteria: (i) Designed and constructed to direct stormwater runoff to adjacent vegetated areas, or other non-erodible permeable areas; OR (ii) Designed and constructed to be hydraulically disconnected from paved streets or roads [i.e., runoff from the new improvement does not drain directly onto paved streets or roads]; OR (iii) Designed and constructed with permeable pavements or surfaces in accordance with City of Temecula Guidance on Green Infrastructure;	Standard Project requirements apply, AND any additional requirements specific to the type of project. City concurrence with the exemption is required. *Provide discussion and list any additional requirements below in this form.* **STOP, you have satisfied stormwater requirements.**
☐ Projects that are only retrofitting or redeveloping existing paved alleys, streets or roads that are designed and constructed in accordance with the City of Temecula Guidance on Green Infrastructure.	**Complete Exhibit A "PDP Requirements." Select Green Streets Exemptions where applicable.**
Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable:	

Exhibit A
City of Temecula
PRIORITY DEVELOPMENT PROJECT REQUIREMENTS

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Attachments

Attachment 1: Stormwater Pollutant Control BMP Selection
- Attachment 1a: DMA Exhibit
- Attachment 1b: 85th percentile 24-hour Isohyetal Map
- Attachment 1c: Worksheet B.1-1 DCV
- Attachment 1d: Structural Pollutant Control BMP Checklist(s)

Attachment 2: Hydromodification Control Measures
- Attachment 2a: Applicability of HMP Requirements
- Attachment 2b: HMP Exhibit(s)
- Attachment 2c: Management of Critical Coarse Sediment Yield Areas
- Attachment 2d: Flow Control Facility Design
- Attachment 2e: Geomorphic Assessment of Receiving Channels (optional)
- Attachment 2f: Vector Control Plan (if applicable)

Attachment 3: Structural BMP Maintenance Plan
- Attachment 3a: Structural BMP Maintenance Thresholds and Actions
- Attachment 3b: Maintenance Agreements / Notifications (when applicable)
- Attachment 3c: Individual Structural BMP DMA Map book

Attachment 4: City of Temecula PDP Structural BMP Verification for DPW Permitted Land Development Projects

Attachment 5: Copy of Plan Sheets Showing Permanent Stormwater BMPs

Attachment 6: Copy of Project's Drainage Report

Attachment 7: Copy of Project's Geotechnical and Groundwater Investigation Report

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Preparer's Certification Page

Project Name: Planning Area 4 of Specific Plan #219
Permit Application Number: Tentative Tract Map 36483

PREPARER'S CERTIFICATION

I hereby declare that I am the Engineer in Responsible Charge of design of Stormwater best management practices (BMPs) for this project, and that I have exercised responsible charge over the design of the BMPs as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the PDP requirements of the City of Temecula BMP Design Manual, which is a design manual for compliance with local City of Temecula Stormwater and Urban Runoff Management and Discharge Controls Ordinance (Chapter 8.28 et seq.) and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100) requirements for stormwater management.

I have read and understand that the City of Temecula has adopted minimum requirements for managing urban runoff, including stormwater, from land development activities, as described in the BMP Design Manual. I certify that this PDP WQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this PDP WQMP by City staff is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of stormwater BMPs for this project, of my responsibilities for project design.

Joseph L. Castaneda

Engineer of Work's Signature, PE Number & Expiration Date

Joseph L. Castaneda
Print Name

JLC Engineering and Consulting, Inc.
Company & Phone No.

June 6, 2019
Date

Engineer's Seal:

Template Date: October 31st, 2018

Preparation Date: May 17, 2019

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Step 1: Site Information Checklist

Step 1.1: Description of Existing Site Condition and Drainage Patterns

Project Watershed (Complete Hydrologic Unit, Area, and Subarea Name with Numeric Identifier; e.g., 902.52 Santa Margarita HU, Pechanga HA, Wolf HSA)	Santa Margarita Watershed (HA 902.00), Temecula Creek Sub-watershed (HAS 902.51 and 902.52)

Current Status of the Site (select all that apply):

- ☐ Existing development
- X Previously graded but not built out
- ☐ Demolition completed without new construction
- ☐ Agricultural or other non-impervious use
- ☐ Vacant, undeveloped/natural

Description / Additional Information:
The site was previously graded, and incorporates fill, earthen drainage ditches and minor erosion control for the fill area. Additionally, an existing sediment basin is located in the south west corner of Planning Area 4. Planning Area 4 currently sheet flows to the south west corner (where the sediment basin is located) and discharges into the existing Line "S" Storm Drain system located within Temecula Parkway.

Existing Land Cover Includes (select all that apply and provide each area on site):

- X Pervious Area 37.79 Acres (1,646,132 Square Feet)
- ☐ Impervious Areas _____ Acres (_____Square Feet)

Description / Additional Information:
The project site is currently graded, with features discussed above. There is no exisitng impervious area within the project site.

How is stormwater runoff conveyed from the site? At a minimum, this description should answer:
(1) Whether existing drainage conveyance is natural or urban;
(2) Is runoff from offsite conveyed through the site? If yes, describe the offsite drainage areas, design flows, and locations where offsite flows enter the project site, and summarize how such flows are conveyed through the site;
(3) Provide details regarding existing project site drainage conveyance network, including any existing storm drains, concrete channels, swales, detention facilities, stormwater treatment facilities, natural or constructed channels; and
(4) Identify all discharge locations from the existing project site along with a summary of conveyance system size and capacity for each of the discharge locations. Provide summary of the pre-project drainage areas and design flows to each of the existing runoff discharge locations. Reference the Drainage report Attachment for detailed calculations.

Describe existing site drainage patterns:
The offsite area currently drains from De Portola Road to the south west corner of the project site. The flows from the existing Line "A" Storm Drain (constructed as part of the Paloma Del Sol Temecula Creek Channel - Alcoba Drive Storm Drain - Tract No. 24185 Storm Drain Plans) discharge directly onto the project site. The offsite flows are mostly generated from the northerly residential area with a total flow rate discharging onto the project of 295.7 ft^3/s. These flows are then conveyed via an earthen channel to the south west corner of the project site where the flows are intercepted by the existing Line "S" Storm Drain. The Line "S" Storm Drain discharges directly into Temecula Creek.

Step 1.2: Description of Proposed Site Development and Drainage Patterns

Project Description / Proposed Land Use and/or Activities:
The proposed project site is a medium high density residential development. The project consists of Tentative Tract Map 36483, which consists of Planning Area 4 of the City of Temecula's Specific Plan #219. The project will construct sidewalks, slope and parkway landscaping, trees, subsurface storm drain, a park area, streets, and residential homes (168 lots). Typical family living activities can be expected throughout the site.

Proposed Land Cover Includes (select all that apply and provide each area on site):
X Pervious Area 14.83 Acres (646,019 Square Feet)
X Impervious Areas 22.96 Acres (1,000,113 Square Feet)

Description / Additional Information: The project site consists of street area (with asphalt, concrete and landscaping), residential lots (with concrete, roof and landscaping), a biofiltration basin (landscaped), and offsite sidewalk improvements within the right-of-way (with concrte and landscaping). Based upon the most conservative lot, the residential lots were analyzed as 57% impervious. All other areas were broken into impervious and pervious areas based upon the site design of the sidewalks, asphalt, and landscaped areas. The project site will also incorporate two small areas of grasscrete for access entries along Temecula Parkway.

List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features):
The project site will incorporate single family residential homes (approximately 5,000 sq. ft. lots, which is classified as medium-high density), a park area that will incorporate playgrounds, basketball courts, a tennis or volley ball court, sidewalks and landscaped area. The project will also incorporate offsite street improvements.

List/describe proposed pervious features of the project (e.g., landscape areas):
The project site will incorporate signficant landscaped area within the park area, as well as within the southerly portion of the project where an earthen channel will be constructed. Additionally, landscaping will be incorporated within the residential lots.The offsite streets will incorporate significant landscaped buffer areas that will be utilized as self-retaining areas. The areas down slope of the sidewalks will be self-retaining area, and the areas upstream of the sidewalk will be self-mitigating areas. Additional self-mitigating areas are included within the median on Butterfield Stage Road. The interior streets will incorporate landscaped area between the sidewalk and the the residential lot. The residential lots will incorporate typical grass and folage landscaping that will be determined by the builders once the homes begin construction. These landscaped features in the residential lots, as well as the landscape buffers within the streets will also serve as an LID element, since impervious surfaces will flow through the landscaping prior to discharging into the streets. The earthen channel is part of a separate permit.

Describe any grading or changes to site topography:
The project site will not significantly change the grading of the site topography. All onsite flows (and tributary offsite flows) will still discharge into the existing Line "S" Storm Drain system at the south west corner of the project site. The project site includes 259,454 C.Y. of cut and 278,265 C.Y. of fill.

Provide details regarding the proposed project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, stormwater treatment facilities, natural or constructed channels, and the method for conveying offsite flows through or around the proposed project site. Identify all discharge locations from the proposed project site along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide a summary of pre- and post-project drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations.

Describe proposed site drainage patterns:
The project site will extend the existing Line "A" offsite storm drain that currently terminates at the northerly project boundary. This system will convey the offsite flows and a portion of the treated onsite flows to the proposed channel at the southerly project boundary. The majority of the onsite flows (with the exception of the north east corner) will be conveyed to the onsite biofiltration basin via subsurface storm drain. The flows will be treated for water quality purposes and will mitigate hydromodifications before discharging at the upstream end of the Line "S" Storm Drain.

Due to the elevations of the Line “A” system and the site layout, it was not feasible to construct a 100-year storm drain system crossing the Line A system for the easterly portion of DMA A (designated as DMA A1 and A3 on the DMA Map Exhibit. Therefore, a modified design was implemented to convey flows up to the 10-year flow rate through a low-flow system that is sized to cross the Line “A” Storm Drain. The Line “A” Storm Drain will be constructed as a 10' wide by 4' high RCB, and the onsite system crossing the box will be an elliptical 19" x 30" storm drain (a 24" equivalent). A structure will be constructed in which flows will pond 2.75 feet and then overflow via a weir structure into a 42" lateral storm drain that will connect directly into the Line “A” Storm Drain. Detailed hydraulic calculations for this analysis has been included in the Drainage Report (Included in Attachment 6) to demonstrate that the flows required for water quality and hydromodification will be conveyed to the onsite biofiltration basin.

Step 1.3: Other Site Requirements and Constraints

When applicable, list other site requirements or constraints that will influence stormwater management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.

The earthen channel area is part of a separate permit, therefore it is not included in the water quality calculations. The receiving waters is Temecula Creek. The minimum street widths utilized are 60' Right-of-way streets, which incorporate a 6' sidewalk that is curb adjacent and a 4 foot landscape buffer area between the residential lots and sidewalk areas. This provides opportunities for LID by allowing impervious areas to flow through the landscaped areas prior to discharging into the streets.

Optional Additional Information or Continuation of Previous Sections As Needed

This space provided for additional information or continuation of information from previous sections as needed.

This WQMP is being prepared for the treatment of the project site for water quality purposes only. The hydromodifications analyses has been prepared by a separate entity and will be included in a separate study. This study has been included in Attachment 2.

The channel area and proposed infiltration trench adjacent to the channel are included as part of a separate permit, and are not included in this WQMP.

Step 2: Strategy for Meeting PDP Performance Requirements

PDPs must implement BMPs to control pollutants in stormwater that may be discharged from a project (see Chapter 5). PDPs subject to hydromodification management requirements must implement flow control BMPs to manage hydromodification (see Chapter 6). Both stormwater pollutant control and flow control can be achieved within the same BMP(s). Projects triggering the 50% rule must address stormwater requirements for the entire site.

Structural BMPs must be verified by the City at the completion of construction. This may include requiring the project owner or project owner's representative and engineer of record to certify construction of the structural BMPs (see Chapter 1.12). Structural BMPs must be maintained into perpetuity, and the City must confirm the maintenance (see Chapter 7).

Provide a narrative description of the general strategy for pollutant control and flow control at the project site in the box below. This information must describe how the steps for selecting and designing stormwater pollutant control BMPs presented in Chapter 5.1 of the BMP Design Manual were followed, and the results (type of BMPs selected). For projects requiring flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate. At the end of this discussion, provide a summary of all the BMPs within the project including the type and number.

Describe the general strategy for BMP implementation at the site.

The project site will incorporate a biofiltration basin, a subsurface basin, and a Modular Wetlands for treating the project site. Flows from DMA B and C will be conveyed to a subsurface system that has been designed to retain the required water quality volume. The outflow for the subsurface system will not discharge below elevation 1111.01, which is the elevation in which the water quality volume ponds to. This will allow for natural infiltration to occur within the subsurface system prior to discharging to the downstream modular wetlands. Worksheet B.5-4 was utilized to determine the size of the modular wetlands (Optimized Biofiltration BMP Footprint when Downstream of a Storage Unit). The first required area calculated is larger than the project site, therefore this area is dismissed as not feasible. The second resulting area is 216.058 sq. ft. The modular wetlands MWS-L-8-20-V provides 250 sq. ft., and therefore meets the optimized biofiltration footprint. Additionally, worksheet B.6-1 has been included which provides the required flow rate to be treated, which is 0.466 ft^3/s. The modular wetlands MWS-L-8-20-V treats a maximum of 0.577 ft^3/s, which is sufficient. This modified design is required due to the offsite storm drain system traversing the site which prevents flows from DMA B and C from being conveyed to the biofiltration basin due to cover issues within Street I and the need for a parallel system. Therefore this Optimized Biofiltration BMP Footprint when Downstream of a Storage Unit was utilized with a subsurface system as the storage unit and the modular wetlands as the Optimized Biofiltration BMP Footprint. The remainider of the onsite project site will be collected via subsurface storm drain and treated within biofiltration basin A. The biofiltration basin will also be utilized to address hydromodifications, and this analyses has been included in Attachment 2.

The project site also incorporates a self-retaining offsite area located down slope of the sidewalks (DMA's D, E and F) which incorporates sidewalk area, street area, and curb returns. DMA D will incorporate two curb openings on either side of the existing catch basin at the low point on De Portola Road to intercept the flows from the curb returns and the new street area along De Portla Road at the project. DMA G consists of self-mitigating area which is landscaped area up slope of the sidewalks, the median within Butterfield Stage Road, and 2,504 sq. ft. of impervious median and curb return. Since the total DMA area is 67,518 sq. ft., this impervious area is only 4% of the area.

Self-retaining area D has 17,122 ft^2 of impervious area and 15,548 ft^2 of pervious landscaped area, resulting in a ratio of 1.1:1. DMA E has 12,572 ft^2 of impervious area and 22,740 ft^2 of pervious landscaped area, resulting in a ratio of 0.55:1. DMA F has 4,876 ft^2 of impervious area and 11,241 ft^2 of pervious landscaped area, resulting in a ratio of 0.44:1. Since nearly all DMA's are close to or less than the 1:1 minimum ratio, self-retaining areas can be considered both pollutant control and hydromidifcation flow control. DMA D is just slightly above 1:1, however, DMAs E and F are signifcantly lower than 1:1, which allows for additional hydromodification control.

(Continue on following page as necessary.)

Description of structural BMP strategy continued (Page reserved for continuation of description of general strategy for structural BMP implementation at the site)
(Continued from previous page)

ATTACHMENT 1

STORMWATER POLLUTANT CONTROL BMP SELECTION

Indicate which Items are Included behind this cover sheet:

Attachment Sequence	Contents	Checklist
	Special Considerations for Redevelopment Projects (50% Rule) see chapter 1.7 and Step 4 of Appendix A.1.	☐ Less than or equal to fifty percent (50%) ☐ Greater than fifty percent (50%)
Refer to Figure 5-1: Stormwater Pollutant Control BMP Selection Flow Chart		
Attachment 1a	DMA Exhibit (Required) See DMA Exhibit Checklist on the back of this form. See Chapter 3.3.3 for guidance	X Included ☐ Entire project is designed with Self-Mitigating and De-Minimis DMAs. The project is compliant with Pollution Control BMP sizing requirements. **STOP** * [1]
Attachment 1b	Figure B.1-1: 85th Percentile 24-hour Isohyetal Map with project location	X Included
Attachment 1c	Worksheet B.1-1 DCV [1]	X Included ☐ Entire project is designed with Self-Retaining DMAs. The project is compliant with Pollution Control BMP sizing requirements. **STOP** *
Attachment 1d	Structural Pollutant Control BMP Checklist(s)	X Included
Attachment 1e	Is Onsite Alternative Compliance proposed?[2]	X No ☐ Include WQE worksheets
Attachment 1f	Offsite Alternative Compliance for Pollutant Control Refer to Figure 1-3:Pathways to Participating in Offsite Alternative Compliance Program	X Full Compliance Onsite ☐ Partial Compliance Onsite with Offsite Alternative Compliance or Full Offsite Alternative Compliance. Document onsite structural BMPs and complete - Pollutant Control Offsite Alternative Compliance Participation Form, and - WQE worksheets

* If this box is checked, the remainder of Attachment 1 does not need to be filled out.

1 – The offsite street areas will utilize self-treating and self-retaining areas consistent with the design manual.

[1] All stormwater pollutant control worksheets have been automated and are available for download at: https://www.sandiegocounty.gov/content/sdc/dpw/watersheds/DevelopmentandConstruction/BMP_Design_Manual.html

[2] Water Quality Equivalency Guidance and automated worksheets for Region 9: http://www.projectcleanwater.org/water-quality-equivalency-guidance/

Preparation Date:_____ Template Date: February 22nd, 2019

DMA Exhibit Checklist

See Chapter 3.3.3 for guidance

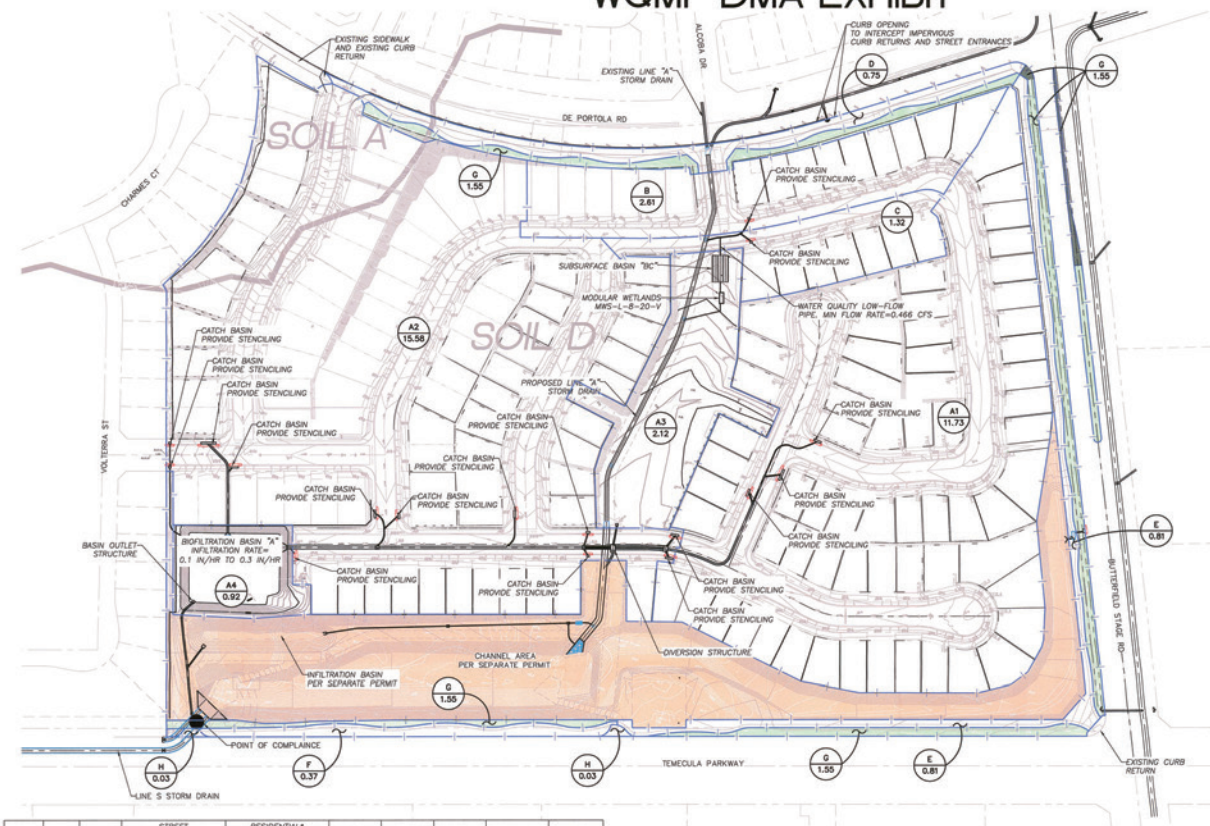
- X Point(s) of Compliance
- X Project Site Boundary
- X Project Disturbed Area Footprint
- X Drainage management area (DMA) boundaries, DMA ID numbers, DMA areas (square footage or acreage), DMA land use and pollutants of concern, and DMA type (i.e., drains to structural BMP, self-retaining, self-mitigating, or de-minimis) Note on exhibit de-minimis areas and discuss reason they could not be included in Step 1.3 per section 5.2.2 of the manual. Include offsite areas receiving treatment to mitigate Onsite Water Quality Equivalency.
- X Include summary table of worksheet inputs for each DMA.
- X Include description of self-mitigating areas.
- X Potential pollutant source areas and corresponding required source control BMPs (see Chapter 4, Appendix E.1, and Step 3.5)
- X Proposed Site Design BMPs and surface treatments used to minimize imperviousness. Show sections, details, and dimensions of site design BMP's per chapter 5.2.3 (tree wells, dispersion areas, rain gardens, permeable pavement, rain barrels, green roofs, etc.)
- ☐ Proposed Harvest and Use BMPs
- X Underlying hydrologic soil group (Web Soil Survey)
- ☐ Existing natural hydrologic features (watercourses, seeps, springs, wetlands, pond, lake)
- X Existing topography and impervious areas
- X Proposed grading and impervious areas. If the project is a subdivision or spans multiple lots show pervious and impervious totals for each lot.
- X Existing and proposed site drainage network and connections to drainage offsite
- ☐ Potable water wells, onsite wastewater treatment systems (septic), underground utilities
- X Structural BMPs (identify location, structural BMP ID No., type of BMP, and size/detail)
- ☐ Approximate depth to groundwater at each structural BMP
- X Approximate infiltration rate and feasibility (full retention, partial retention, biofiltration) at each structural BMP
- ☐ Critical coarse sediment yield areas to be protected and or conveyed through the project site, if applicable.
- ☐ Temporary Construction BMPs. Include protection of source control, site design and structural BMPs during construction.

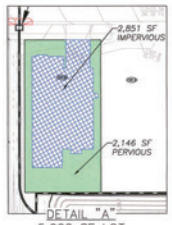
SHEET 1 OF 1

TTM 36483 – PLANNING AREA 4

IN THE CITY OF TEMECULA, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

WQMP DMA EXHIBIT





NOTES:

TRASH RECEPTACLES SHALL BE LOCATED ON INDIVIDUAL PRIVATE RESIDENTIAL LOTS. LIDS SHALL BE REQUIRED TO BE CLOSED OR COVERED AT ALL TIMES.

ROOF GUTTERS SHALL NOT BE MADE OF COPPER OR OTHER UNPROTECTED METALS THAT MAY LEACH INTO RUNOFF.

SITE DESIGN BMPS ARE LISTED IN STEP 2 OF THE WATER QUALITY MANAGEMENT PLAN.

SITE DESIGN BMPS:

THE PROJECT SITE WILL CONSTRUCT AN EARTHEN CHANNEL THAT WILL PRESERVE THE NATURAL FLOW PATHS TRAVERSING THE PROJECT SITE.

THE PROJECT SITE MINIMIZES IMPERVIOUS AREAS BY CONSTRUCTING A PARK WITHIN THE PROJECT SITE, UTILIZING THE MINIMUM STREET WIDTHS AND SIDEWALK WIDTHS, AND BY CONSTRUCTING LANDSCAPING WITHIN THE RIGHT-OF-WAY OF THE STREETS SURROUNDING THE PROJECT SITE.

THE PROJECT SITE WILL MINIMIZE SOIL COMPACTION WITHIN THE BIOFILTRATION AREA, CHANNEL AREA, AND OTHER LANDSCAPED AREAS, WHERE FEASIBLE.

ROOF RUNOFF SHALL BE CONVEYED THROUGH ADJACENT LANDSCAPING, WHERE FEASIBLE, PRIOR TO DISCHARGING INTO THE STREETS. THE OUTER STREETS WILL DISCHARGE TEH PROPOSED SIDEWALK INTO THE ADJACENT LANDSCAPING.

THE PROJECT SITE WILL COLLECT RUNOFF VIA STORM DRAIN.

THE PROJECT SITE WILL UTILIZE NATIVE OR DROUGHT TOLERANT SPECIES WHERE FEASIBLE.

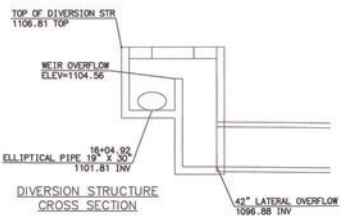
SOURCE CONTROL BMP SUMMARY	
SC–A	ON–SITE STORM DRAIN INLETS
SC–01	NEED FOR FUTURE INDOOR & STRUCTURAL PEST CONTROL
SC–02	LANDSCAPE/OUTDOOR PESTICIDE USE
SC–E	POOLS, SPAS, PONDS, FOUNTAINS, AND OTHER WATER FEAUTRES
SC–G	REFUSE AREAS
SC–P	PLAZAS, SIDEWALKS, AND PARKING LOTS

DMA	AREA (AC)	AREA (SF)	STREET IMPERVIOUS	STREET PERVIOUS	RESIDENTIAL* IMPERVIOUS	RESIDENTIAL* PERVIOUS	CONCRETE /SIDEWALK	LANDSCAPE	BASIN AREA (IMP.)	GRASSCRETE	COMPOSITE % IMPERVIOUS
A1	11.73	510,959	115,296	11,426	219,015	165,222	0	0	0	0	65%
A2	15.58	678,665	170,898	17,616	279,386	210,765	0	0	0	0	66%
A3	2.12	92,347	0	0	0	0	24,273	68,074	0	0	26%
A4	0.92	40,075	0	0	0	0	0	0	40,075	0	100%
B	2.61	113,692	28,599	3,574	46,466	35,053	0	0	0	0	66%
C	1.32	57,499	17,085	1,913	21,946	16,555	0	0	0	0	68%
D	0.75	32,670	5,201	0	0	0	11,921	15,548	0	0	52%
E	0.81	35,283	0	0	0	0	12,572	22,740	0	0	36%
F	0.37	16,117	0	0	0	0	4,876	11,241	0	0	30%
G	1.55	67,518	0	0	0	0	2,504	64,985	0	0	4%
H	0.03	1,307	0	0	0	0	0	0	0	1,307	0%

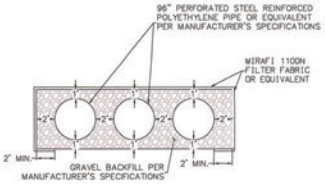
* NOTE: RESIDENTIAL AREA IS 57% IMPERVIOUS BASED UPON THE MOST CONSERVATIVE TENTATIVE LOT LAYOUT (SEE DETAIL A HEREON).

Automated Worksheet B.1-1: Calculation of Design Capture Volume (V1.3)

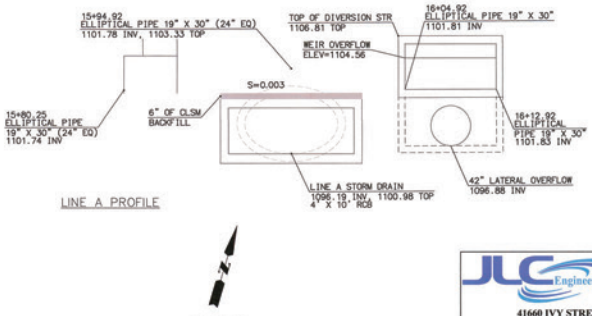
	#	Drainage Basin ID or Name	A	BC	D	E	F	units/cu
	1	Basin Drains to the Following BMP Type:	Biofiltration	Biofiltration	n/a	n/a	n/a	units/cu
	2	85th Percentile 24-hr Storm Depth	1.00	1.00	1.00	1.00	1.00	inches
	3	Design Infiltration Rate Recommended by Geotechnical Engineer	0.300	0.300	0.300	0.300	0.300	in/hr
	4	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	848,943	113,256				sq ft
	5	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)						sq ft
	6	Engineered Pervious Surface Not Serving as Dispersion Area (C=0.10)	475,103	60,984				sq ft
	7	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)						sq ft
	8	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)						sq ft
	9	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)						sq ft
	10	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)						sq ft
	11	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	No	Yes	Yes	Yes	yes/no
	12	Impervious Surfaces **Directed to Dispersion Area** per SD-B (C=0.50)			17,122	13,572	4,876	sq ft
	13	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (C=0.30)						sq ft
	14	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (C=0.10)			15,548	25,147	11,241	sq ft
	15	Natural Type A Soil **Serving as Dispersion Area** per SD-B (C=0.10)						sq ft
	16	Natural Type B Soil **Serving as Dispersion Area** per SD-B (C=0.14)						sq ft
	17	Natural Type C Soil **Serving as Dispersion Area** per SD-B (C=0.23)						sq ft
	18	Natural Type D Soil **Serving as Dispersion Area** per SD-B (C=0.30)						sq ft
	19	Number of Tree Wells Proposed per SD-A						ea
	20	Average Mature Tree Canopy Diameter						ft
	21	Number of Rain Barrels Proposed per SD-E						ea
	22	Average Rain Barrel Size						gal
	23	Does BMP Overflow to Stormwater Features in Downstream Drainage?	No	No	No	No	No	yes/no
	24	Identify Downstream Drainage Basin Providing Treatment in Series						yes/no
	25	Percent of Upstream Flows Directed to Downstream Dispersion Areas						percent
	26	Upstream Impervious Surfaces Directed to Dispersion Area (C=0.90)	0	0	0	0	0	cubic-feet
	27	Upstream Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	0	0	0	0	0	cubic-feet
	28	Total Tributary Area	1,322,046	174,240	32,670	35,719	16,117	sq ft
	29	Initial Runoff Factor for Standard Drainage Areas	0.61	0.62	0.00	0.00	0.00	unitless
	30	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	0.00	0.32	0.38	0.34	unitless
	31	Initial Weighted Runoff Factor	0.61	0.62	0.32	0.38	0.34	unitless
	32	Initial Design Capture Volume	67,204	9,002	1,456	1,531	457	cubic-feet
	33	Total Impervious Area Dispersed to Pervious Surface	0	0	17,122	13,572	4,876	sq ft
	34	Total Pervious Dispersion Area	0	0	15,548	25,147	11,241	sq ft
	35	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	n/a	1.10	0.50	0.40	ratio
	36	Adjustment Factor for Dispersed & Dispersion Areas	1.00	1.00	0.00	0.00	0.00	ratio
	37	Runoff Factor After Dispersion Techniques	0.61	0.62	0.00	0.00	0.00	unitless
	38	Design Capture Volume After Dispersion Techniques	67,204	9,002	0	0	0	cubic-feet
	39	Total Tree Well Volume Reduction	0	0	0	0	0	cubic-feet
	40	Total Rain Barrel Volume Reduction	0	0	0	0	0	cubic-feet
	41	Final Adjusted Runoff Factor	0.61	0.62	0.00	0.00	0.00	unitless
	42	Final Effective Tributary Area	806,448	108,029	0	0	0	sq ft
	43	Initial Design Capture Volume Retained by Site Design Elements	0	0	1,456	1,531	457	cubic-feet
	44	Final Design Capture Volume Tributary to BMP	67,204	9,002	0	0	0	cubic-feet



DIVERSION STRUCTURE CROSS SECTION



SUBSURFACE BASIN CROSS SECTION



LINE A PROFILE

LEGEND:

XXX / X.X — DMA / ACRES

DMA BOUNDARY

SELF–MITIGATING AREA

IMPERVIOUS AREA WITHIN SELF–MITIGATING AREA

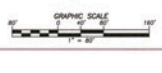


EXHIBIT "1"

TTM NO. 36483 – PA4

WQMP DMA EXHIBIT

JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

TTM 36483 - PLANNING AREA 4

IN THE CITY OF TEMECULA, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

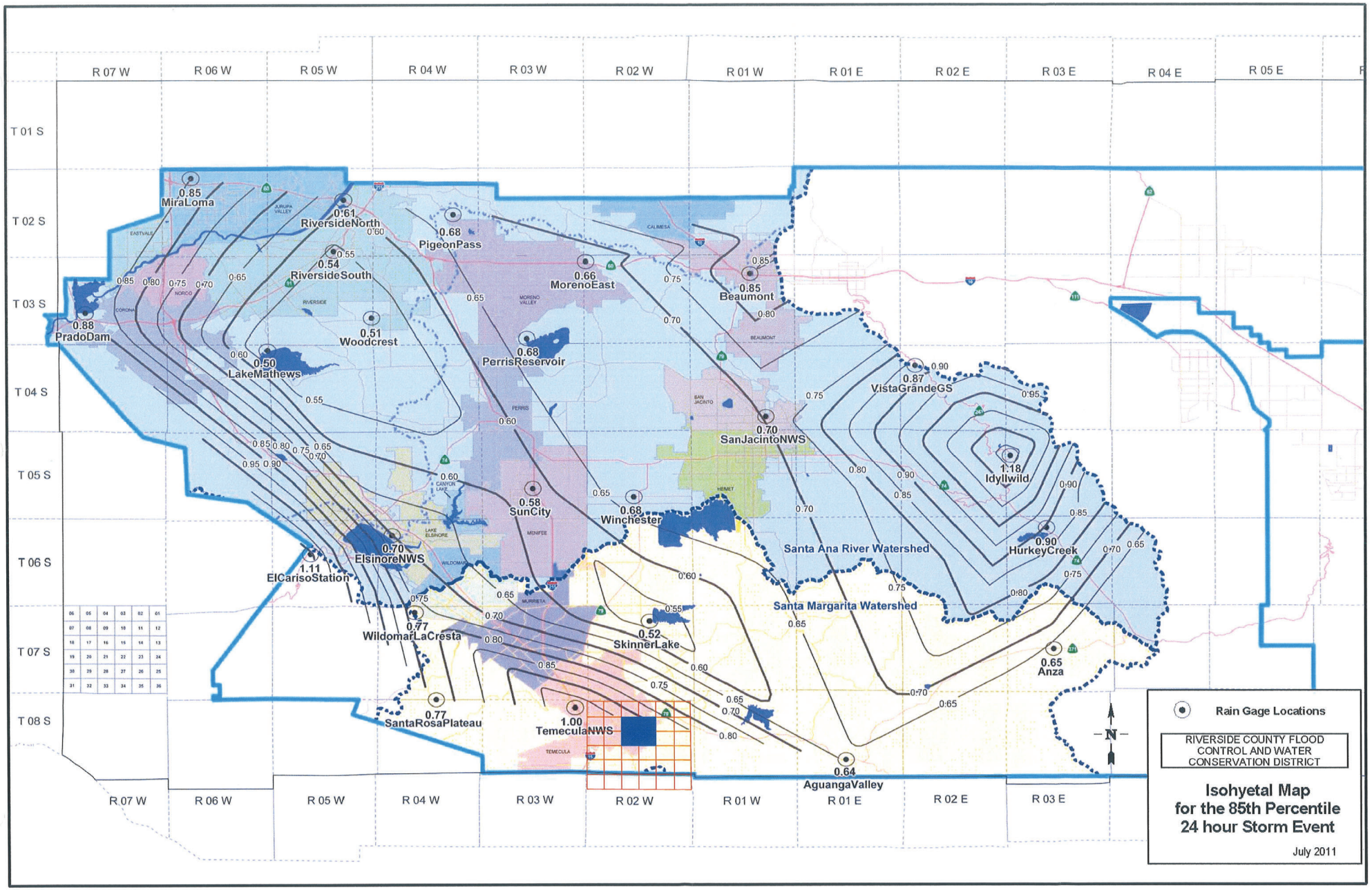
WQMP LAND COVER MAP

EXHIBIT "2"

JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

TTM NO. 36483 - PA4

LAND COVER MAP


R 07 W
R 06 W
R 05 W
R 04 W
R 03 W
R 02 W
R 01 W
R 01 E
R 02 E
R 03 E
R 04 E
R 05 E
T 01 S
T 02 S
T 03 S
T 04 S
T 05 S
T 06 S
T 07 S
T 08 S
0.85 MiraLoma
0.61 RiversideNorth
0.68 PigeonPass
0.54 RiversideSouth
0.66 MorenoEast
0.85 Beaumont
0.88 PradoDam
0.51 Woodcrest
0.68 PerrisReservoir
0.50 LakeMathews
0.87 VistaGrandeGS
0.70 SanJacintoNWS
1.18 Idyllwild
0.58 SunCity
0.68 Winchester
0.70 ElsinoreNWS
1.11 ElCarisoStation
0.90 HurkeyCreek
Santa Ana River Watershed
Santa Margarita Watershed
0.77 WildomarLaCresta
0.52 SkinnerLake
0.65 Anza
0.77 SantaRosaPlateau
1.00 TemeculaNWS
0.64 AguangaValley
Rain Gage Locations
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
Isohyetal Map for the 85th Percentile 24 hour Storm Event
July 2011

Categorization of Infiltration Feasibility Condition		Worksheet C.4-1	
Part 1 - Full Infiltration Feasibility Screening Criteria **Would Infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?** Note that it is not necessary to investigate each and every criterion in the worksheet if infiltration is precluded. Instead a letter of justification from a geotechnical professional familiar with local conditions substantiating any geotechnical issues will be required.			
Criteria	Screening Question	Yes	No
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question must be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		x
Provide basis: Per an email (included with this worksheet) from the Geotechinical Engineer, the soils have minimal infiltration rates. During final engineering, infiltration testing will be performed to validate the low infiltration rates. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicablity.			
2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question must be based on a comprehensive evaluation of the factors presented in Appendix C.2.	x	
Provide basis: There are no geotechnical hazards for the project site. See geotechnical report attached to the WQMP. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicablity.			

Factor of Safety and Design Infiltration Rate Worksheet			Worksheed D.5-1		
Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \sum p$			1.25
B	Design	Level of pretreatment / expected sediment loads	0.5	1	0.5
		Redundancy / resiliency	0.25	2	0.5
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \sum p$			1.5
Combined Safety Factor, $S_{total} = S_A \times S_B$					1.875
Observed Infiltration Rate, inch/hr $K_{observed}$ (corrected for specific bias)					0.3
Design Infiltration Rate, in/hr, $K_{design} = K_{observed}/S_{total}$					0.16
Supporting Data					
Briefly describe infiltration test and provide reference to test forums:					

Automated Worksheet B.3-1: Project-Scale BMP Feasibility Analysis (V1.3)

Category	#	Description	Value	Units
Capture & Use Inputs	0	Design Capture Volume for Entire Project Site	78,797	cubic-feet
	1	Proposed Development Type	Residential	unitless
	2	Number of Residents or Employees at Proposed Development	507	#
	3	Total Planted Area within Development	564,538	sq-ft
	4	Water Use Category for Proposed Planted Areas	Low	unitless
Infiltration Inputs	5	Is Average Site Design Infiltration Rate ≤0.500 Inches per Hour?	Yes	yes/no
	6	Is Average Site Design Infiltration Rate ≤0.010 Inches per Hour?	No	yes/no
	7	Is Infiltration of the Full DCV Anticipated to Produce Negative Impacts?	Yes	yes/no
	8	Is Infiltration of Any Volume Anticipated to Produce Negative Impacts?	No	yes/no
Calculations	9	36-Hour Toilet Use Per Resident or Employee	1.86	cubic-feet
	10	Subtotal: Anticipated 36 Hour Toilet Use	946	cubic-feet
	11	Anticipated 1 Acre Landscape Use Over 36 Hours	52.14	cubic-feet
	12	Subtotal: Anticipated Landscape Use Over 36 Hours	676	cubic-feet
	13	Total Anticipated Use Over 36 Hours	1,621	cubic-feet
	14	Total Anticipated Use / Design Capture Volume	0.02	cubic-feet
	15	Are Full Capture and Use Techniques Feasible for this Project?	No	unitless
	16	Is Full Retention Feasible for this Project?	No	yes/no
	17	Is Partial Retention Feasible for this Project?	Yes	yes/no
Result	18	Feasibility Category	4	1, 2, 3, 4, 5

Worksheet B.3-1 General Notes:

A. Applicants may use this worksheet to determine the types of structural BMPs that are acceptable for implementation at their project site (as required in Section 5 of the BMPDM). User input should be provided for yellow shaded cells, values for all other cells will be automatically generated. Projects demonstrating feasibility or potential feasibility via this worksheet are encouraged to incorporate capture and use features in their project.

B. Negative impacts associated with retention may include geotechnical, groundwater, water balance, or other issues identified by a geotechnical engineer and substantiated through completion of Form I-8.

C. Feasibility Category 1: Applicant must implement capture & use, retention, and/or infiltration elements for the entire DCV.

D. Feasibility Category 2: Applicant must implement capture & use elements for the entire DCV.

E. Feasibility Category 3: Applicant must implement retention and/or infiltration elements for all DMAs with Design Infiltration Rates greater than 0.50 in/hr.

F. Feasibility Category 4: Applicant must implement standard unlined biofiltration BMPs sized at ≥3% of the effective impervious tributary area for all DMAs with Design Infiltration Rates of 0.011 to 0.50 in/hr. Applicants may be permitted to implement lined BMPs, reduced size BMPs, and/or specialized biofiltration BMPs provided additional criteria identified in "Supplemental Retention Criteria for Non-Standard Biofiltration BMPs" are satisfied.

G. Feasibility Category 5: Applicant must implement standard lined biofiltration BMPs sized at ≥3% of the effective impervious tributary area for all DMAs with Design Infiltration Rates of 0.010 in/hr or less. Applicants may also be permitted to implement reduced size and/or specialized biofiltration BMPs provided additional criteria identified in "Supplemental Retention Criteria for Non-Standard Biofiltration BMPs" are satisfied.

H. PDPs participating in an offsite alternative compliance program are not held to the feasibility categories presented herein.

TECHNICAL MEMORANDUM

Date: May 14, 2019

To: Pat Thomas, P.E.

From: Joseph L. Castaneda, P.E.

Re: Bio-Filtration with Partial Infiltration Basin Sizing

JLC Engineering has prepared this technical memorandum to obtain City of Temecula approval associated with the design of the Bio-Filtration with Partial Infiltration Basin for Tentative Tract Map 36483.

Our current design implements a BMP that has 4:1 side slope and a soil media bottom area of 20,647 square feet. The Fact Sheet for Bio-Filtration with Partial Infiltration (PR-1) requires approval from the City Engineer for the following:

1. The drainage management area (DMA) exceeds 5 acres.
2. The soil media layer area must be sized for 3% of the contributing drainage after being adjusted for the runoff factor.

The City of Temecula BMP Design Manual provides language that allows the City Engineer to adjust the criteria listed above if the following elements are met:

- Project with DMA area greater than 5 acres are allowed if the project incorporates design features related to "minimizing short circuiting, providing flow spreading devices, provide additional design features to enhance performance.
- A soil media surface area less than 3% can be used if the project demonstrates that volume retention is being maximized and decrease loading rates per square foot to increase longevity.
- A soil media surface area less than 3% can be used if the project demonstrates that the BMP surface area proposed will function for water quality volume.

The proposed project is proposing the following design features as part of the BMP design:

1. The project will provide headwall/wingwall structures with a baffle wall that will be used as forebays in order to capture sediments and trash. This will promote the following:
    a. The ability for flows to spread in a sheet flow manner.
    b. The ability to capture sediment and trash that will reduce pollutant loading to the soil media.

   c. The capture of trash, debris and sediments will increase the longevity of the soil media.
2. The project inflow points will be located within slope areas that are on the opposite side of the outflow point. This will ensure project does not have a short-circuit and allows flows to travel across basin.
3. The project has been designed to be about 5 feet deep. The current water quality volume only ponds 1 foot. The project will provide an outflow point with a structure that will control the outflow rate by promoting additional storage within the basin. This will ensure that volume storage is being maximized within the proposed BMP.
4. The project will provide an outflow structure with orifice holes that will control the discharge rate released by the basin for runoff greater than the water quality volume. This design feature will provide performance enhancement that stores more runoff volume and ensure more treatment through the soil media.
5. The Bio-Filtration with Partial Infiltration sizing per the City of Temecula BMP Design Manual require a soil media area of 20,647 square feet, which is equal to 2.65% of the contributing drainage area adjusted for the runoff factor. The basin soil media is equal to 2.65%, which is sized to treat the water quality runoff volume generated by the project. As a result, the project is providing a design that meets the treatment requirements for water quality.

The Bio-Filtration with Partial Infiltration Basin used for the project has been sized for the water quality volume requirements. This project is providing enhancement and design features that allow the City Engineer to approve a design that will allow the drainage management area to be greater than 5 acres and ratio to be less than 3% as discussed previously. Therefore, the project meets City of Temecula BMP Design Manual and treats the water quality runoff volume associated with the project.

Please do not hesitate to call me with any questions at 951.304.9552. We are looking forward to the City of Temecula providing concurrence with our technical memorandum.

Summary of Stormwater Pollutant Control Calculations (V1.3)

Category	#	Description	i	ii	iii	iv	v	Units
General Info	0	Drainage Basin ID or Name	A	BC	D	E	F	unitless
	1	85th Percentile Storm Depth	1.00	1.00	1.00	1.00	1.00	inches
	2	Design Infiltration Rate Recommended by Geotechnical Engineer	0.300	0.300	0.300	0.300	0.300	in/hr
	3	Total Tributary Area	1,322,046	174,240	32,670	35,719	16,117	sq-ft
	4	85th Percentile Storm Volume (Rainfall Volume)	110,171	14,520	2,723	2,977	1,343	cubic-feet
Initial DCV	5	Initial Weighted Runoff Factor	0.61	0.62	0.52	0.38	0.34	unitless
	6	Initial Design Capture Volume	67,204	9,002	1,416	1,131	457	cubic-feet
Site Design Volume Reductions	7	Dispersion Area Reductions	0	0	1,416	1,131	457	cubic-feet
	8	Tree Well and Rain Barrel Reductions	0	0	0	0	0	cubic-feet
BMP Volume Reductions	9	Effective Area Tributary to BMP	806,448	108,029	0	0	0	square feet
	10	Final Design Capture Volume Tributary to BMP	67,204	9,002	0	0	0	cubic-feet
	11	Basin Drains to the Following BMP Type	Biofiltration	Biofiltration	n/a	n/a	n/a	unitless
	12	Volume Retained by BMP (normalized to 36 hour drawdown)	16,801	0	0	0	0	cubic-feet
Total Volume Reductions	13	Total Fraction of Initial DCV Retained within DMA	0.25	0.00	1.00	1.00	1.00	fraction
	14	Percent of Average Annual Runoff Retention Provided	32.4%	0.0%	80.4%	80.4%	80.4%	%
	15	Percent of Average Annual Runoff Retention Required	27.9%	27.9%	27.9%	27.9%	27.9%	%
Performance Standard	16	Percent of Pollution Control Standard Satisfied	100.0%	7.0%	100.0%	100.0%	100.0%	%
Treatment Train	17	Discharges to Secondary Treatment in Drainage Basin	-	-	-	-	-	unitless
	18	Impervious Surface Area Still Requiring Treatment	0	111,630	0	0	0	square feet
	19	Impervious Surfaces Directed to Downstream Dispersion Area	-	-	-	-	-	square feet
	20	Impervious Surfaces Not Directed to Downstream Dispersion Area	-	-	-	-	-	square feet
Result	21	Deficit of Effectively Treated Stormwater	0	-8,372	0	0	0	cubic-feet

Summary Notes:

All fields in this summary worksheet are populated based on previous user inputs. If applicable, drainage basin elements that require revisions and/or supplemental information outside the scope of these worksheets are highlighted in orange and summarized in the red text below. If all drainage basins achieve full compliance without a need for supplemental

Attention!

-Requirements for minimum annual retention are not satisfied at the drainage area level. Incorporate additional retention features or demonstrate minimum retention criteria is
-Performance standards for onsite pollutant control are not satisfied. The applicant must implement onsite flow-thru BMPs per Worksheet B.6-1 and an offsite alternative compliance project to mitigate for the deficit of effectively treated stormwater.

Automated Worksheet B.1-1: Calculation of Design Capture Volume (V1.3)

Category	#	Description	i	ii	iii	iv	v	Units
Standard Drainage Basin Inputs	0	Drainage Basin ID or Name	A	BC	D	E	F	unitless
	1	Basin Drains to the Following BMP Type	Biofiltration	Biofiltration	n/a	n/a	n/a	unitless
	2	85th Percentile 24-hr Storm Depth	1.00	1.00	1.00	1.00	1.00	inches
	3	Design Infiltration Rate Recommended by Geotechnical Engineer	0.300	0.300	0.300	0.300	0.300	in/hr
	4	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	848,943	113,256				sq-ft
	5	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)						sq-ft
	6	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)	473,103	60,984				sq-ft
	7	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)						sq-ft
	8	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)						sq-ft
	9	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)						sq-ft
	10	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)						sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	11	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	No	Yes	Yes	Yes	yes/no
	12	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)			17,122	12,572	4,876	sq-ft
	13	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)						sq-ft
	14	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)			15,548	23,147	11,241	sq-ft
	15	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)						sq-ft
	16	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)						sq-ft
	17	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)						sq-ft
	18	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)						sq-ft
	19	Number of Tree Wells Proposed per SD-A						#
	20	Average Mature Tree Canopy Diameter						ft
	21	Number of Rain Barrels Proposed per SD-E						#
	22	Average Rain Barrel Size						gal
Treatment Train Inputs & Calculations	23	Does BMP Overflow to Stormwater Features in Downstream Drainage?	No	No	No	No	No	unitless
	24	Identify Downstream Drainage Basin Providing Treatment in Series						unitless
	25	Percent of Upstream Flows Directed to Downstream Dispersion Areas						percent
	26	Upstream Impervious Surfaces Directed to Dispersion Area (Ci=0.90)	0	0	0	0	0	cubic-feet
	27	Upstream Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	0	0	0	0	0	cubic-feet
Initial Runoff Factor Calculation	28	Total Tributary Area	1,322,046	174,240	32,670	35,719	16,117	sq-ft
	29	Initial Runoff Factor for Standard Drainage Areas	0.61	0.62	0.00	0.00	0.00	unitless
	30	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	0.00	0.52	0.38	0.34	unitless
	31	Initial Weighted Runoff Factor	0.61	0.62	0.52	0.38	0.34	unitless
	32	Initial Design Capture Volume	67,204	9,002	1,416	1,131	457	cubic-feet
Dispersion Area Adjustments	33	Total Impervious Area Dispersed to Pervious Surface	0	0	17,122	12,572	4,876	sq-ft
	34	Total Pervious Dispersion Area	0	0	15,548	23,147	11,241	sq-ft
	35	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	n/a	1.10	0.50	0.40	ratio
	36	Adjustment Factor for Dispersed & Dispersion Areas	1.00	1.00	0.00	0.00	0.00	ratio
	37	Runoff Factor After Dispersion Techniques	0.61	0.62	0.00	0.00	0.00	unitless
	38	Design Capture Volume After Dispersion Techniques	67,204	9,002	0	0	0	cubic-feet
Tree & Barrel Adjustments	39	Total Tree Well Volume Reduction	0	0	0	0	0	cubic-feet
	40	Total Rain Barrel Volume Reduction	0	0	0	0	0	cubic-feet
Results	41	Final Adjusted Runoff Factor	0.61	0.62	0.00	0.00	0.00	unitless
	42	Final Effective Tributary Area	806,448	108,029	0	0	0	sq-ft
	43	Initial Design Capture Volume Retained by Site Design Elements	0	0	1,416	1,131	457	cubic-feet
	44	Final Design Capture Volume Tributary to BMP	67,204	9,002	0	0	0	cubic-feet

Worksheet B.1-1 General Notes:

A. Applicants may use this worksheet to calculate design capture volumes for up to 10 drainage areas User input must be provided for yellow shaded cells, values for all other cells will be automatically generated, errors/notifications will be highlighted in red and summarized below. Upon completion of this worksheet, proceed to the appropriate BMP Sizing worksheet(s).

Automated Worksheet B.5-1: Sizing Lined or Unlined Biofiltration BMPs (V1.3)

Category	#	Description	i	ii	Units
BMP Inputs	0	Drainage Basin ID or Name	A	BC	sq-ft
	1	Design Infiltration Rate Recommended by Geotechnical Engineer	0.300	0.300	in/hr
	2	Effective Tributary Area	806,448	108,029	sq-ft
	3	Minimum Biofiltration Footprint Sizing Factor	0.002	0.002	ratio
	4	Design Capture Volume Tributary to BMP	67,204	9,002	cubic-feet
	5	Is Biofiltration Basin Impermeably Lined or Unlined?	Unlined	Lined	unitless
	6	Provided Biofiltration BMP Surface Area	20,647	250	sq-ft
	7	Provided Surface Ponding Depth	1	6	inches
	8	Provided Soil Media Thickness	30	21	inches
	9	Provided Depth of Gravel Above Underdrain Invert	12	6	inches
	10	Diameter of Underdrain or Hydromod Orifice (Select Smallest)	6.00	4.00	inches
	11	Provided Depth of Gravel Below the Underdrain	3	3	inches
Retention Calculations	12	Volume Infiltrated Over 6 Hour Storm	3,097	0	cubic-feet
	13	Soil Media Pore Space Available for Retention	0.05	0.05	unitless
	14	Gravel Pore Space Available for Retention	0.40	0.00	unitless
	15	Effective Retention Depth	2.70	1.05	inches
	16	Calculated Retention Storage Drawdown (Including 6 Hr Storm)	10	120	hours
	17	Volume Retained by BMP	7,742	22	cubic-feet
	18	Fraction of DCV Retained	0.12	0.00	ratio
	19	Portion of Retention Performance Standard Satisfied	0.41	0.00	ratio
	20	Fraction of DCV Retained (normalized to 36-hr drawdown)	0.25	0.00	ratio
	21	Design Capture Volume Remaining for Biofiltration	50,403	9,002	cubic-feet
Biofiltration Calculations	22	Max Hydromod Flow Rate through Underdrain	1.7261	0.6754	CFS
	23	Max Soil Filtration Rate Allowed by Underdrain Orifice	3.61	116.70	in/hr
	24	Soil Media Filtration Rate per Specifications	5.00	5.00	in/hr
	25	Soil Media Filtration Rate to be used for Sizing	3.61	5.00	in/hr
	26	Depth Biofiltered Over 6 Hour Storm	21.67	30.00	inches
	27	Soil Media Pore Space Available for Biofiltration	0.20	0.20	unitless
	28	Effective Depth of Biofiltration Storage	11.80	12.60	inches
	29	Drawdown Time for Surface Ponding	0	1	hours
	30	Drawdown Time for Effective Biofiltration Depth	3	3	hours
	31	Total Depth Biofiltered	33.47	42.60	inches
	32	Option 1 - Biofilter 1.50 DCV: Target Volume	75,605	13,503	cubic-feet
	33	Option 1 - Provided Biofiltration Volume	57,586	888	cubic-feet
	34	Option 2 - Store 0.75 DCV: Target Volume	37,802	6,752	cubic-feet
	35	Option 2 - Provided Storage Volume	20,302	263	cubic-feet
	36	Portion of Biofiltration Performance Standard Satisfied	0.76	0.07	ratio
Result	37	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	Yes	No	yes/no
	38	Overall Portion of Performance Standard Satisfied	1.00	0.07	ratio
	39	This BMP Overflows to the Following Drainage Basin	-	-	unitless
	40	**Deficit of Effectively Treated Stormwater**	0	-8,372	cubic-feet

Worksheet B.5-1 General Notes:

A. Applicants may use this worksheet to size Lined or Unlined Biofiltration BMPs (BF-1, PR-1) for up to 10 basins. User input must be provided for yellow shaded cells, values for blue cells are automatically populated based on user inputs from previous worksheets, values for all other cells will be automatically generated, errors/notifications will be highlighted in red/orange and summarized below. BMPs fully satisfying the pollutant control

Attention!

-Minimum annual retention criteria are not satisfied for each individual drainage area. Implement additional site design elements, increase structural BMP
-This BMP does not fully satisfy the performance standards for pollutant control and must be supplemented with flow-thru treatment and an offsite

Automated Worksheet B.5-3: Alternate Minimum Biofiltration Footprint Ratio (V1.3)

Category	#	Description	i	ii	Units
Drainage Basin Info	0	Drainage Basin ID or Name	A	BC	unitless
	1	Drains to following BMP Type	Biofiltration	Biofiltration	unitless
	2	Final Effective Tributary Area	806,448	108,029	sq-ft
Biofiltration Clogging Inputs	3	Is Proposed Biofiltration BMP <3% of Effective Tributary Area Desired?	Yes	Yes	yes/no
	4	Average Annual Precipitation	12.0	12.0	inches
	5	Load to Clog (default =2.0)	4.0	4.0	lb/sq-ft
	6	Allowable Period to Accumulate Clogging Load (default =10)	1	1	years
	7	Pretreatment Measures Included?	No	No	yes/no
	8	Commercial: TSS=128 mg/L, C= 0.80			sq-ft
	9	Education: TSS=132 mg/L, C= 0.50			sq-ft
	10	Industrial: TSS=125 mg/L, C= 0.90			sq-ft
	11	Low Traffic Areas: TSS=50 mg/L, C= 0.50			sq-ft
	12	Multi-Family Residential: TSS=40 mg/L, C= 0.60			sq-ft
	13	Roof Areas: TSS=14 mg/L, C= 0.90			sq-ft
	14	Single Family Residential: TSS=123 mg/L, C= 0.40	806,448	108,029	sq-ft
	15	Transportation: TSS=78 mg/L, C= 0.90			sq-ft
	16	Vacant/Open Space: TSS=216 mg/L, C= 0.10			sq-ft
Minimum Footprint Calculations	17	Effective-Area Based on Specified Land Use Coefficients	322,579	43,212	sq-ft
	18	Average TSS Concentration for Tributary	123	123	mg/L
	19	Average Annual Runoff	806,448	108,029	cubic-feet
	20	Average Annual TSS Load	6,192	830	lb/yr
	21	Average Annual TSS Load After Pretreatment Measures	6,192	830	lb/yr
	22	Minimum Allowable Biofiltration Footprint Ratio	0.002	0.002	ratio

Worksheet B.5-3 General Notes:

A. Applicants may use this worksheet to calculate Alternate Minimum Biofiltration Footprint Ratios for up to 10 basins. User input must be provided for yellow shaded cells, values for blue cells are automatically populated based on user inputs from previous worksheets, values for all other cells will be automatically generated, errors/notifications will be highlighted in red and summarized below. Inputs for Lines 4-7 (precipitation, load to clog, clogging

Optimized Biofiltration BMP Footprint when Downstream of a Storage Unit		Worksheet B.5-4	
1	Area draining to the storage unit and biofiltration BMP	174240	sq-ft
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.62	
3	Effective impervious area draining to the storage unit and biofiltration BMP [Line 1 x Line 2]	108029	sq-ft
4	Remaining DCV after implementing retention BMPs	9002	cubic-feet
5	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	0.3	ft/hr
6	Media Thickness [1.5 feet minimum], also add mulch layer thickness to this line for sizing calculations	1.5	ft
7	Media filtration rate to be used for sizing (0.42 ft/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet control rate)	0.42	ft/hr
8	Media retained pore storage	0.1	ft/ft
Storage Unit Requirement			
9	Drawdown time of the storage unit, minimum (from the elevation that bypasses the biofiltration BMP, overflow elevation)	12	hours
10	Storage required to achieve greater than 92 percent capture (see Table B.5-4)	0.85	fraction
11	Storage required in cubic feet (Line 4 x Line 10)	7651.7	cubic-feet
12	Storage provided in the design, minimum (from the elevation that bypasses the biofiltration BMP, overflow elevation)	10524.3	cubic-feet
13	Is Line 12 ≥ 11. If no increase storage provided until this criteria is met	x☐ YES	☐ NO
Criteria 1: BMP Footprint Biofiltration Capacity			
14	Peak flow rate the storage unit to the biofiltration BMP (using the elevation to evaluate the percent capture)	0.496	cfs
15	Required biofiltration footprint [(3,000 x Line 14)/Line 7]	12754285.71	sq-ft
Criteria 2: Alternative Minimum Sizing Factor (Clogging)			
16	Alternative Minimum Footprint Sizing Factor [Worksheet B.5-3]	0.002	Fraction
17	Required biofiltration footprint [Line 3 x Line 16]	216.058	sq-ft
Optimized Biofiltration Footprint			
18	Optimized biofiltration footprint, maximum (Line 15, Line 17)	216.058	sq-ft

Note: Biofiltration BMP Smaller than the alternative minimum footprint sizing (Line 17) is considered compact biofiltration BMP and may be allowd at the discretion of the County staff if the BMP meets the requirements in Appendix F and Option 1 or Option 2 sizing in Worksheets B.5-1 (See Appendix I).

NOTES: Item 15 was calculated by converting 0.42 ft/hr into ft/s to be consistent with the units of cfs. This value of 12,754,285 sq-ft is 292 acres, which is approximately 7 times larger than the entire project site, therefore this value is unrealistic and not utilized. The rquired biofiltration footprint for Item 17 is utilized, therefore, as the target value. The modular wetlands will provide 252 square feet of area with a treatment flow rate of 0.577 cfs. Per Worksheet B.6-1, the required Water Quality Flow Rate Requiring Flow-Thru Treatment is 0.466 cfs. Therefore, the MWS-L-8-20 is sufficient for treatment purposes.

Automated Worksheet B.6-1: Sizing Flow-Thru BMPs (V1.3)

Category	#	Description	i	ii	Units
Flow-Thru BMP Inputs	0	Drainage Basin ID or Name	-	BC	unitless
	1	Final Effective Tributary Area	-	108,029	sq-ft
	2	Final Adjusted Runoff Factor	-	0.62	unitless
	3	Final Design Capture Volume Tributary to BMP	-	9,002	cubic-feet
	4	Volume Effectively Retained and/or Biofiltered	-	630	cubic-feet
	5	Deficit of Effectively Treated Stormwater Requiring Flow-Thru Treatment	-	-8,372	cubic-feet
	6	Maximum Rated Water Quality Flow Rate of Proposed BMP		0.577	CFS
Flow Rate Calculations	7	Adjustment Factor	-	0.93	unitless
	8	Design Rainfall Intensity for Flow-Thru BMPs	-	0.20	in/hr
	9	Water Quality Flow Rate Requiring Flow-Thru Treatment	-	0.461	CFS
Result	10	Is Flow-Thru BMP Adequately Sized?	-	Yes	unitless

Worksheet B.6-1 General Notes:

A. Applicants may use this worksheet to size flow-thru BMPs (FT-1 through FT-5) for up to 10 basins. Note that applicants proposing flow-thru BMPs must provide supplemental documentation to support the maximum water quality flow rate referenced above, demonstrate medium to high pollutant removal efficiency for project's most significant pollutants of concern, and must also implement an offsite alternative compliance project to offset the deficit of effectively treated stormwater volume. User input must be provided for yellow shaded cells, values for blue cells are automatically populated based on user inputs from previous worksheets, values for all other cells will be automatically generated, errors/notifications will be

Attachment 1d: Structural Pollutant Control BMP Checklist

Provide the following items for each Structural BMP selected
Refer to Figure 5-2: *Stormwater Pollutant Control Structural BMP Selection Flow Chart*

DMA ID No. A1, A2, A3, A4 Structural BMP ID No.A Construction Plan Sheet No. TBD

X Structural BMP Feasibility -Worksheet B.3-1: Project-Scale BMP Feasibility Analysis

X Worksheet C.4-1: Categorization of Infiltration Feasibility Condition *Refer to Appendices C and D to complete.*

☐ Not included because the entire project will use harvest and use BMPs

X Worksheet D.5-1 Infiltration & partial retention Safety Factor

Structural BMP Selection and Design (Chapter 5.5) complete an include the applicable worksheet(s) found in appendix B and design criteria checklists from the associated fact sheets found in appendix E for selected Structural BMP(s):

☐ Worksheet B.6-1 - Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)

☐ Retention by harvest and use (HU-1)

- ☐ Continuous simulation Model

☐ Worksheet B.4-1

- ☐ Infiltration basin (INF-1)
- ☐ Bioretention (INF-2)
- ☐ Permeable pavement (INF-3)

X Worksheet B.5-1

- X Biofiltration with partial retention (PR-1)
- ☐ Biofiltration (BF-1)
  - X Biofiltration with Nutrient Sensitive Media Design (BF-2)
    - ☐ Identification and Narrative of Receiving Water Pollutants of Concern
  - ☐ Proprietary Biofiltration (BF-3)
    - ☐ Appendix F checklist
    - ☐ Identification and Narrative of Receiving Water Pollutants of Concern

☐ -Worksheet B.5-3 Minimum Footprint

☐ -Worksheet B.5-4 Biofiltration + Storage

X Selected BMPs have been designed to address the entire DCV. The DMA is compliant with Pollution Control BMP sizing requirements. **STOP** *

☐ Other (describe in discussion section below)

☐ Worksheet B.6-1 - Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)

- ☐ Describe in discussion section below why the remaining BMP size could not fit on site.
- ☐ Identification and Narrative of Receiving Water Pollutants of Concern
- ☐ Selection of Flow-Thru Treatment Control BMPs with high or medium effectiveness
  - ☐ FT-1 Vegetated swales
  - ☐ FT-2 Media Filters
  - ☐ FT-3 Sand Filters
  - ☐ FT-4 Dry Extended Detention Basin
  - ☐ FT-5 Proprietary flow-thru treatment control
- ☐ Pollutant Control Offsite Alternative Compliance Participation form
- ☐ Water Quality Equivalency Worksheets[20]

Preparation Date:_____ Template Date: February 22nd, 2019

Purpose: ☐ Pre-treatment/forebay for another structural BMP ☐ Pollutant control only X Combined pollutant control and hydromodification control (see Attachment 2) ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms (See Chapter 1.12 of the BMP Design Manual)	TBD
Who will be the final owner of this BMP?	X HOA ☐ Property Owner ☐ City ☐ Other (describe)
Who will maintain this BMP into perpetuity?	X HOA ☐ Property Owner ☐ City ☐ Other (describe)

Discussion (as needed): DMA A1, A2, A3, and A4 will utilize a biofiltration with partial retention as the method of treatment.

The biofiltration basin with partial retention will utilize 36" of soil media since the downstream Impaired Waterbody is listed as impaired for nutrients. The biofiltration basin will also utilize nutrient sensitive media design.

(Continue on subsequent pages as necessary)

* If this box is checked, Worksheet B.6-1 does not need to be filled out.

E.17 PR-1 Biofiltration with Partial Retention

Location: 805 and Bonita Road, Chula vista, CA.

MS4 Permit Category
NA

Manual Category
Partial Retention

Applicable Performance Standard
Pollutant Control
Flow Control

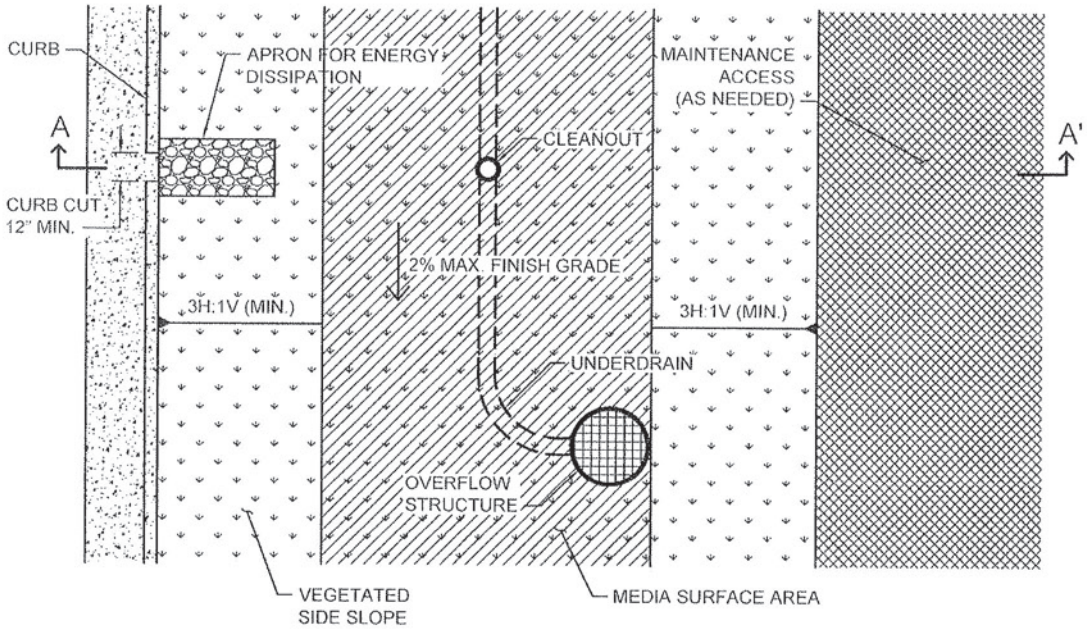
Primary Benefits
Volume Reduction
Treatment
Peak Flow Attenuation

Description

Biofiltration with partial retention (partial infiltration and biofiltration) facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to infiltrating into native soils, discharge via underdrain, or overflow to the downstream conveyance system. Where feasible, these BMPs have an elevated underdrain discharge point that creates storage capacity in the aggregate storage layer. Biofiltration with partial retention facilities are commonly incorporated into the site within parking lot landscaping, along roadsides, and in open spaces. They can be constructed in ground or partially aboveground, such as planter boxes with open bottoms to allow infiltration. Treatment is achieved through filtration, sedimentation, sorption, infiltration, biochemical processes and plant uptake.

Typical biofiltration with partial retention components include:

- Inflow distribution mechanisms (e.g, perimeter flow spreader or filterstrips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side Slope and basin bottom vegetation selected based on climate and ponding depth
- Non-floating mulch layer (Optional)
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer consisting of aggregate to prevent the migration of fines into uncompacted native soils or the optional aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Uncompacted native soils at the bottom of the facility
- Overflow structure



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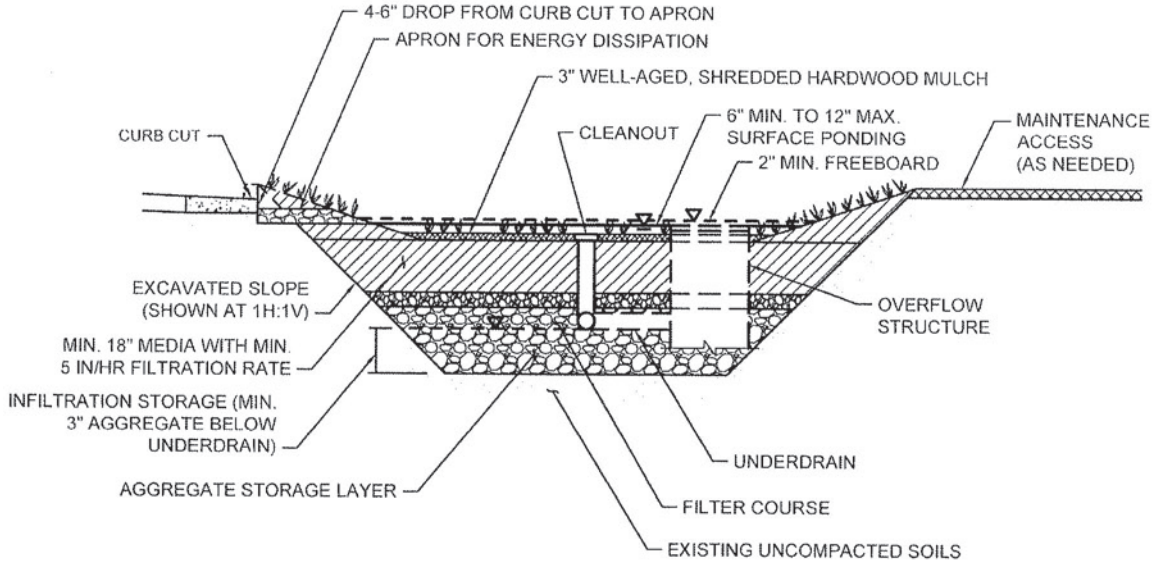

SECTION A-A'
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Typical plan and Section view of a Biofiltration with Partial Retention BMP

Design Adaptations for Project Goals

Partial infiltration BMP with biofiltration treatment for storm water pollutant control. Biofiltration with partial retention can be designed so that a portion of the DCV is infiltrated by providing infiltration storage below the underdrain invert. The infiltration storage depth should be determined by the volume that can be reliably infiltrated within drawdown time limitations. Water discharged through the underdrain is considered biofiltration treatment. Storage provided above the underdrain within surface ponding, media, and aggregate storage is included in the biofiltration treatment volume.

Integrated storm water flow control and pollutant control configuration. The system can be designed to provide flow rate and duration control by primarily providing increased surface ponding and/or having a deeper aggregate storage layer. This will allow for significant detention storage, which can be controlled via inclusion of an orifice in an outlet structure at the downstream end of the underdrain.

Recommended Siting Criteria

	Siting Criteria	*Intent/Rationale*
☒	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☒	Selection and design of basin is based on infiltration feasibility criteria and appropriate design infiltration rate (See Appendix C and D).	Must operate as a partial infiltration design and must be supported by drainage area and in-situ infiltration rate feasibility findings.
☐	Contributing tributary area shall be ≤ 5 acres (≤ 1 acre preferred).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the [City Engineer} if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the City Engineer for proper performance of the regional BMP.
☒	Finish grade of the facility is ≤ 2%.	Flatter surfaces reduce erosion and

Siting Criteria	*Intent/Rationale*
	channelization within the facility.

Recommended BMP Component Dimensions

BMP Component	*Dimension*	*Intent/Rationale*
Freeboard	≥ 2 inches	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
Surface Ponding	≥ 6 and ≤ 12 inches	Surface ponding capacity lowers subsurface storage requirements. Deep surface ponding raises safety concerns. Surface ponding depth greater than 12 inches (for additional pollutant control or surface outlet structures or flow-control orifices) may be allowed at the discretion of the City Engineer if the following conditions are met: 1) surface ponding depth drawdown time is less than 24 hours; and 2) safety issues and fencing requirements are considered (typically ponding greater than 18" will require a fence and/or flatter side slopes) and 3) potential for elevated clogging risk is considered.
Ponding Area Side Slopes	3H:1V or shallower	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
Mulch	≥ 3 inches	Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows the beneficial microbes to multiply.
Media Layer	≥ 18 inches	A deep media layer provides additional filtration and supports

BMP Component	*Dimension*	*Intent/Rationale*
		plants with deeper roots. Standard specifications shall be followed. For non-standard or proprietary designs, compliance with Appendix F.1 ensures that adequate treatment performance will be provided.
Underdrain Diameter	≥ 6 inches	Smaller diameter underdrains are prone to clogging.
Cleanout Diameter	≥ 6 inches	Properly spaced cleanouts will facilitate underdrain maintenance.

Design Criteria and Considerations

Biofiltration with partial retention must meet the following design criteria and considerations. Deviations from the below criteria may be approved at the discretion of the City Engineer if it is determined to be appropriate:

Design Criteria		*Intent/Rationale*
Surface Ponding		
☒	Surface ponding is limited to a 24-hour drawdown time.	Surface ponding limited to 24 hours for plant health. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the City Engineer if certified by a landscape architect or agronomist.
Vegetation		
☒	Plantings are suitable for the climate and expected ponding depth. A plant list to aid in selection can be found in Appendix E.26	Plants suited to the climate and ponding depth are more likely to survive.
☐	An irrigation system with a connection to water supply should be provided as needed.	Seasonal irrigation might be needed to keep plants healthy.
Mulch (Optional or Mandatory – Dependent on jurisdiction)		

Design Criteria	*Intent/Rationale*
☒ A minimum of 3 inches of well-aged, shredded hardwood mulch that has been stockpiled or stored for at least 12 months is provided. Mulch must be non-floating to avoid clogging of overflow structure.	Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows the beneficial microbes to multiply.
Media Layer	
☒ Media maintains a minimum filtration rate of 5 in/hr over lifetime of facility. An initial filtration rate of 8 to 12 in/hr is recommended to allow for clogging over time; the initial filtration rate should not exceed 12 inches per hour.	A filtration rate of at least 5 inches per hour allows soil to drain between events, and allows flows to relatively quickly enter the aggregate storage layer, thereby minimizing bypass. The initial rate should be higher than long term target rate to account for clogging over time. However an excessively high initial rate can have a negative impact on treatment performance, therefore an upper limit is needed.
☒ Media is a minimum 18 inches deep, meeting either of these two media specifications: Section F.3 Biofiltration Soil Media (BSM) or specific jurisdictional guidance. Alternatively, for proprietary designs and custom media mixes not meeting the media specifications, the media meets the pollutant treatment performance criteria in Section F.1.	A deep media layer provides additional filtration and supports plants with deeper roots. Standard specifications shall be followed. For non-standard or proprietary designs, compliance with Appendix F.1 ensures that adequate treatment performance will be provided.
☐ Media surface area is 3% of contributing area times adjusted runoff factor or greater. Unless demonstrated that the BMP surface area can be smaller than 3%.	Greater surface area to tributary area ratios: a) maximizes volume retention as required by the MS4 Permit and b) decrease loading rates per square foot and therefore increase longevity. Adjusted runoff factor is to account for site design BMPs implemented upstream of the BMP (such as rain barrels, impervious area dispersion, etc.). Refer to Appendix B.2 guidance.

Design Criteria		*Intent/Rationale*
☒	Where receiving waters are impaired or have a TMDL for nutrients, the system is designed with nutrient sensitive media design (see fact sheet BF-2).	Potential for pollutant export is partly a function of media composition; media design must minimize potential for export of nutrients, particularly where receiving waters are impaired for nutrients.
Filter Course Layer		
☐	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade. Filter fabric is more likely to clog.
☒	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility
☒	Filter course calculations assessing suitability for particle migration prevention have been completed.	Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.
Aggregate Storage Layer		
☒	Class 2 Permeable per Caltrans specification 68-1.025 is recommended for the storage layer. Washed, open-graded crushed rock may be used, however a 4-6 inch washed pea gravel filter course layer at the top of the crushed rock is required.	Washing aggregate will help eliminate fines that could clog the aggregate storage layer void spaces or subgrade.
☒	Maximum aggregate storage layer depth below the underdrain invert is determined based on the infiltration storage volume that will infiltrate within a 36-hour drawdown time.	A maximum drawdown time is needed for vector control and to facilitate providing storm water storage for the next storm event.
Inflow, Underdrain, and Outflow Structures		
☒	Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☒	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods. (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
☐	Curb cut inlets are at least 12 inches wide, have a 4-6 inch reveal (drop) and an apron and	Inlets must not restrict flow and apron prevents blockage from vegetation as it

Design Criteria		*Intent/Rationale*
	energy dissipation as needed.	grows in. Energy dissipation prevents erosion.
☒	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
☒	Minimum underdrain diameter is 6 inches.	Smaller diameter underdrains are prone to clogging.
☒	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
☒	An underdrain cleanout with a minimum 6-inch diameter and lockable cap is placed every 250 to 300 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.
☒	Overflow is safely conveyed to a downstream storm drain system or discharge point. Size overflow structure to pass 100-year peak flow for on-line infiltration basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Nutrient Sensitive Media Design

To design biofiltration with partial retention with underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design biofiltration with partial retention and an underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Generalized sizing procedure is presented in Appendix B.5. The surface ponding should be verified to have a maximum 24-hour drawdown time.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide detention and/or infiltration storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If biofiltration with partial retention cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with significant storage volume such as an underground vault can be used to provide remaining controls.
4. After biofiltration with partial retention has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

Maintenance Overview

Normal Expected Maintenance. Biofiltration with partial retention requires routine maintenance to: remove accumulated materials such as sediment, trash or debris; maintain vegetation health; maintain infiltration capacity of the media layer; replenish mulch; and maintain integrity of side slopes, inlets, energy dissipators, and outlets. A summary table of standard inspection and maintenance indicators is provided within this Fact Sheet.

Non-Standard Maintenance or BMP Failure. If any of the following scenarios are observed, the BMP is not performing as intended to protect downstream waterways from pollution and/or erosion. Corrective maintenance, increased inspection and maintenance, BMP replacement, or a different BMP type will be required.

- The BMP is not drained between storm events. Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health, and surface ponding longer than approximately 96 hours following a storm event poses a risk of vector (mosquito) breeding. Poor drainage can result from clogging of the media layer, filter course, aggregate storage layer, underdrain, or outlet structure. The specific cause of the drainage issue must be determined and corrected.

- Sediment, trash, or debris accumulation greater than 25% of the surface ponding volume

within one month. This means the load from the tributary drainage area is too high, reducing BMP function or clogging the BMP. This would require pretreatment measures within the tributary area draining to the BMP to intercept the materials. Pretreatment components, especially for sediment, will extend the life of components that are more expensive to replace such as media, filter course, and aggregate layers.

- Erosion due to concentrated storm water runoff flow that is not readily corrected by adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the City Engineer shall be contacted prior to any additional repairs or reconstruction.

Other Special Considerations. Biofiltration with partial retention is a vegetated structural BMP. Vegetated structural BMPs that are constructed in the vicinity of, or connected to, an existing jurisdictional water or wetland could inadvertently result in creation of expanded waters or wetlands. As such, vegetated structural BMPs have the potential to come under the jurisdiction of the United States Army Corps of Engineers, San Diego Water Board, California Department of Fish and Wildlife, or the United States Fish and Wildlife Service. This could result in the need for specific resource agency permits and costly mitigation to perform maintenance of the structural BMP. Along with proper placement of a structural BMP, routine maintenance is key to preventing this scenario.

Summary of Standard Inspection and Maintenance

The property owner is responsible to ensure inspection, operation and maintenance of permanent BMPs on their property unless responsibility has been formally transferred to an agency, community facilities district, homeowners association, property owners association, or other special district.

Maintenance frequencies listed in this table are average/typical frequencies. Actual maintenance needs are site-specific, and maintenance may be required more frequently. Maintenance must be performed whenever needed, based on maintenance indicators presented in this table. The BMP owner is responsible for conducting regular inspections to see when maintenance is needed based on the maintenance indicators. During the first year of operation of a structural BMP, inspection is recommended at least once prior to August 31 and then monthly from September through May. Inspection during a storm event is also recommended. After the initial period of frequent inspections, the minimum inspection and maintenance frequency can be determined based on the results of the first year inspections.

Threshold/Indicator	Maintenance Action	Typical Maintenance Frequency
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation or compaction of the media layer.	• Inspect monthly. If the BMP is 25% full* or more in one month, increase inspection frequency to monthly plus after every 0.1-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Obstructed inlet or outlet structure	Clear blockage.	• Inspect monthly and after every 0.5-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable.	• Inspect annually. • Maintain when needed.
Poor vegetation establishment	Re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintain when needed.

Threshold/Indicator	Maintenance Action	Typical Maintenance Frequency
Dead or diseased vegetation	Remove dead or diseased vegetation, re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintain when needed.
Overgrown vegetation	Mow or trim as appropriate.	• Inspect monthly. • Maintain when needed.
2/3 of mulch has decomposed, or mulch has been removed	Remove decomposed fraction and top off with fresh mulch to a total depth of 3 inches.	• Inspect monthly. • Replenish mulch annually, or more frequently when needed based on inspection.
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.	• Inspect monthly. • Maintain when needed.
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the City Engineer shall be contacted prior to any additional repairs or reconstruction.	• Inspect after every 0.5-inch or larger storm event. If erosion due to storm water flow has been observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintain when needed. If the issue is not corrected by restoring the BMP to the original plan and grade, the City Engineer shall be contacted prior to any additional repairs or reconstruction.
Standing water in BMP for longer than 24 hours following a storm event Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains, or repairing/replacing clogged or compacted soils.	• Inspect monthly and after every 0.5-inch or larger storm event. If standing water is observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintain when needed.

Threshold/Indicator	Maintenance Action	Typical Maintenance Frequency
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology	If mosquitos/larvae are observed: first, immediately remove any standing water by dispersing to nearby landscaping; second, make corrective measures as applicable to restore BMP drainage to prevent standing water. If mosquitos persist following corrective measures to remove standing water, or if the BMP design does not meet the 96-hour drawdown criteria due to release rates controlled by an orifice installed on the underdrain, the City Engineer shall be contacted to determine a solution. A different BMP type, or a Vector Management Plan prepared with concurrence from the County of Riverside Department of Environmental Health, may be required.	• Inspect monthly and after every 0.5-inch or larger storm event. If mosquitos are observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintain when needed.
Underdrain clogged	Clear blockage.	Inspect if standing water is observed for longer than 24-96 hours following a storm event. Maintain when needed.

Some studies of biofiltration with underdrains have observed export of nutrients, particularly inorganic nitrogen (nitrate and nitrite) and dissolved phosphorus. This has been observed to be a short-lived phenomenon in some studies or a long term issue in some studies. The composition of the soil media, including the chemistry of individual elements is believed to be an important factor in the potential for nutrient export. Organic amendments, often compost, have been identified as the most likely source of nutrient export. The quality and stability of organic amendments can vary widely.

The biofiltration media specifications contained in the County of San Diego Low Impact Development Handbook: Appendix G - Biofiltration Soil Specification (June 2014, unless superseded by more recent edition) and the City of San Diego Low Impact Development Design Manual (page B-18) (July 2011, unless superseded by more recent edition) were developed with consideration of the potential for nutrient export. These specifications include criteria for individual component characteristics and quality in order to control the overall quality of the blended mixes. As of the publication of this manual, the June 2014 County of San Diego specifications provide more detail regarding mix design and quality control.

The City and County specifications noted above were developed for general purposes to meet permeability and treatment goals. In cases where the BMP discharges to receiving waters with nutrient impairments or nutrient TMDLs, the biofiltration media should be designed with the specific goal of minimizing the potential for export of nutrients from the media. Therefore, in addition to adhering to the City or County media specifications, the following guidelines should be followed:

1. **Select plant palette to minimize plant nutrient needs**

A landscape architect or agronomist should be consulted to select a plant palette that minimizes nutrient needs. Utilizing plants with low nutrient needs results in less need to enrich the biofiltration soil mix. If nutrient quantity is then tailored to plants with lower nutrient needs, these plants will generally have less competition from weeds, which typically need higher nutrient content. The following practices are recommended to minimize nutrient needs of the plant palette:

- **Utilize native, drought-tolerant plants and grasses where possible.** Native plants generally have a broader tolerance for nutrient content, and can be longer lived in leaner/lower nutrient soils.

- **Start plants from smaller starts or seed.** Younger plants are generally more tolerant of lower nutrient levels and tend to help develop soil structure as they grow. Given the lower cost of smaller plants, the project should be able to accept a plant mortality rate that is somewhat higher than starting from larger plants and providing high organic content.

2. **Minimize excess nutrients in media mix**

Once the low-nutrient plant palette is established (item 1), the landscape architect and/or agronomist should be consulted to assist in the design of a biofiltration media to balance the interests of plant establishment, water retention capacity (irrigation demand), and the potential for nutrient export. The following guidelines should be followed:

- **The mix should not exceed the nutrient needs of plants.** In conventional landscape design, the nutrient needs of plants are often exceeded intentionally in order to provide a factor of safety for plant survival. This practice must be avoided in biofiltration media as excess nutrients will increase the chance of export. The mix designer should keep in mind that nutrients can be added later (through mulching, tilling of amendments into the surface), but it is not possible to remove nutrients, once added.

- **The actual nutrient content and organic content of the selected organic amendment source should be determined when specifying mix proportions.** Nutrient content (i.e., C:N ratio; plant extractable nutrients) and organic content (i.e, % organic material) are relatively inexpensive to measure via standard agronomic methods and can provide important information about mix design. If mix design relies on approximate assumption about nutrient/organic content and this is not confirmed with testing (or the results of prior representative testing), it is possible that the mix could contain much more nutrient than intended.

- **Nutrients are better retained in soils with higher cation exchange capacity.** Cation exchange capacity can be increased through selection of organic material with naturally high cation exchange capacity, such as peat or coconut coir pith, and/or selection of inorganic material with high cation exchange capacity such as some sands or engineered minerals (e.g., low P-index sands, zeolites, rhyolites, etc). Including higher cation exchange capacity materials would tend to reduce the net export of nutrients. Natural silty materials also provide cation exchange capacity; however potential impacts to permeability need to be considered.

- **Focus on soil structure as well as nutrient content.** Soil structure is loosely defined as the ability of the soil to conduct and store water and nutrients as well as the degree of aeration of the soil. Soil structure can be more important than nutrient content in plant survival and biologic health of the system. If a good soil structure can be created with very low amounts of organic amendment, plants survivability should still be provided. While soil structure generally develops with time, biofiltration media can be designed to promote earlier development of soil structure. Soil structure is enhanced by the use of amendments with high humus content (as found in well-aged organic material). In addition, soil structure can be enhanced through the use of organic material with a distribution of particle sizes (i.e., a more heterogeneous mix).

- **Consider alternatives to compost.** Compost, by nature, is a material that is continually evolving and decaying. It can be challenging to determine whether tests previously done on a given compost stock are still representative. It can also be challenging to determine how the properties of the compost will change once placed in the media bed. More stable materials

such as aged coco coir pith, peat, biochar, shredded bark, and/or other amendments should be considered.

With these considerations, it is anticipated that less than 10 percent organic amendment by volume could be used, while still balancing plant survivability and water retention. If compost is used, designers should strongly consider utilizing less than 10 percent by volume.

3. **Design with partial retention and/or internal water storage**

An internal water storage zone, as described in Fact Sheet PR-1 is believed to improve retention of nutrients. For lined systems, an internal water storage zone worked by providing a zone that fluctuates between aerobic and anaerobic conditions, resulting in nitrification/denitrification. In soils that will allow infiltration, a partial retention design (PR-1) allows significant volume reduction and can also promote nitrification/denitrification.

Acknowledgment: This fact sheet has been adapted from the Orange County Technical Guidance Document (May 2011). It was originally developed based on input from: Deborah Deets, City of Los Angeles Bureau of Sanitation, Drew Ready, Center for Watershed Health, Rick Fisher, ASLA, City of Los Angeles Bureau of Engineering, Dr. Garn Wallace, Wallace Laboratories, Glen Dake, GDML, and Jason Schmidt, Tree People. The guidance provided herein does not reflect the individual opinions of any individual listed above and should not be cited or otherwise attributed to those listed.

Maintenance Overview

Refer to maintenance information provided in the Biofiltration (BF-1) Fact Sheet. Adjust maintenance actions and reporting if required based on the specific media design.

Provide the following items for each Structural BMP selected
Refer to Figure 5-2: *Stormwater Pollutant Control Structural BMP Selection Flow Chart*

DMA ID No. B & C Structural BMP ID No. BC Construction Plan Sheet No. TBD

☐ Structural BMP Feasibility -Worksheet B.3-1: Project-Scale BMP Feasibility Analysis

X Worksheet C.4-1: Categorization of Infiltration Feasibility Condition *Refer to Appendices C and D to complete.*

☐ Not included because the entire project will use harvest and use BMPs

☐ Worksheet D.5-1 Infiltration & partial retention Safety Factor

Structural BMP Selection and Design (Chapter 5.5) complete an include the applicable worksheet(s) found in appendix B and design criteria checklists from the associated fact sheets found in appendix E for selected Structural BMP(s):

☐ Worksheet B.6-1 - Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)

☐ Retention by harvest and use (HU-1)

- ☐ Continuous simulation Model

☐ Worksheet B.4-1

- ☐ Infiltration basin (INF-1)
- ☐ Bioretention (INF-2)
- ☐ Permeable pavement (INF-3)

X Worksheet B.5-1

- ☐ Biofiltration with partial retention (PR-1)
- ☐ Biofiltration (BF-1)
  - ☐ Biofiltration with Nutrient Sensitive Media Design (BF-2)
  - ☐ Identification and Narrative of Receiving Water Pollutants of Concern
- X Proprietary Biofiltration (BF-3)
  - X Appendix F checklist
  - X Identification and Narrative of Receiving Water Pollutants of Concern

☐ -Worksheet B.5-3 Minimum Footprint

X -Worksheet B.5-4 Biofiltration + Storage

X Selected BMPs have been designed to address the entire DCV. The DMA is compliant with Pollution Control BMP sizing requirements. **STOP** *

☐ Other (describe in discussion section below)

☐ Worksheet B.6-1 - Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)

- ☐ Describe in discussion section below why the remaining BMP size could not fit on site.
- ☐ Identification and Narrative of Receiving Water Pollutants of Concern
- ☐ Selection of Flow-Thru Treatment Control BMPs with high or medium effectiveness
  - ☐ FT-1 Vegetated swales
  - ☐ FT-2 Media Filters
  - ☐ FT-3 Sand Filters
  - ☐ FT-4 Dry Extended Detention Basin
  - ☐ FT-5 Proprietary flow-thru treatment control
- ☐ Pollutant Control Offsite Alternative Compliance Participation form
- ☐ Water Quality Equivalency Worksheets[20]

Purpose: ☐ Pre-treatment/forebay for another structural BMP ☐ Pollutant control only ☐ Combined pollutant control and hydromodification control (see Attachment 2) ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms (See Chapter 1.12 of the BMP Design Manual)	TBD
Who will be the final owner of this BMP?	X HOA ☐ Property Owner ☐ City ☐ Other (describe)
Who will maintain this BMP into perpetuity?	X HOA ☐ Property Owner ☐ City ☐ Other (describe)

Discussion (as needed:

DMAs B and C will utilize a Biofiltration BMP Downstream of a Storage Unit. Due to the Line A system traversing the project site, it is not feasible to convey these flows to the biofiltration basin. Therefore, within the park area, a subsurface basin will serve as the storage unit and a modular wetlands will be utilized as the biofiltration BMP. Flows will be conveyed from the subsurface system to the modular wetlands, and then connect to the Line "A" Storm Drain traversing the site.

Worksheet B.5-4 was utilized to determine the Optimized Biofiltration Footprint when Downstream of a Storage Unit. The storage required to achieve greater than 92 percent capture fraction of 0.85 was used, since this corresponds to a 12 hour drawdown time. Therefore, the resulting storage required is 7,652 cu. ft., and 10, 524 cu. ft. has been provided, which is more than sufficient.

Worksheet B.5-3 was utilized to determine the Alternative Minimum Footprint Sizing Factor, which resulted in 0.002. Line 15 resulted in an area that is larger than the project itself, therefore this is deemed unfeasible and not realistic. Line 17 was utilized as the Optimized Biofiltration Footprint of 216 sq. ft. The modular wetlands MWS-L-8-20-V provides 250 sq. ft. Additionally, worksheet B.6-1 was utilized only to calculate the water quality flow rate, which gave a flow rate of 0.466 ft^3/s. The MWS-L-8-20-V can treat 0.577 ft^3/s, therefore this BMP is sufficient for treating the water quality volume.

The receiving waters pollutants of concern based upon the pollutants generated are Nutrients, Bacteria & Viruses and Pesticides. Based upon the measured pollutant removal performance, the majority of pollutants have a medium to high removal rate. During final engineering, documentation from the proprietary device manufacturer shall be obtained regarding pollutant removal performance for the specified pollutants.

(Continue on subsequent pages as necessary)

Subsurface System Volume Calculations - Subsurface System BC
Design Capture Volume Storage

Elevation	96" Pipe Area Each (ft^2)	Gross Cross Sectional Area of Pipe with Gravel (ft^2)	Net Gravel Area (ft^2)	Pipe Volume (ft^3) [A]	Gravel Volume (ft^3) [B]	Cumulative Subsurface System Volume (ft^3)
1103	0	0	0	0	0	0
1104	0	10	10	0	600	600
1105	3.63	20	16.37	544.5	982.2	1526.7
1106	9.83	30	20.17	1474.5	1210.2	2684.7
1107	17.22	40	22.78	2583	1366.8	3949.8
1108	25.13	50	24.87	3769.5	1492.2	5261.7
1109	33.05	60	26.95	4957.5	1617	6574.5
1110	40.44	70	29.56	6066	1773.6	7839.6
1111	46.64	80	33.36	6996	2001.6	8997.6
1112	50.27	90	39.73	7540.5	2383.8	9924.3
1113	50.27	100	49.73	7540.5	2983.8	10524.3

1111.005

A - Pipe volume equal to linear feet of subsurface system times area of pipe

B - Gravel volume equal to linear feet of subsurface system times Net Gravel Area, multiplied by 0.40 void ratio.

The purpose of this fact sheet is to help explain the potential role of proprietary BMPs in meeting biofiltration requirements, when full retention of the DCV is not feasible. The fact sheet does not describe design criteria like the other fact sheets in this appendix because this information varies by BMP product model.

Criteria for Use of a Proprietary BMP as a Biofiltration BMP

A proprietary BMP may be acceptable as a "biofiltration BMP" under the following conditions:

(1) The BMP meets the minimum design criteria listed in Appendix F, including the pollutant treatment performance standard in Appendix F.1;

(2) The BMP is designed and maintained in a manner consistent with its performance certifications (See explanation in Appendix F.2); and

(3) The BMP is acceptable at the discretion of the City Engineer. In determining the acceptability of a BMP, the City Engineer should consider, as applicable, (a) the data submitted; (b) representativeness of the data submitted; (c) consistency of the BMP performance claims with pollutant control objectives; certainty of the BMP performance claims; (d) for projects within the public right of way and/or public projects: maintenance requirements, cost of maintenance activities, relevant previous local experience with operation and maintenance of the BMP type, ability to continue to operate the system in event that the vending company is no longer operating as a business; and (e) other relevant factors. If a proposed BMP is not accepted by the City Engineer, a written explanation/reason will be provided to the applicant.

Guidance for Sizing a Proprietary BMP as a Biofiltration BMP

Proprietary biofiltration BMPs must meet the same sizing guidance as non-proprietary BMPs. Sizing is typically based on capturing and treating 1.50 times the DCV not reliably retained. Guidance for sizing biofiltration BMPs to comply with requirements of this manual is provided in Appendix F.2.

Maintenance Overview

Refer to manufacturer for maintenance information.

Modular Wetlands System™ Linear

Biofiltration

Comprehensive Stormwater Solutions

Bio Clean

A Forterra Company

OVERVIEW

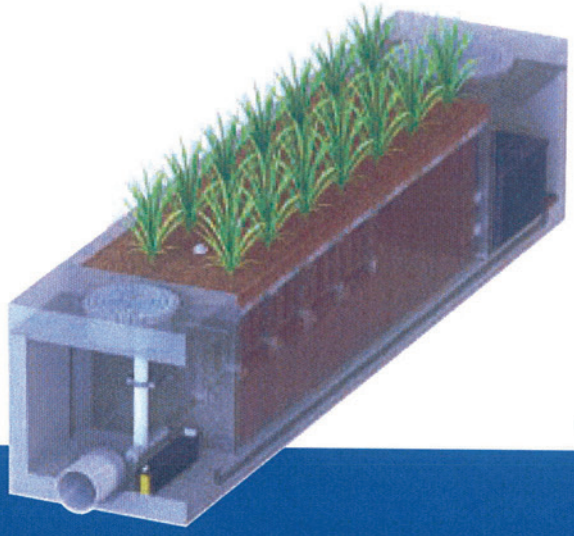
The Bio Clean Modular Wetlands System™ Linear (MWS Linear) represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint and higher treatment capacity. While most biofilters use little or no pretreatment, the MWS Linear incorporates an advanced pretreatment chamber that includes separation and pre-filter cartridges. In this chamber, sediment and hydrocarbons are removed from runoff before entering the biofiltration chamber, in turn reducing maintenance costs and improving performance.

The Urban Impact

For hundreds of years, natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as our cities grow and develop, these natural wetlands have perished under countless roads, rooftops, and parking lots.

Plant A Wetland

Without natural wetlands, our cities are deprived of water purification, flood control, and land stability. Modular Wetlands and the MWS Linear re-establish nature's presence and rejuvenate waterways in urban areas.



PERFORMANCE

The MWS Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons, and bacteria. Since 2007 the MWS Linear has been field tested on numerous sites across the country. With its advanced pretreatment chamber and innovative horizontal flow biofilter, the system is able to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. With the same biological processes found in natural wetlands, the MWS Linear harnesses nature's ability to process, transform, and remove even the most harmful pollutants.

66% REMOVAL OF DISSOLVED ZINC	**69%** REMOVAL OF TOTAL ZINC	**38%** REMOVAL OF DISSOLVED COPPER	**64%** REMOVAL OF TOTAL PHOSPHORUS	
45% REMOVAL OF NITROGEN	**50%** REMOVAL OF TOTAL COPPER	**95%** REMOVAL OF MOTOR OIL	**67%** REMOVAL OF ORTHO PHOSPHORUS	**85%** REMOVAL OF TSS

APPROVALS

The MWS Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation and perhaps the world.

WASHINGTON STATE TAPE APPROVED

The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft^2 loading rate. The highest performing BMP on the market for all main pollutant categories.

DEQ ASSIGNMENT

The Virginia Department of Environmental Quality assigned the MWS Linear, the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) Regulation technical criteria.

MARYLAND DEPARTMENT OF THE ENVIRONMENT APPROVED

Granted Environmental Site Design (ESD) status for new construction, redevelopment, and retrofitting when designed in accordance with the design manual.

MASTEP EVALUATION

The University of Massachusetts at Amherst – Water Resources Research Center issued a technical evaluation report noting removal rates up to 84% TSS, 70% total phosphorus, 68.5% total zinc, and more.

RHODE ISLAND DEM APPROVED

Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% pathogens, 30% total phosphorus, and 30% total nitrogen.

ADVANTAGES

- HORIZONTAL FLOW BIOFILTRATION
- GREATER FILTER SURFACE AREA
- PRETREATMENT CHAMBER
- PATENTED PERIMETER VOID AREA
- FLOW CONTROL
- NO DEPRESSED PLANTER AREA
- AUTO DRAINDOWN MEANS NO MOSQUITO VECTOR

OPERATION

The MWS Linear is the most efficient and versatile biofiltration system on the market, and it is the only system with horizontal flow which improves performance, reduces footprint, and minimizes maintenance. Figure 1 and Figure 2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.

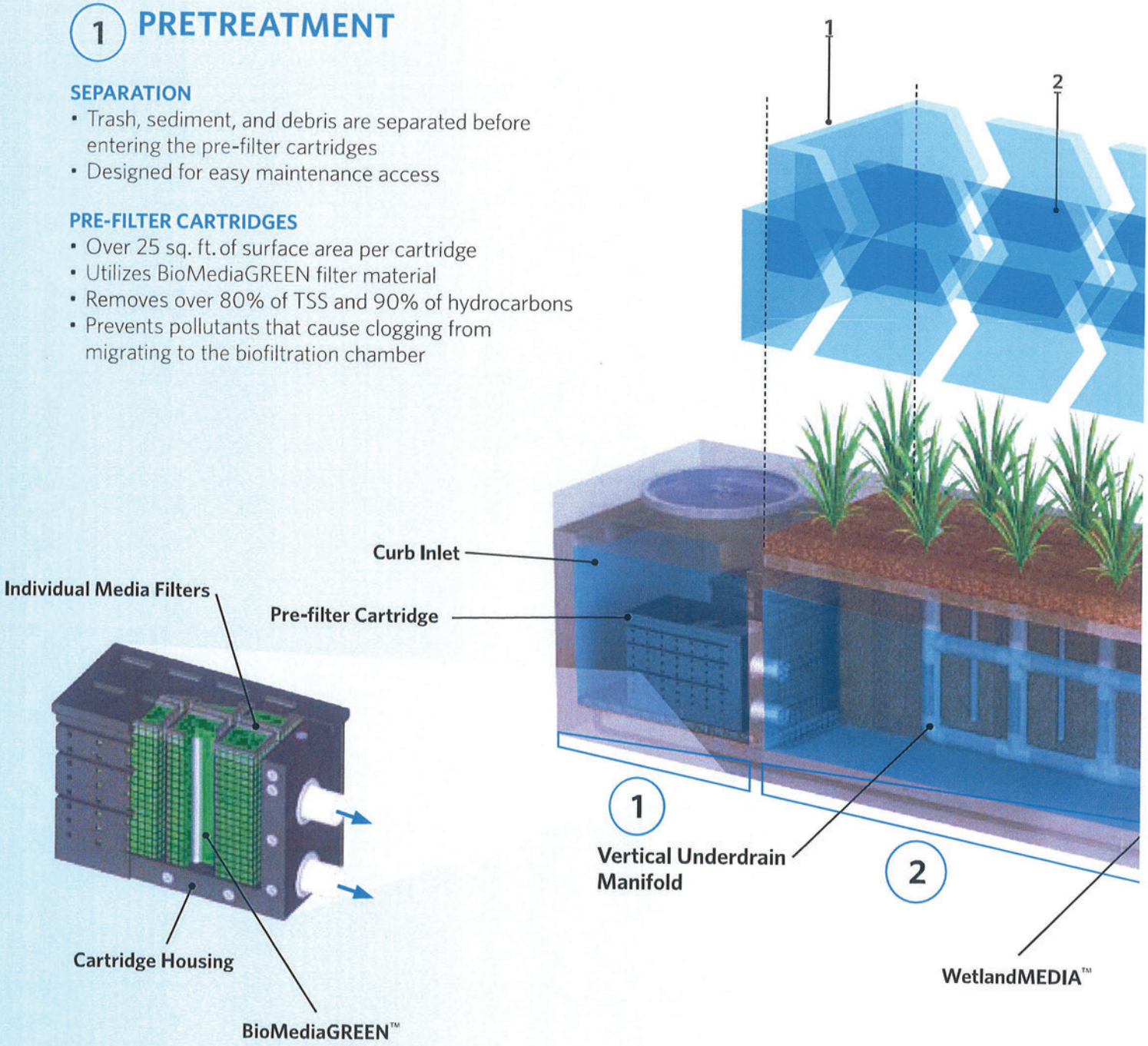
1 PRETREATMENT

SEPARATION

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

PRE-FILTER CARTRIDGES

- Over 25 sq. ft. of surface area per cartridge
- Utilizes BioMediaGREEN filter material
- Removes over 80% of TSS and 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber



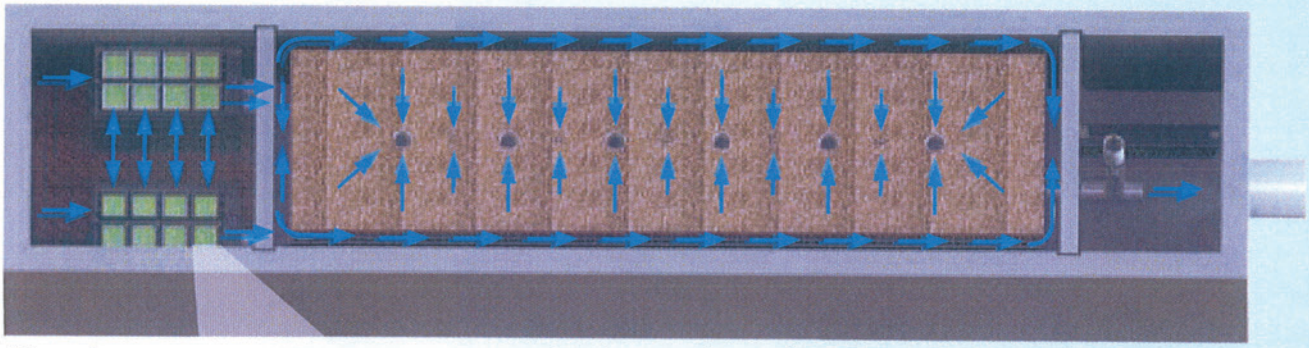
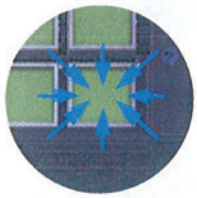


Figure 2,
Top View



2x to 3x more surface area than traditional downward flow bioretention systems.

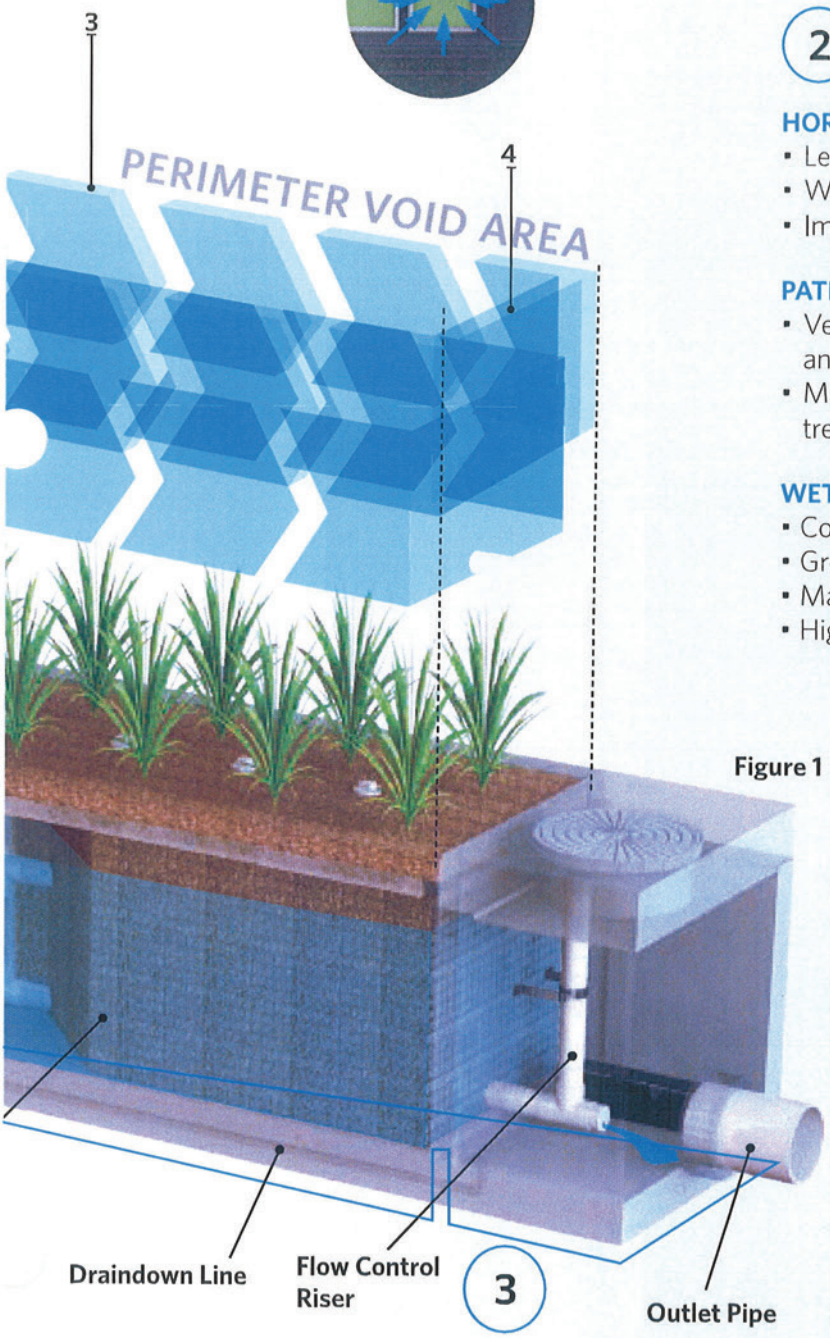


Figure 1

2 BIOFILTRATION

HORIZONTAL FLOW

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

PATENTED PERIMETER VOID AREA

- Vertically extends void area between the walls and the WetlandMEDIA on all four sides
- Maximizes surface area of the media for higher treatment capacity

WETLANDMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and lightweight

3 DISCHARGE

FLOW CONTROL

- Orifice plate controls flow of water through WetlandMEDIA to a level lower than the media's capacity
- Extends the life of the media and improves performance

DRAINDOWN FILTER

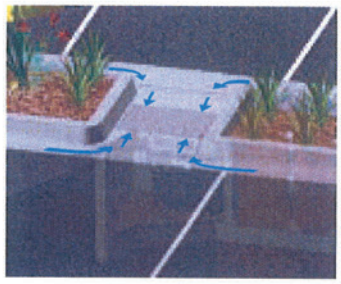
- The draindown is an optional feature that completely drains the pretreatment chamber
- Water that drains from the pretreatment chamber between storm events will be treated

CONFIGURATIONS

The MWS Linear is the preferred biofiltration system of civil engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your storm drain design.

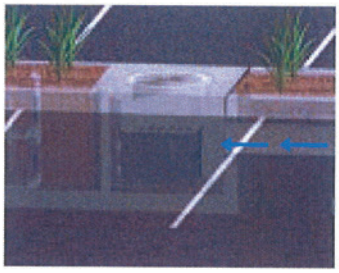
CURB TYPE

The Curb Type configuration accepts sheet flow through a curb opening and is commonly used along roadways and parking lots. It can be used in sump or flow-by conditions. Length of curb opening varies based on model and size.



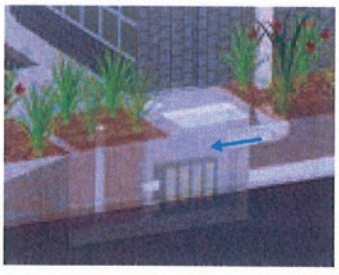
GRATE TYPE

The Grate Type configuration offers the same features and benefits as the Curb Type but with a grated/drop inlet above the systems pretreatment chamber. It has the added benefit of allowing pedestrian access over the inlet. ADA-compliant grates are available to assure easy and safe access. The Grate Type can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.



VAULT TYPE

The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pretreatment chamber, meaning the MWS Linear can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/ bioretention systems. Another benefit of the "pipe-in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.



DOWNSPOUT TYPE

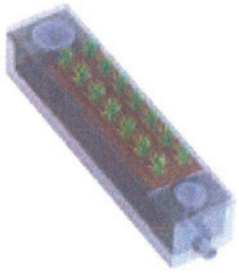
The Downspout Type is a variation of the Vault Type and is designed to accept a vertical downspout pipe from rooftop and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter, and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

ORIENTATIONS

SIDE-BY-SIDE

The Side-By-Side orientation places the pretreatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side.This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.

END-TO-END



The End-To-End orientation places the pretreatment and discharge chambers on opposite ends of the biofiltration chamber, therefore minimizing the width of the system to 5 ft. (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is that bypass must be external.

BYPASS

INTERNAL BYPASS WEIR (SIDE-BY-SIDE ONLY)

The Side-By-Side orientation places the pretreatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pretreatment chamber directly to the discharge chamber.

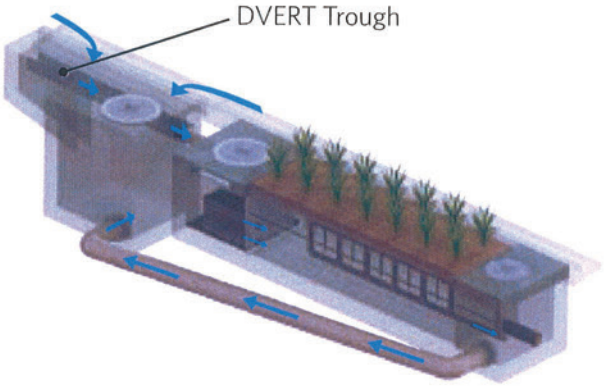
EXTERNAL DIVERSION WEIR STRUCTURE

This traditional offline diversion method can be used with the MWS Linear in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the MWS Linear for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

FLOW-BY-DESIGN

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the MWS Linear and into the standard inlet downstream.

DVERT LOW FLOW DIVERSION



This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the MWS Linear via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allow the MWS Linear to be installed anywhere space is available.

SPECIFICATIONS

FLOW-BASED

The MWS Linear can be used in stand-alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface, it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

MODEL #	DIMENSIONS	WETLANDMEDIA SURFACE AREA (sq.ft.)	TREATMENT FLOW RATE (cfs)
MWS-L-4-4	4' x 4'	23	0.052
MWS-L-4-6	4' x 6'	32	0.073
MWS-L-4-8	4' x 8'	50	0.115
MWS-L-4-13	4' x 13'	63	0.144
MWS-L-4-15	4' x 15'	76	0.175
MWS-L-4-17	4' x 17'	90	0.206
MWS-L-4-19	4' x 19'	103	0.237
MWS-L-4-21	4' x 21'	117	0.268
MWS-L-6-8	7' x 9'	64	0.147
MWS-L-8-8	8' x 8'	100	0.230
MWS-L-8-12	8' x 12'	151	0.346
MWS-L-8-16	8' x 16'	201	0.462
MWS-L-8-20	9' x 21'	252	0.577
MWS-L-8-24	9' x 25'	302	0.693

SPECIFICATIONS

VOLUME-BASED

Many states require treatment of a water quality volume and do not offer the option of flow-based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume-based design installed downstream of ponds, detention basins, and underground storage systems.

MODEL #	TREATMENT CAPACITY (cu. ft.) @ 24-HOUR DRAINDOWN	TREATMENT CAPACITY (cu. ft.) @ 48-HOUR DRAINDOWN
MWS-L-4-4	1140	2280
MWS-L-4-6	1600	3200
MWS-L-4-8	2518	5036
MWS-L-4-13	3131	6261
MWS-L-4-15	3811	7623
MWS-L-4-17	4492	8984
MWS-L-4-19	5172	10345
MWS-L-4-21	5853	11706
MWS-L-6-8	3191	6382
MWS-L-8-8	5036	10072
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145
MWS-L-8-20	12560	25120
MWS-L-8-24	15108	30216

APPLICATIONS

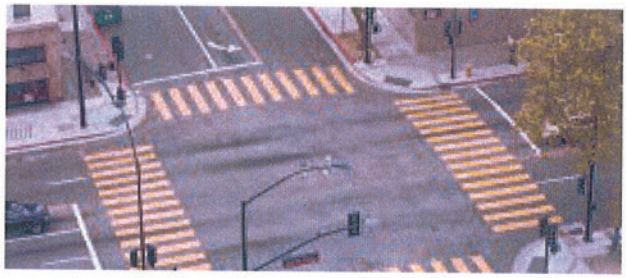
The MWS Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.

INDUSTRIAL

Many states enforce strict regulations for discharges from industrial sites. The MWS Linear has helped various sites meet difficult EPA-mandated effluent limits for dissolved metals and other pollutants.

RESIDENTIAL

Low to high density developments can benefit from the versatile design of the MWS Linear. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.



STREETS

Street applications can be challenging due to limited space. The MWS Linear is very adaptable, and it offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.

PARKING LOTS

Parking lots are designed to maximize space and the MWS Linear's 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.

COMMERCIAL

Compared to bioretention systems, the MWS Linear can treat far more area in less space, meeting treatment and volume control requirements.

MIXED USE

The MWS Linear can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

More applications include:

• Agriculture • Reuse • Low Impact Development • Waste Water

PLANT SELECTION

Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the MWS Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade, the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the MWS Linear, giving the plants more contact time so that pollutants are more successfully decomposed, volatilized, and incorporated into the biomass of the MWS Linear's micro/macro flora and fauna.

A wide range of plants are suitable for use in the MWS Linear, but selections vary by location and climate. View suitable plants by visiting biocleanenvironmental.com/plants.

INSTALLATION

The MWS Linear is simple, easy to install, and has a space-efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles precast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians are available to supervise installations and provide technical support.

MAINTENANCE

Reduce your maintenance costs, man hours, and materials with the MWS Linear. Unlike other biofiltration systems that provide no pretreatment, the MWS Linear is a self-contained treatment train which incorporates simple and effective pretreatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pretreatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pretreatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long-term operation, and there is absolutely no need to replace expensive biofiltration media.

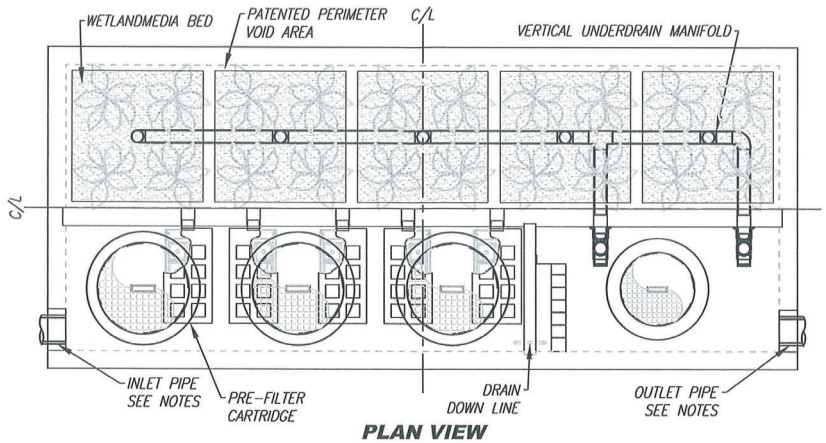
Bio Clean
A Forterra Company

398 Via El Centro
Oceanside, CA 92058
855.566.3938
stormwater@forterrabp.com
biocleanenvironmental.com

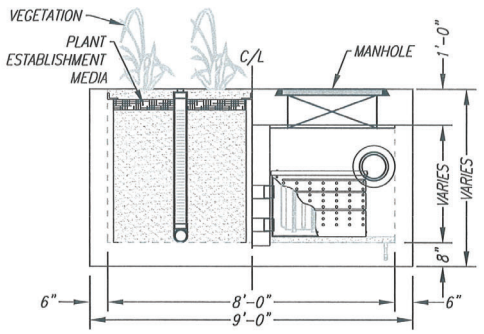
072318R1

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.577	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	3EA ø30"	OPEN PLANTER	ø24"
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



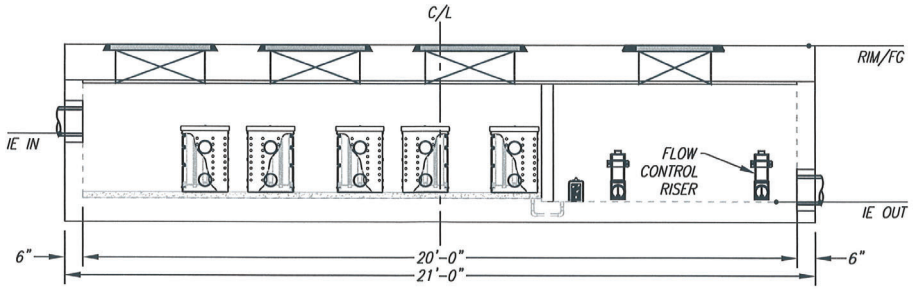
PLAN VIEW



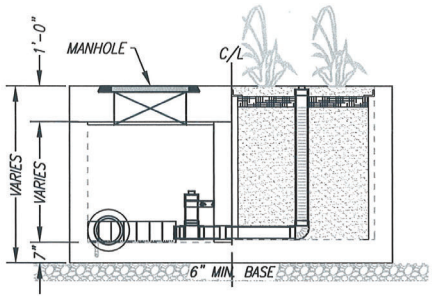
LEFT END VIEW

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.



ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.577
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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.

MODULAR WETLANDS
THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

PROPRIETARY AND CONFIDENTIAL:
THE INFORMATION CONTAINED IN THIS DOCUMENT IS THE SOLE PROPERTY OF FORTERRA AND ITS COMPANIES. THIS DOCUMENT, NOR ANY PART THEREOF, MAY BE USED, REPRODUCED OR MODIFIED IN ANY MANNER WITH OUT THE WRITTEN CONSENT OF FORTERRA.

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MWS-L-8-20-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

5/23/19TDLEE

Identification and Narrative of Receiving Water and Pollutants of Concern

Describe flow path of stormwater from the project site discharge location(s), through urban storm conveyance systems as applicable, to receiving creeks, rivers, and lagoons as applicable, and ultimate discharge to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable): Project site discharges into the existing Line "S" Storm Drain system which discharges directly into Temecula Creek. Temecula Creek discharges into the Santa Margarita River, which conveys flows to the Santa Margarita Lagoon and then to the Pacific Ocean.

List any 303(d) impaired water bodies[3] within the path of stormwater from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs and/or Highest Priority Pollutants from the WQIP for the impaired water bodies (see BMP Design Manual Appendix B.6.1):

303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs / WQIP Highest Priority Pollutant
Temecula Creek	Nutrients (Phosphorus); Metals (Copper); Pesticides (Chlorphyrifos); Bacteria (Fecal Indicator Bacteria); Salinity (Total Dissolved Solids), Toxicity	Nutrients, Bacteria
Santa Margarita River (Upper and Lower)	Nutrients (Phosphorus, Nitrogen); Metals (Manganese, Iron); Pesticides (Chlorpyrifos); Bacteria (Fecal Indicator Bacteria); Toxicity, Miscellaneous (Benthic Community Effects)	Nutrients, Bacteria
Santa Margarita Lagoon	Nutrients (Eutrophic)	Nutrients

Identification of Project Site Pollutants*

*Identification of project site pollutants below is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs. Note the project must also participate in an alternative compliance program (unless prior lawful approval to meet earlier PDP requirements is demonstrated).

Identify pollutants expected from the project site based on all proposed use(s) of the site (see BMP Design Manual Appendix B.6.):

Pollutant	Not Applicable to the Project Site	Anticipated from the Project Site	Also a Receiving Water Pollutant of Concern
Sediment	☐	X	☐
Nutrients	☐	X	X
Heavy Metals	☐	X	☐
Organic Compounds	☐	X	☐
Trash & Debris	☐	X	☐

[3] The current list of Section 303(d) impaired water bodies can be found at http://www.waterboards.ca.gov/water_issues/programs/water_quality_assessment/#impaired

Oxygen Demanding Substances	☐	X	☐
Oil & Grease	☐	X	☐
Bacteria & Viruses	☐	X	X
Pesticides	☐	X	X

Pollutant Control Offsite Alternative Compliance Participation Form

Refer to Chapter 1.8

Onsite Project Information					
Record ID:					
Assessor's Parcel Number(s) [APN(s)]					
Quantity of Pollutant Control Debits or Credits (cubic feet) ☐ Debits ☐ Credits *See Attachment 1 of the PDP WQMP					
Offsite Project Information – Projects providing or receiving credits *(add rows as needed)*					
	Record ID:	APN(s)	Project Owner/Address	Credit/Debit	Quantity (cubic feet)
1.				☐ Credit ☐ Debit	
2.				☐ Credit ☐ Debit	
3.				☐ Credit ☐ Debit	
4.				☐ Credit ☐ Debit	
5.				☐ Credit ☐ Debit	
6.				☐ Credit ☐ Debit	
Total sum of Credits and Debits (∑Credits -∑Debits) (cubic feet)					
Additional Information					
Are offsite project(s) in the same credit trading area as the onsite project?					☐ Yes ☐ No
Will projects providing credits be completed prior to completion of projects receiving credits?					☐ Yes ☐ No
Are all deficits accounted for? If No, onsite and offsite projects must be redesigned to account for all deficits.					☐ Yes ☐ No

Preparation Date:_____

Template Date: February 22nd, 2019

Provide supporting WQE calculations as part of this attachment.

ATTACHMENT 2

HYDROMODIFICATION CONTROL MEASURES

Indicate which Items are Included behind this cover sheet:

Attachment Sequence	Contents	Checklist
Attachment 2a	Do Hydromodification Management Requirements apply? See Chapter 1.6 and Figure 1-2.	X Hydromodification management controls required. X Green Streets Project (Exempt from hydromodification management requirements) **STOP** * ☐ Exempt from hydromodification management requirements ☐ Include Figure 1-2 and document any "NO" answer **STOP** *
Attachment 2b	HMP Exhibits (Required) See Checklist on the back of this Attachment cover sheet. *see Chapter 6.3.1*	☐ Combined with DMA Exhibit X Included
Attachment 2c	Management of Critical Coarse Sediment Yield Areas See Chapter 6.2 and Appendix H of the BMP Design Manual.	X Exhibit depicting onsite/ upstream CCSYAs (Figure H.1-1) AND, documentation that project avoids CCSYA per Appendix H.1. OR ☐ Sediment Supply BMPs implemented.
Attachment 2d	Structural BMP Design Calculations, Drawdown Calculations, & Overflow Design. See Chapter 6 & Appendix G of the BMP Design Manual	X Included ☐ Project is designed entirely with De-Minimus, Self–Mitigating, and/or qualifying Self-Retaining Areas. **STOP** *
Attachment 2e	Geomorphic Assessment of Receiving Channels. See Chapter 6.3.4 of the BMP Design Manual.	☐ low flow threshold is 0.1Q2 ☐ low flow threshold is 0.3Q2 ☐ low flow threshold is 0.5Q2
Attachment 2f	Vector Control Plan (Required when structural BMPs will not drain in 96 hours)	☐ Included ☐ Not required because BMPs will drain in less than 96 hours
Attachment 2g	Hydromodification Offsite Alternative Compliance form. Refer to Figure 1-3: Pathways to Participating in Offsite Alternative Compliance Program	X Full Compliance Onsite ☐ Offsite ACP. Document onsite structural BMPs and complete Hydromodification Offsite Alternative Compliance Participation Form, and WQE worksheets

* If this box is checked, the remainder of Attachment 2 does not need to be filled out.

Preparation Date:_____

Template Date: February 22nd, 2019

Use this checklist to ensure the required information has been included on the Hydromodification Management Exhibit:

X Point(s) of Compliance with name or number
X Project Site Boundary
X Project Disturbed Area Footprint
X Drainage management area (DMA) boundaries, DMA ID numbers, DMA areas (square footage or acreage), and DMA type (i.e., drains to structural BMP, self-retaining, self-mitigating, or de-minimis) Note on exhibit De-minimis areas and reason they could not be included. Include offsite areas receiving treatment to mitigate Onsite Water Quality Equivalency.
X Potential pollutant source areas and corresponding required source control BMPs (see Chapter 4, Appendix E.1, and Step 3.5)
X Proposed Site Design BMPs and surface treatments used to minimize imperviousness. Show sections, details, and dimensions of site design BMP's (tree wells, dispersion areas, rain gardens, permeable pavement, rain barrels, green roofs, etc.)
☐ Proposed Harvest and Use BMPs
X Underlying hydrologic soil group (Web Soil Survey)
X Existing natural hydrologic features (watercourses, seeps, springs, wetlands, pond, lake)
X Existing topography and impervious areas
X Proposed grading and impervious areas. If the project is a subdivision or spans multiple lots show pervious and impervious totals for each lot.
X Existing and proposed site drainage network and connections to drainage offsite
☐ Potable water wells, onsite wastewater treatment systems (septic), underground utilities
X Structural BMPs (identify location, structural BMP ID No., type of BMP, and size/detail)
☐ Approximate depth to groundwater at each structural BMP
X Approximate infiltration rate and feasibility (full retention, partial retention, biofiltration) at each structural BMP
☐ Critical coarse sediment yield areas to be protected and or conveyed through the project site.
☐ Temporary Construction BMPs. Include protection of source control, site design and structural BMPs during construction.

☐ Onsite and Offsite Critical coarse sediment yield areas to be protected
☐ Proposed design features and surface treatments used to minimize imperviousness
X Existing and proposed drainage boundary and drainage area to each POC (when necessary, create separate exhibits for pre-development and post-project conditions)
X Structural BMPs for hydromodification management (identify location, type of BMP, and size/detail)

Management of Critical Coarse Sediment Yield Areas (Attachment 2c)

Document the findings of Site-specific Critical Coarse Sediment Analysis below. Include any calculations, and additional documentation completed as part of the analysis. Refer to Chapter 6.2 and Appendix H of the City of Temecula BMP Design Manual for additional guidance.

The project effectively manages Critical Coarse Sediment Yield Areas (CCSYAs) using the following methodology:

X **Step A.** A Site-Specific Critical Coarse Sediment Yield Analysis was performed:

X **Step A.1.** Determine whether the project site is a significant source of critical coarse sediment to the channel receiving runoff (refer to CCSYA mapping in Appendix H):

☐ The project site is a significant source of Bed Sediment Supply. All channels on the project site are preserved or bypassed within the site plan. *(Complete Step A.2, below)*

☐ The project site is a source of Bed Sediment Supply. Channels identified as verified critical coarse sediment yield areas are preserved. *(Complete Step A.2, below)*

X The Project site is not a significant source of Bed Sediment Supply. ***(STOP,*** *supporting information provided with this checklist****)***

☐ Impacts to verified CCSYAs cannot be avoided. *(Complete Step B, below)*

☐ **Step A.2.** Project site design avoids CCSYAs and maintains sediment supply pathways, documentation is provided following this checklist. (***STOP,*** *include supporting documentation with this checklist)*

☐ **Step B.** Sediment Supply BMPs are implemented onsite to mitigate impacts of development in CCSYAs, documentation is provided following this checklist. ***(STOP,*** *include supporting documentation with this checklist)*

Hydromodification Offsite Alternative Compliance Participation Form

Refer to Chapter 1.8

Onsite Project Information					
Record ID:					
Assessor's Parcel Number(s) [APN(s)]					
Quantity of Hydromodification Debits or Credits (DCIA) ☐ Debits ☐ Credits *See Attachment 1 of the PDP WQMP					
Offsite Project Information – Projects providing or receiving credits *(add rows as needed)*					
	Record ID:	APN(s)	Project Owner/Address	Credit/Debit	Quantity (DCIA)
1.				☐ Credit ☐ Debit	
2.				☐ Credit ☐ Debit	
3.				☐ Credit ☐ Debit	
4.				☐ Credit ☐ Debit	
5.				☐ Credit ☐ Debit	
6.				☐ Credit ☐ Debit	
Total sum of Credits and Debits (∑Credits -∑Debits) (DCIA)					
Additional Information					
Are offsite projects in the same credit trading area as the onsite project?					☐ Yes ☐ No
Do offsite projects discharge directly to the same susceptible stream reach as the onsite project? (required for certain hydromodification scenarios)					☐ Yes ☐ No
Will projects providing credits be completed prior to completion of projects receiving credits?					☐ Yes ☐ No
Are all deficits accounted for? If No, onsite and offsite projects must be redesigned to account for all deficits.					☐ Yes ☐ No

Provide supporting WQE calculations as part of this attachment.

TECHNICAL MEMORANDUM:

SWMM Modeling for Hydromodification Compliance of:

Villas at Paseo del Sol, Temecula, CA

Prepared For:

Cal-Paseo del Sol LLC
November 19, 2018

Prepared by:

Luis Parra, PhD, CPSWQ, ToR, D.WRE.
R.C.E. 66377

REC Consultants
2442 Second Avenue
San Diego, CA 92101
Telephone: (619) 232-9200

TECHNICAL MEMORANDUM

TO: Michael Rust
Cal-Paseo del Sol LLC

FROM: Luis Parra, PhD, PE, CPSWQ, ToR, D.WRE.
Victor Velasco, PE

DATE: November 19, 2018

RE: Summary of SWMM Modeling for Hydromodification Compliance for Villas at Paseo del Sol, Temecula, CA.

INTRODUCTION

This memorandum summarizes the approach used to model the proposed residential development project site located in the southwest corner of De Portola Road and Butterfield Stage Road in the City of Temecula, CA, using the Environmental Protection Agency (EPA) Storm Water Management Model 5.0 (SWMM). SWMM models were prepared for the pre and ultimate post-developed conditions of POC-1 at the site in order to determine if the proposed detention basing facility has sufficient volume to meet Section F.1.h of Order R9-201-0016 requirements of the California Regional Water Quality Control Board Santa Ana Region (SDRWQCB), as explained in the Draft Santa Margarita Region Hydromodification Management Plan (SMRHMP) prepared for the County and other Copermittees by RBF on June 2013.

SWMM MODEL DEVELOPMENT

The Villas at Paseo del Sol project comprises of a proposed residential development and associated roads, sidewalks and open space areas. Two (2) SWMM models were prepared for this study: the first for the pre-development and the second for the post-developed conditions. The project site drains to one (1) Point of Compliance (POC), POC-1 located to the southwest corner of the project at the entrance of the existing 84" and 96" storm drains.

The SWMM model was used as it is comparable to Santa Margarita area watersheds and also because it is a non-proprietary model indirectly approved by the HMP document, which is also extensively approved by the Water Quality Control Board, Region 9 all over San Diego County. For both SWMM models, flow duration curves were prepared to determine if the proposed biofiltration basin facility is sufficient to meet the current HMP requirements.

The inputs required to develop SWMM models include rainfall, watershed characteristics, and BMP configurations. The Temecula Rain Gage from the SMRHM model was downloaded and used for this study, since (1) most of the watershed of the receiving creek is associated with the precipitation of this station in the SMRHM map, and (2) it is the most representative of the project site precipitation due to elevation and proximity to the project site.

Per the California Irrigation Management Information System "Reference Evaporation Zones" (CIMIS ETo Zone Map), the project site is located within the Zone 6 Evapotranspiration Area. Thus, evapotranspiration values for the site were modeled using Zone 6 average monthly values from Table

G.1-1 from the City of San Diego 2016 BMP Design Manual, as Zone 6 extends all the way to Temecula. POC-1 was modeled with Type A and D hydrologic soils as those are the existing soils determined from the NRCS Web Soil Survey. Soils have been assumed to be compacted in the existing condition to represent the mass graded condition of the site and fully compacted in the post developed conditions. Other SWMM inputs for the subareas are discussed in the appendices to this document, where the selection of the parameters is explained in detail.

HMP MODELING

EXISTING CONDITIONS

The existing site is a lightly vegetated open space that sheet flows into a channel that bifurcate the site. Once flows reach the channel they are conveyed to the location of the existing MS4 systems located at the southwest corner, which is the location of POC-1. Table 1 below illustrates the existing natural condition tributaries to POC-1.

TABLE 1 – SUMMARY OF EXISTING CONDITIONS

HMP DMAs	Tributary Area, A (Ac)	Impervious Percentage, Ip
DMA-1-A	0.92	0.0%
DMA-1-D	34.60	0.0%
POC-1 Total	**35.52**	**0.0%**

DEVELOPED CONDITIONS

POC-1

In proposed conditions the east area of the existing channel identified as Area–A1 as well as the majority of the existing channel itself, Area-C, are collected and conveyed into a diversion structure. The diversion structure will then convey the high flows (mostly in excess of the 10 year peak flow obtained from the continuous simulation of the contributing area) directly to POC-1.

In regards, to the low flows they will drain into the biofiltration basin BMP. However, in order to model this issue in SWMM (a diversion draining to an LID) an auxiliary outfall identified as "Aux" was created and the inflow (the low flows) were then converted into a storm and a rain gage identified as "Aux-rain" was created. A catchment was then added to the model identified as "Area-Aux" where the Aux-rain was assigned to it such that it discharges the equivalent of the low flows into the BMP-1. This process is necessary as SWMM does not allow a divider node to discharge into an LID catchment node. A comparison between the runoff produced by this artificial storm (Aux-rain) over the artificial sub-area Area-Aux and the real runoff diverted by the diversion structure discharging into the auxiliary POC (Aux) shows that there is less than 0.1% difference between the 2 time series. Therefore, the approach is satisfactory to model a diverted flow into an LID.

With respect to the western portion of the site, which is composed of areas A2-SoilA, A2-SoilD, Area-B and the BMP-1 area itself, flows from these areas with the exception of the BMP itself will be intercepted by inlets and will discharged into the BMP where they will confluence with the low flows from the east portion of the site. Once flows are routed through the biofiltration basin they will discharge into POC-1 where they will confluence with the high flows from the eastern portion of the site. Table 2 summarizes all areas in POC-1.

TABLE 2 – SUMMARY OF DEVELOPED CONDITIONS

DMA	Drainage Pattern	Tributary Area, A (Ac)	Impervious Percentage, Ip
Area-A1	Diversion →Basin → POC-1	12.62	65.00%
Area-C	Diversion →Basin → POC-1	2.12	40.00%
A2-SoilA	Basin → POC-1	0.92	65.00%
A2-SoilD	Basin → POC-1	15.37	67.10%
Area-B	Basin → POC-1	4.00	65.00%
BMP-1	POC-1	0.49	00.00%
TOTAL		**35.52**	**58.48%**

BMP MODELING FOR HMP PURPOSES

LID BMP SUMMARY

One (1) LID biofiltration basin is located within the project site and is responsible for handling hydromodification requirements for the project site. In developed conditions, the basin will have a surface depth of 5.0 feet and a riser spillway structure. Flows will then discharge from the basin via a surface outlet structure and a low flow orifice outlet within the gravel layer. The riser structure will act as a spillway such that peak flows can be safely discharged to the receiving storm drain.

Beneath the basin's invert lies the proposed LID biofiltration portion of the drainage facility. This portion of the basin is comprised of a 3-inch layer of mulch, a 24-inch layer of amended soil (a highly sandy, organic rich composite with an infiltration capacity of at least 5 inches/hr) and a 21-inch layer of gravel for additional detention and to accommodate the French drain system. This system is to be located beneath the biofiltration layer to intercept treated storm water and convey these flows to a single small diameter lower outlet orifice. Once flows have been routed by the outlet structure, flows are then drained to the POC. Finally, it should be noticed that the LID BMP will be unlined to allow for infiltration into the underground surface based on recommendation from the geotechnical report.

The biofiltration basins were modeled using the biofiltration LID module within SWMM. The biofiltration module can model the underground gravel storage layer, underdrain with an orifice plate, amended soil layer, and a surface storage pond up to the elevation of the invert of the spillway. It should be noted that detailed outlet structure location and elevations will be shown on the construction plans based on the recommendations of this study.

CONSIDERATIONS ABOUT THE DIVERSION STRUCTURE

The diversion structure was modeled as a partition table where the inflow represents the total runoff entering into the diversion structure while the outflow represents the portion of the flow that goes to the downstream LID. It can be seen that any flow smaller than 19.88 cfs will be diverted 100% to the LID facility, while larger flows will split depending on the hydraulic of the diversion structure (for example, for a total inflow of 56.73 cfs, 25.14 cfs will divert to the LID while the remaining 31.59 cfs will go directly to POC-1). The flow of 19.88 cfs corresponds to the flow that enters to the elliptical pipe when the water ponding in the structure is at a level equal to the invert of the diversion weir (Approximately 2.825 ft). For higher levels, water entering the elliptical pipe increases, but water flowing over the weir increases even faster, so that in the example included, and when the water level is equal to 4 ft above the invert of the elliptical pipe, 25.14 cfs enter thru the pipe while 31.59 cfs overflows thru the 8 ft wide weir (with an energy head of 4 ft - 2.825 ft = 1.175 ft). The table was prepared with hydraulic calculations and included in the SWMM model.

BMP MODELING FOR HMP PURPOSES

Modeling of dual purpose Water Quality/HMP BMPs

One (1) biofiltration basin BMP is proposed for water quality treatment and hydromodification conformance for the project site. Tables 3 and 4 illustrate the dimensions required for HMP compliance according to the SWMM model that was undertaken for the project.

TABLE 3 – SUMMARY OF DEVELOPED CONDITIONS DUAL PURPOSE BMP

BMP	Tributary Area (Ac)	DIMENSIONS					
		BMP Area[1] (ft^2)	Gravel Depth[2] (in)	Lower Orif. D (in)[3]	Depth Riser Invert (ft)[4]	Weir Perimeter Length[5] (ft)	Total Surface Depth[6] (ft)
Basin-1	35.52	21,534	21	5.0"	3.0'	16.0	5.0

Notes:
(1): Area of amended soil equal to area of gravel
(2): Includes filter gravel layers and gravel below the French Drain. French Drain is set at an elevation of 3-inches above the base of the facilities with the exception of LID B which is set 3-inches above to allow for more infiltration.
(3): Diameter of orifice in gravel layer with invert at bottom of layer; tied with hydromod min threshold ($0.1 \cdot Q_2$).
(4): Depth of ponding beneath riser structure's surface spillway, this includes the 3 inches of mulch.
(5): Overflow length, the internal perimeter of the riser is 16 ft (4 ft x 4 ft internal dimensions).
(6): Total surface depth of BMP from top crest elevation to surface invert.

TABLE 4 – SUMMARY OF RISER DETAILS

BMP	Lower Surface Slot			Upper Surface Slot			Emergency Weir	
	Elev.(ft)	Width (ft)	Height (in)	Elev.(ft)	Width (ft)	Height (in)	Elev. (ft)	Weir Perimeter (ft)
Basin	1101.75	2.50	3.0	1103.00	8.0	6.0	1104.00	16.0

FLOW DURATION CURVE COMPARISON

The Flow Duration Curve (FDC) for the site was compared at POC-1 by exporting the 15-minute runoff time series results from SWMM to a spreadsheet. The FDC was compared between 10% of the existing condition Q_2 up to the existing condition Q_{10} for POC-1. The Q_2 and Q_{10} were determined with a partial duration statistical analysis of the runoff time series in an Excel spreadsheet using the Cunnane plotting position method (which is the preferred plotting methodology in the HMP Permit). As the SWMM Model includes a statistical analysis based on the Weibull Plotting Position Method, the Weibull Method was also used within the spreadsheet to ensure that the results were similar to those obtained by the SWMM Model.

The range between 10% of Q_2 and Q_{10} was divided into 100 equal time intervals; the number of 15-minute intervals that each flow rate was exceeded was counted from the 15-minute interval time series. Additionally, the intermediate peaks with a return period "i" were obtained (Q_i with i=3 to 9). For the purpose of the plot, the values were presented as percentage of time exceeded for each flow rate. FDC comparison at the POC is illustrated in Figure 1 in both normal and logarithmic scale. Attachment 5 provides a detailed drainage exhibit for the post-developed condition.

As can be seen in Figure 1 the FDC for the proposed condition with the detention basin BMP is within 110% of the curve for the existing condition in both peak flows and durations. The additional runoff volume generated from developing the site will be released to the existing points of discharge at a flow rate below the 10% Q_2 lower threshold for the POC. Additionally, the project will also not increase peak flow rates between the Q_2 and the Q_{10}, as shown in the graphic and also in the peak flow table in Attachment 1.

SUMMARY

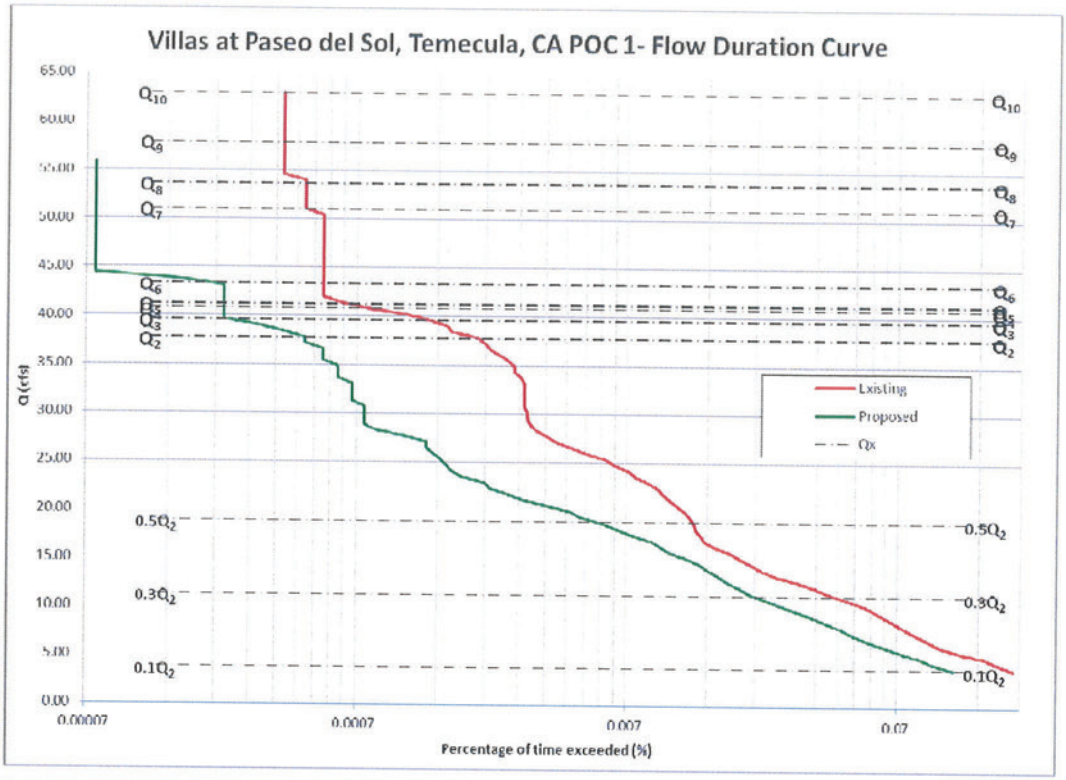
This study has demonstrated that the proposed biofiltration basin BMP provided for the Villas at Paseo del Sol project site is sufficient to meet the current SMRHMP criteria if the cross-section areas and volumes recommended within this technical memorandum, and the respective orifices in the gravel layer and surface outlet structure are incorporated as specified within the proposed project site.

KEY ASSUMPTIONS

1. Types A & D Soils are representative of the existing condition site.
2. The Basin will be unlined to allow infiltration.

ATTACHMENTS

1. Q_2 to Q_{10} Comparison Tables
2. FDC Plots (log and natural "x" scale) and Flow Duration Table.
3. List of the "n" largest Peaks: Pre-Development and Post-Development Conditions
4. Elevations vs. Discharge & Stage- Storage Curves to be used in SWMM
5. Pre & Post Development Maps, Project plan and section sketches
6. SWMM Input Data in Input Format (Existing and Proposed Models)
7. SWMM Screens and Explanation of Significant Variables
8. Soil Maps
9. Summary files from the SWMM Model



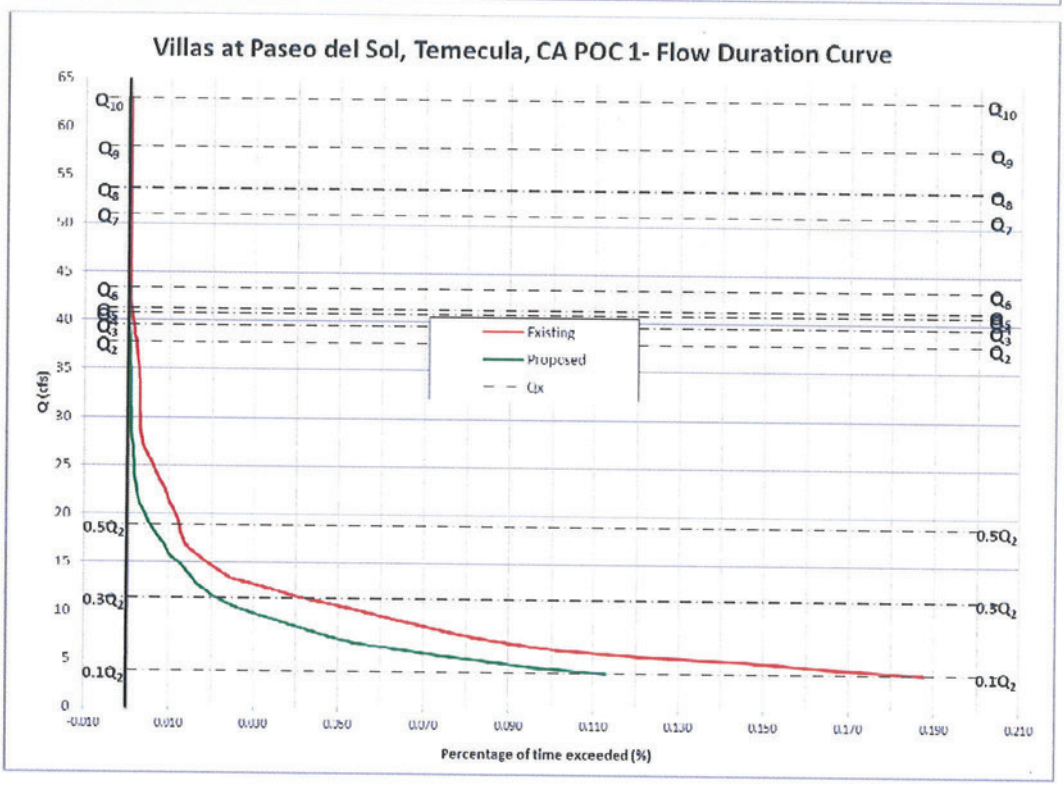


Figure 1a and 1b. Flow Duration Curve Comparison (logarithmic and normal "x" scale)

ATTACHMENT 1

Q_2 to Q_{10} Comparison Tables

ATTACHMENT 1.

Q_2 to Q_{10} Comparison Table – POC 1

Return Period	Existing Condition (cfs)	Mitigated Condition (cfs)	Reduction, Exist - Mitigated (cfs)
2-year	37.741	19.398	18.343
3-year	39.606	20.856	18.750
4-year	40.772	23.023	17.750
5-year	41.277	24.173	17.104
6-year	43.364	27.894	15.470
7-year	51.059	29.320	21.739
8-year	53.686	32.238	21.448
9-year	57.967	34.232	23.735
10-year	62.971	35.822	27.150

ATTACHMENT 1.

Q_2 to Q_{10} Comparison Table – POC 1

Return Period	Existing Condition (cfs)	Mitigated Condition (cfs)	Reduction, Exist - Mitigated (cfs)
2-year	37.728	19.389	18.339
3-year	39.604	20.919	18.685
4-year	40.772	22.959	17.813
5-year	41.267	24.139	17.128
6-year	43.347	27.877	15.469
7-year	51.048	29.308	21.740
8-year	53.692	32.237	21.455
9-year	57.971	34.231	23.740
10-year	62.965	35.815	27.150

ATTACHMENT 2

FDC Plots (log and natural "x" scale) and Flow Duration Table

ATTACHMENT 2

FLOW DURATION CURVE ANALYSIS

1) Flow duration curve shall not exceed the existing conditions by more than 10%, neither in peak flow nor duration.

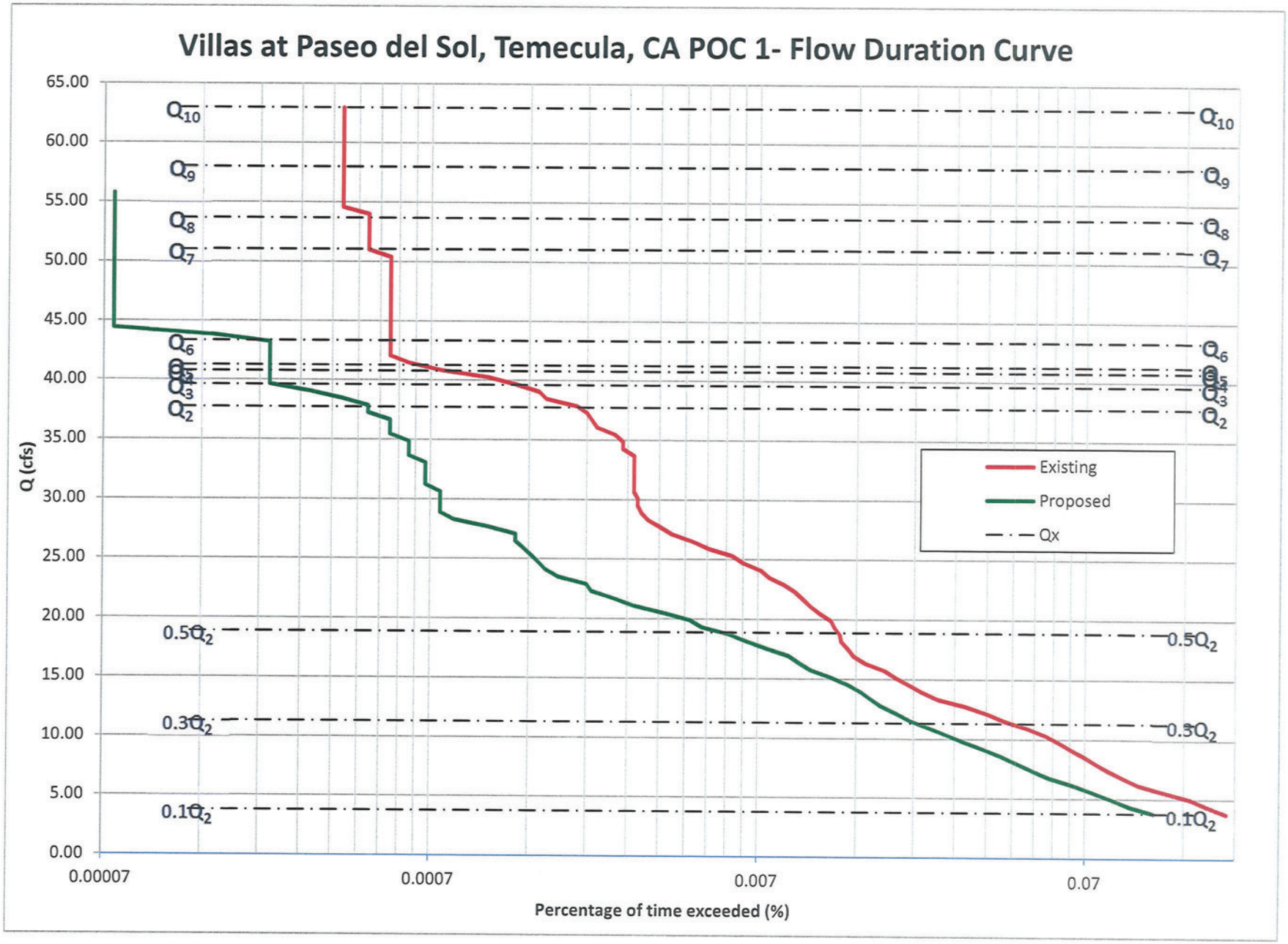
The figures on the following pages illustrate that the flow duration curve in post-development conditions, after the proposed BMPs are installed, is below the existing flow duration curve. The flow duration curve table following the curve shows that if the interval $0.10Q_2 - Q_{10}$ is divided in 100 sub-intervals, then a) the post development divided by pre-development durations are never larger than 110% (the permit allows up to 110%); and b) there are no more than 10 intervals in the range 101%-110% which would imply an excess over 10% of the length of the curve (the permit allows less than 10% of excesses measured as 101-110%).

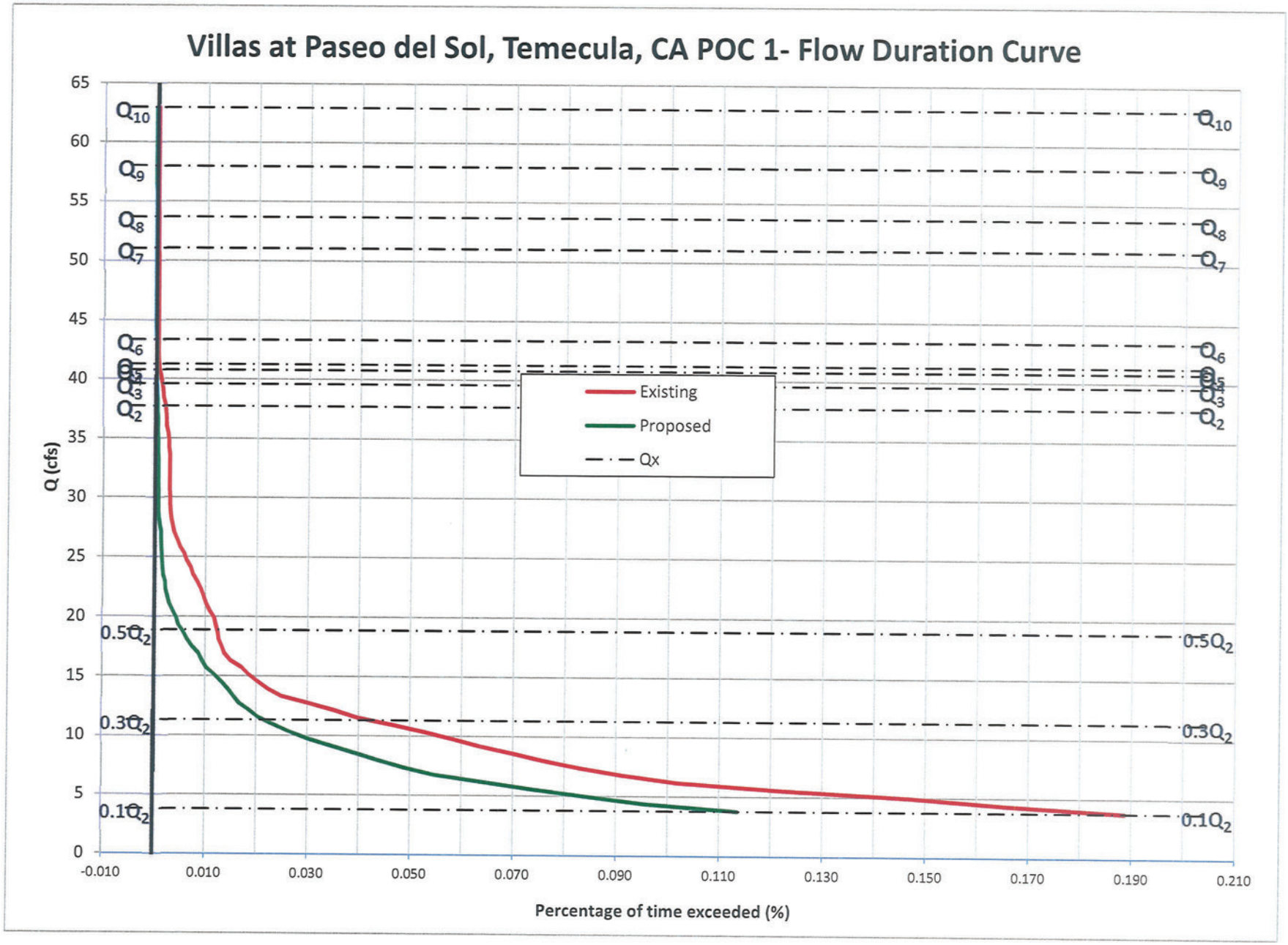
Consequently, the design passes the hydromodification test.

It is important to note that the flow duration curve can be expressed in the "x" axis as percentage of time, hours per year, total number of hours, or any other similar time variable. As those variables only differ by a multiplying constant, their plot in logarithmic scale is going to look exactly the same, and compliance can be observed regardless of the variable selected. However, in order to satisfy the City of Temecula HMP example, % of time exceeded is the variable of choice in the flow duration curve. The selection of a logarithmic scale in lieu of the normal scale is preferred, as differences between the pre-development and post-development curves can be seen more clearly in the entire range of analysis. Both graphics are presented just to prove the difference.

In terms of the "y" axis, the peak flow value is the variable of choice. As an additional analysis performed by REC, not only the range of analysis is clearly depicted (10% of Q_2 to Q_{10}) but also all intermediate flows are shown (Q_2, Q_3, Q_4, Q_5, Q_6, Q_7, Q_8 and Q_9) in order to demonstrate compliance at any range $Q_x - Q_{x+1}$. It must be pointed out that one of the limitations of both the SWMM and SDHM models is that the intermediate analysis is not performed (to obtain Q_i from i = 2 to 10). REC performed the analysis using the Cunnane Plotting position Method (the preferred method in the HMP permit) from the "n" largest independent peak flows obtained from the continuous time series.

The largest "n" peak flows are attached in this appendix, as well as the values of Q_i with a return period "i", from i=2 to 10. The Q_i values are also added into the flow-duration plot.


Villas at Paseo del Sol, Temecula, CA POC 1- Flow Duration Curve
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Q (cfs)
Q10
Q9
Q8
Q7
Q6
Q5
Q4
Q3
Q2
0.5Q2
0.3Q2
0.1Q2
Existing
Proposed
Qx
0.00007
0.0007
0.007
0.07
Percentage of time exceeded (%)


Villas at Paseo del Sol, Temecula, CA POC 1- Flow Duration Curve
Q (cfs)
Percentage of time exceeded (%)
Existing
Proposed
Qx
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-0.010
0.010
0.030
0.050
0.070
0.090
0.110
0.130
0.150
0.170
0.190
0.210
Q10
Q9
Q8
Q7
Q6
Q5
Q4
Q3
Q2
0.5Q2
0.3Q2
0.1Q2

Flow Duration Curve Data for Villas at Paseo del Sol, City of Temecula POC-1

Q2 = 37.74 cfs Fraction 10 %
Q10 = 62.97 cfs
Step = 0.5980 cfs
Count = *1332432* 15 min interval
38.00 years

Interval	Existing Condition			Detention Optimized			Pass or Fail?
	Q (cfs)	Hours > Q	% time	Hours>Q	% time	Post/Pre	
1	3.7741	2501	1.88E-01	1504	1.13E-01	60%	Pass
2	4.3721	2196	1.65E-01	1268	9.52E-02	58%	Pass
3	4.9700	1950	1.46E-01	1120	8.41E-02	57%	Pass
4	5.5680	1613	1.21E-01	977	7.33E-02	61%	Pass
5	6.1659	1354	1.02E-01	846	6.35E-02	62%	Pass
6	6.7639	1219	9.15E-02	722	5.42E-02	59%	Pass
7	7.3618	1098	8.24E-02	642	4.82E-02	58%	Pass
8	7.9598	1005	7.54E-02	579	4.35E-02	58%	Pass
9	8.5577	925	6.94E-02	517	3.88E-02	56%	Pass
10	9.1557	844	6.33E-02	458	3.44E-02	54%	Pass
11	9.7536	771	5.79E-02	399	2.99E-02	52%	Pass
12	10.3516	704	5.28E-02	349	2.62E-02	50%	Pass
13	10.9496	617	4.63E-02	308	2.31E-02	50%	Pass
14	11.5475	529	3.97E-02	268	2.01E-02	51%	Pass
15	12.1455	470	3.53E-02	246	1.85E-02	52%	Pass
16	12.7434	403	3.02E-02	221	1.66E-02	55%	Pass
17	13.3414	331	2.48E-02	204	1.53E-02	62%	Pass
18	13.9393	297	2.23E-02	189	1.42E-02	64%	Pass
19	14.5373	271	2.03E-02	175	1.31E-02	65%	Pass
20	15.1352	245	1.84E-02	156	1.17E-02	64%	Pass
21	15.7332	227	1.70E-02	136	1.02E-02	60%	Pass
22	16.3311	199	1.49E-02	125	9.38E-03	63%	Pass
23	16.9291	183	1.37E-02	116	8.71E-03	63%	Pass
24	17.5270	176	1.32E-02	99	7.43E-03	56%	Pass
25	18.1250	168	1.26E-02	86	6.45E-03	51%	Pass
26	18.7229	166	1.25E-02	76	5.70E-03	46%	Pass
27	19.3209	160	1.20E-02	63	4.73E-03	39%	Pass
28	19.9189	154	1.16E-02	58	4.35E-03	38%	Pass
29	20.5168	144	1.08E-02	47	3.53E-03	33%	Pass
30	21.1148	135	1.01E-02	39	2.93E-03	29%	Pass
31	21.7127	128	9.61E-03	34	2.55E-03	27%	Pass
32	22.3107	122	9.16E-03	29	2.18E-03	24%	Pass
33	22.9086	113	8.48E-03	28	2.10E-03	25%	Pass
34	23.5066	101	7.58E-03	23	1.73E-03	23%	Pass
35	24.1045	95	7.13E-03	21	1.58E-03	22%	Pass
36	24.7025	84	6.30E-03	20	1.50E-03	24%	Pass

Interval	Existing Condition			Detention Optimized			Pass or Fail?
	Q (cfs)	Hours > Q	% time	Hours>Q	% time	Post/Pre	
37	25.3004	78	5.85E-03	19	1.43E-03	24%	Pass
38	25.8984	66	4.95E-03	18	1.35E-03	27%	Pass
39	26.4963	59	4.43E-03	17	1.28E-03	29%	Pass
40	27.0943	51	3.83E-03	17	1.28E-03	33%	Pass
41	27.6922	47	3.53E-03	14	1.05E-03	30%	Pass
42	28.2902	43	3.23E-03	11	8.26E-04	26%	Pass
43	28.8882	41	3.08E-03	10	7.51E-04	24%	Pass
44	29.4861	40	3.00E-03	10	7.51E-04	25%	Pass
45	30.0841	40	3.00E-03	10	7.51E-04	25%	Pass
46	30.6820	39	2.93E-03	10	7.51E-04	26%	Pass
47	31.2800	39	2.93E-03	9	6.75E-04	23%	Pass
48	31.8779	39	2.93E-03	9	6.75E-04	23%	Pass
49	32.4759	39	2.93E-03	9	6.75E-04	23%	Pass
50	33.0738	39	2.93E-03	9	6.75E-04	23%	Pass
51	33.6718	38	2.85E-03	8	6.00E-04	21%	Pass
52	34.2697	36	2.70E-03	8	6.00E-04	22%	Pass
53	34.8677	36	2.70E-03	8	6.00E-04	22%	Pass
54	35.4656	34	2.55E-03	7	5.25E-04	21%	Pass
55	36.0636	31	2.33E-03	7	5.25E-04	23%	Pass
56	36.6615	29	2.18E-03	7	5.25E-04	24%	Pass
57	37.2595	28	2.10E-03	6	4.50E-04	21%	Pass
58	37.8574	26	1.95E-03	6	4.50E-04	23%	Pass
59	38.4554	21	1.58E-03	5	3.75E-04	24%	Pass
60	39.0534	20	1.50E-03	4	3.00E-04	20%	Pass
61	39.6513	17	1.28E-03	3	2.25E-04	18%	Pass
62	40.2493	14	1.05E-03	3	2.25E-04	21%	Pass
63	40.8472	10	7.51E-04	3	2.25E-04	30%	Pass
64	41.4452	8	6.00E-04	3	2.25E-04	38%	Pass
65	42.0431	7	5.25E-04	3	2.25E-04	43%	Pass
66	42.6411	7	5.25E-04	3	2.25E-04	43%	Pass
67	43.2390	7	5.25E-04	3	2.25E-04	43%	Pass
68	43.8370	7	5.25E-04	2	1.50E-04	29%	Pass
69	44.4349	7	5.25E-04	1	7.51E-05	14%	Pass
70	45.0329	7	5.25E-04	1	7.51E-05	14%	Pass
71	45.6308	7	5.25E-04	1	7.51E-05	14%	Pass
72	46.2288	7	5.25E-04	1	7.51E-05	14%	Pass
73	46.8267	7	5.25E-04	1	7.51E-05	14%	Pass
74	47.4247	7	5.25E-04	1	7.51E-05	14%	Pass
75	48.0227	7	5.25E-04	1	7.51E-05	14%	Pass
76	48.6206	7	5.25E-04	1	7.51E-05	14%	Pass
77	49.2186	7	5.25E-04	1	7.51E-05	14%	Pass
78	49.8165	7	5.25E-04	1	7.51E-05	14%	Pass
79	50.414	7	5.25E-04	1	7.51E-05	14%	Pass
80	51.012	6	4.50E-04	1	7.51E-05	17%	Pass
81	51.610	6	4.50E-04	1	7.51E-05	17%	Pass

Interval	Existing Condition			Detention Optimized			Pass or Fail?
	Q (cfs)	Hours > Q	% time	Hours>Q	% time	Post/Pre	
82	52.208	6	4.50E-04	1	7.51E-05	17%	Pass
83	52.806	6	4.50E-04	1	7.51E-05	17%	Pass
84	53.404	6	4.50E-04	1	7.51E-05	17%	Pass
85	54.002	6	4.50E-04	1	7.51E-05	17%	Pass
86	54.600	5	3.75E-04	1	7.51E-05	20%	Pass
87	55.198	5	3.75E-04	1	7.51E-05	20%	Pass
88	55.796	5	3.75E-04	1	7.51E-05	20%	Pass
89	56.394	5	3.75E-04	0	0.00E+00	0%	Pass
90	56.992	5	3.75E-04	0	0.00E+00	0%	Pass
91	57.590	5	3.75E-04	0	0.00E+00	0%	Pass
92	58.188	5	3.75E-04	0	0.00E+00	0%	Pass
93	58.786	5	3.75E-04	0	0.00E+00	0%	Pass
94	59.384	5	3.75E-04	0	0.00E+00	0%	Pass
95	59.982	5	3.75E-04	0	0.00E+00	0%	Pass
96	60.580	5	3.75E-04	0	0.00E+00	0%	Pass
97	61.178	5	3.75E-04	0	0.00E+00	0%	Pass
98	61.776	5	3.75E-04	0	0.00E+00	0%	Pass
99	62.374	5	3.75E-04	0	0.00E+00	0%	Pass
100	62.971	5	3.75E-04	0	0.00E+00	0%	Pass

Peak Flows calculated with Cunnane Plotting Position

Return Period (years)	Pre-dev. Q (cfs)	Post-Dev. Q (cfs)	Reduction (cfs)
10	62.971	35.822	27.150
9	57.967	34.232	23.735
8	53.686	32.238	21.448
7	51.059	29.320	21.739
6	43.364	27.894	15.470
5	41.277	24.173	17.104
4	40.772	23.023	17.750
3	39.606	20.856	18.750
2	37.741	19.398	18.343

ATTACHMENT 3

List of the "n" largest Peaks: Pre-Development and Post-Development Conditions

ATTACHMENT 3

List of the "n" Largest Peaks: Pre & Post-Developed Conditions

Basic Probabilistic Equation:

R = 1/P R: Return period (years).

P: Probability of a flow to be equaled or exceeded any given year (dimensionless).

Cunnane Equation:

$$P = \frac{i-0.4}{n+0.2}$$

Weibull Equation:

$$P = \frac{i}{n+1}$$

i: Position of the peak whose probability is desired (sorted from large to small)

n: number of years analyzed.

Explanation of Variables for the Tables in this Attachment

Peak: Refers to the peak flow at the date given, taken from the continuous simulation hourly results of the n year analyzed.

Posit: If all peaks are sorted from large to small, the position of the peak in a sorting analysis is included under the variable Posit.

Date: Date of the occurrence of the peak at the outlet from the continuous simulation

Note: all peaks are not annual maxima; instead they are defined as event maxima, with a threshold to separate peaks of at least 12 hours. In other words, any peak P in a time series is defined as a value where dP/dt = 0, and the peak is the largest value in 25 hours (12 hours before, the hour of occurrence and 12 hours after the occurrence, so it is in essence a daily peak).

List of Peak events and Determination of Q2 and Q10 (Pre-Development)
Villas at Paseo del Sol - POC 1

T (Year)	Cunnane (cfs)	Weibull (cfs)
10	**62.97**	**66.07**
9	**57.97**	**61.59**
8	**53.69**	**55.67**
7	**51.06**	**52.09**
6	**43.36**	**45.69**
5	**41.28**	**41.34**
4	**40.77**	**40.77**
3	**39.61**	**39.65**
2	**37.74**	**37.74**

Note:
Cunnane is the preferred method by the HMP permit.

Peaks (cfs)	Date	Posit	Period of Return (Years)	
			Weibull	Cunnane
25.500	2/7/1994	38	1.03	1.02
25.541	2/21/2000	37	1.05	1.04
25.689	2/8/1998	36	1.08	1.07
25.781	3/1/1983	35	1.11	1.10
25.822	12/25/1983	34	1.15	1.14
26.156	12/18/1987	33	1.18	1.17
26.340	2/10/1978	32	1.22	1.21
26.448	9/11/1976	31	1.26	1.25
27.000	1/9/1998	30	1.30	1.29
27.472	2/23/1998	29	1.34	1.34
28.150	12/4/1987	28	1.39	1.38
30.228	11/30/2007	27	1.44	1.44
33.539	10/20/2004	26	1.50	1.49
33.738	1/14/1993	25	1.56	1.55
34.263	12/25/2003	24	1.63	1.62
35.165	1/18/1993	23	1.70	1.69
36.437	1/3/1977	22	1.77	1.77
36.974	12/4/1980	21	1.86	1.85
37.580	12/4/1974	20	1.95	1.95
37.911	12/22/2010	19	2.05	2.05
37.968	12/22/1982	18	2.17	2.17
38.311	2/12/1992	17	2.29	2.30
38.328	1/10/1995	16	2.44	2.45
38.900	1/18/2010	15	2.60	2.62
39.356	3/2/1983	14	2.79	2.81
39.648	12/6/1997	13	3.00	3.03
39.907	12/30/1976	12	3.25	3.29
40.083	1/4/1995	11	3.55	3.60
40.772	3/20/1992	10	3.90	3.98
40.783	1/16/1993	9	4.33	4.44
41.300	1/6/1993	8	4.88	5.03
41.498	1/9/2005	7	5.57	5.79
50.590	1/20/1982	6	6.50	6.82
54.485	2/8/1993	5	7.80	8.30
66.030	1/10/1978	4	9.75	10.61
66.537	11/30/1982	3	13.00	14.69
67.134	1/29/1980	2	19.50	23.88
69.873	1/4/1978	1	39.00	63.67

List of Peak events and Determination of Q2 and Q10 (Post-Development)
Villas at Paseo del Sol - POC 1

T (Year)	Cunnane (cfs)	Weibull (cfs)
10	**35.82**	**36.93**
9	**34.23**	**35.38**
8	**32.24**	**33.50**
7	**29.32**	**30.46**
6	**27.89**	**28.19**
5	**24.17**	**24.80**
4	**23.02**	**23.23**
3	**20.86**	**20.92**
2	**19.40**	**19.40**

Note:
Cunnane is the preferred method by the HMP permit.

Peaks (cfs)	Date	Posit	Period of Return (Years) Weibull	Cunnane
15.53	2/15/1986	38	1.03	1.02
15.61	12/6/1997	37	1.05	1.04
15.68	1/6/1979	36	1.08	1.07
16.17	2/8/1998	35	1.11	1.10
16.21	1/3/1977	34	1.15	1.14
16.26	2/19/1980	33	1.18	1.17
16.30	1/10/1995	32	1.22	1.21
16.50	1/11/2005	31	1.26	1.25
16.68	10/20/2004	30	1.30	1.29
16.76	12/25/1983	29	1.34	1.34
16.96	11/30/1982	28	1.39	1.38
16.99	3/11/1995	27	1.44	1.44
17.16	3/20/1992	26	1.50	1.49
17.22	12/7/2009	25	1.56	1.55
17.53	2/7/1994	24	1.63	1.62
18.21	1/18/2010	23	1.70	1.69
18.48	1/16/1978	22	1.77	1.77
18.95	1/20/1982	21	1.86	1.85
19.34	12/22/1982	20	1.95	1.95
19.46	12/22/2010	19	2.05	2.05
19.67	2/23/1998	18	2.17	2.17
20.10	2/16/1980	17	2.29	2.30
20.30	11/30/2007	16	2.44	2.45
20.42	12/22/2010	15	2.60	2.62
20.46	9/11/1976	14	2.79	2.81
20.92	3/2/1983	13	3.00	3.03
21.32	12/16/2002	12	3.25	3.29
21.59	1/9/1998	11	3.55	3.60
22.97	1/10/1978	10	3.90	3.98
24.10	12/4/1974	9	4.33	4.44
24.18	12/6/1997	8	4.88	5.03
27.66	1/16/1993	7	5.57	5.79
28.80	1/4/1995	6	6.50	6.82
33.13	11/30/1982	5	7.80	8.30
36.79	1/6/1993	4	9.75	10.61
38.62	1/29/1980	3	13.00	14.69
39.26	2/8/1993	2	19.50	23.88
56.36	1/4/1978	1	39.00	63.67

ATTACHMENT 4

Elevations vs. Discharge & Stage- Storage Curves to be used in SWMM

ATTACHMENT 4

AREA VS ELEVATION

The area vs. elevation curve in the model is calculated in Excel and imported into the model. The stage-storage relationship is provided on the following page.

DISCHARGE VS ELEVATION

The total discharge peak flow is imported from an Excel spreadsheet that calculates the discharge vs. elevation of the outlet system. Discharge vs. elevation relationships are provided for the detention basin as this is where a Modified Puls routing procedure will be taken into account in the continuous simulation model.

The orifices have been selected to maximize its size while still restricting flows to conform with the required 10% of the Q_2 event flow as mandated in the SMRHMP document.

While REC acknowledges that the orifices are small, to increase the size of the outlet or to change the placement of their invert would impact the basin's ability to restrict flows beneath the HMP thresholds, thus preventing the BMP from conformance with HMP requirements.

In order to further reduce the risk of blockage of the orifices, regular maintenance of the riser and orifice must be performed to ensure potential blockages are minimized. A detail of the orifice and riser structure is provided in Attachment 5 of this memorandum.

A stage-discharge relationship was developed to represent the outlet structure for the basin and is provided on the following pages.

DISCHARGE EQUATIONS

1) Weir:

$$Q_W = C_W \cdot L \cdot H^{3/2} \qquad (1)$$

2) Slot:

As an orifice: $$Q_s = B_s \cdot h_s \cdot c_g \cdot \sqrt{2g\left(H - \frac{h_s}{2}\right)} \qquad (2.a)$$

As a weir: $$Q_s = C_W \cdot B_s \cdot H^{3/2} \qquad (2.b)$$

For H > h_s slot works as weir until orifice equation provides a smaller discharge. The elevation such that equation (2.a) = equation (2.b) is the elevation at which the behavior changes from weir to orifice.

3) Vertical Orifices

As an orifice: $$Q_o = 0.25 \cdot \pi D^2 \cdot c_g \cdot \sqrt{2g\left(H - \frac{D}{2}\right)} \qquad (3.a)$$

As a weir: Critical depth and geometric family of circular sector must be solved to determined Q as a function of H:

$$\frac{Q_O^2}{g} = \frac{A_{cr}^3}{T_{cr}}; \quad H = y_{cr} + \frac{A_{cr}}{2 \cdot T_{cr}}; \; T_{cr} = 2\sqrt{y_{cr}(D - y_{cr})}; \quad A_{cr} = \frac{D^2}{8}[\alpha_{cr} - sin(\alpha_{cr})];$$

$$y_{cr} = \frac{D}{2}[1 - sin(0.5 \cdot \alpha_{cr})] \qquad (3.b.1, 3.b.2, 3.b.3, 3.b.4 \text{ and } 3.b.5)$$

There is a value of H (approximately H = 110% D) from which orifices no longer work as weirs as critical depth is not possible at the entrance of the orifice. This value of H is obtained equaling the discharge using critical equations and equations (3.b).

A mathematical model is prepared with the previous equations depending on the type o discharge.

The following are the variables used above:

Q_W, Q_s, Q_O = Discharge of weir, slot or orifice (cfs)

C_W, c_g : Coefficients of discharge of weir (typically 3.1) and orifice (0.61 to 0.62)

L, B_s, D, h_s : Length of weir, width of slot, diameter of orifice and height of slot, respectively; (ft)

H: Level of water in the pond over the invert of slot, weir or orifice (ft)

A_{cr}, T_{cr}, y_{cr}, α_{cr}: Critical variables for circular sector: area (sq-ft), top width (ft), critical depth (ft), and angle to the center, respectively.

Elev - Area - Volume curve for BMP-1

	Elev (ft)	h1 (ft)	h2 (ft)	A (ft^2)	V (ft^3)
BMP level	1101	0		**21534**	0
	1101.25	0.25		22004	2177
	1101.5	0.5		22474	7737
	1101.75	0.75	0	22949	13414
	1102	1	0.25	23431	19212
	1103	2	1.25	25430	43642
	1104	3	2.25	27497	70106
	1105	4	3.25	29632	98670
	1106	5	4.25	31944	129458

h1: Elevation measured over surface (top of amended soil, ft)
h2: Elevation measureed over lowest surface outlet (ft). Values used for discharge table
A: area at given elevation
V: volume at given elevation (40% voids for the first 3" composed of mulch)

Outlet structure for Discharge of Detention Basin BMP-1

Discharge vs Elevation Table

Lower slot		Upper slot	
Invert:	0.00 ft	Invert:	0.00 ft
B	2.50 ft	B	0.00 ft
h	0.25 ft	h	0.00 ft
Middle slot			
Invert:	1.25 ft	Emergency Weir	
B:	8.00 ft	Invert:	2.25 ft
h	0.50 ft	B:	16 ft

h (ft)	Elev. (ft)	Qslot-low (cfs)	Qslot-mid (cfs)	Qslot-upp (cfs)	Qemer (cfs)	Qtot (cfs)
0.000	1101.75	0.000	0.000	0.000	0.000	0.000
0.083	1101.83	0.186	0.000	0.000	0.000	0.186
0.167	1101.92	0.527	0.000	0.000	0.000	0.527
0.250	1102.00	0.969	0.000	0.000	0.000	0.969
0.333	1102.08	1.396	0.000	0.000	0.000	1.396
0.417	1102.17	1.652	0.000	0.000	0.000	1.652
0.500	1102.25	1.874	0.000	0.000	0.000	1.874
0.583	1102.33	2.071	0.000	0.000	0.000	2.071
0.667	1102.42	2.252	0.000	0.000	0.000	2.252
0.750	1102.50	2.419	0.000	0.000	0.000	2.419
0.833	1102.58	2.575	0.000	0.000	0.000	2.575
0.917	1102.67	2.722	0.000	0.000	0.000	2.722
1.000	1102.75	2.862	0.000	0.000	0.000	2.862
1.083	1102.83	2.995	0.000	0.000	0.000	2.995
1.167	1102.92	3.123	0.000	0.000	0.000	3.123
1.250	1103.00	3.245	0.000	0.000	0.000	3.245
1.333	1103.08	3.363	0.597	0.000	0.000	3.960
1.417	1103.17	3.477	1.687	0.000	0.000	5.165
1.500	1103.25	3.588	3.100	0.000	0.000	6.688
1.583	1103.33	3.695	4.773	0.000	0.000	8.467
1.667	1103.42	3.799	6.670	0.000	0.000	10.469
1.750	1103.50	3.900	8.768	0.000	0.000	12.668
1.833	1103.58	3.999	11.049	0.000	0.000	15.048
1.917	1103.67	4.095	12.639	0.000	0.000	16.735
2.000	1103.75	4.189	13.846	0.000	0.000	18.035
2.083	1103.83	4.282	14.955	0.000	0.000	19.237
2.167	1103.92	4.372	15.988	0.000	0.000	20.359
2.250	1104.00	4.460	16.958	0.000	0.000	21.418
2.333	1104.08	4.547	17.875	0.000	1.193	23.615
2.417	1104.17	4.632	18.747	0.000	3.375	26.754
2.500	1104.25	4.715	19.581	0.000	6.200	30.496
2.583	1104.33	4.797	20.380	0.000	9.545	34.723
2.667	1104.42	4.878	21.150	0.000	13.340	39.368
2.750	1104.50	4.957	21.892	0.000	17.536	44.385
2.833	1104.58	5.035	22.610	0.000	22.098	49.743
2.917	1104.67	5.112	23.306	0.000	26.999	55.417
3.000	1104.75	5.188	23.982	0.000	32.216	61.385
3.083	1104.83	5.262	24.639	0.000	37.732	67.633
3.167	1104.92	5.336	25.279	0.000	43.531	74.146
3.250	1105.00	5.409	25.903	0.000	49.600	80.912
3.333	1105.08	5.480	26.513	0.000	55.927	87.920
3.417	1105.17	5.551	27.109	0.000	62.503	95.162
3.500	1105.25	5.621	27.692	0.000	69.318	102.63
3.583	1105.33	5.690	28.263	0.000	76.364	110.32
3.667	1105.42	5.758	28.822	0.000	83.634	118.21
3.750	1105.50	5.825	29.371	0.000	91.121	126.32
3.833	1105.58	5.892	29.910	0.000	98.819	134.62
3.917	1105.67	5.958	30.440	0.000	106.722	143.12
4.000	1105.75	6.023	30.960	0.000	114.826	151.81
4.083	1105.83	6.087	31.472	0.000	123.124	160.68
4.167	1105.92	6.151	31.975	0.000	131.614	169.74
4.250	1106.00	6.214	32.471	0.000	140.290	178.98

Diversion Structure

Inflow (cfs)	Outflow (cfs)	Weir (cfs)
0.0	0.0	0.00
19.88	19.88	0.00
21.55	20.62	0.93
27.03	22.05	4.99
42.17	24.15	18.02
56.73	25.14	31.59

ATTACHMENT 5

Pre & Post-Developed Maps, Project Plan and Detention

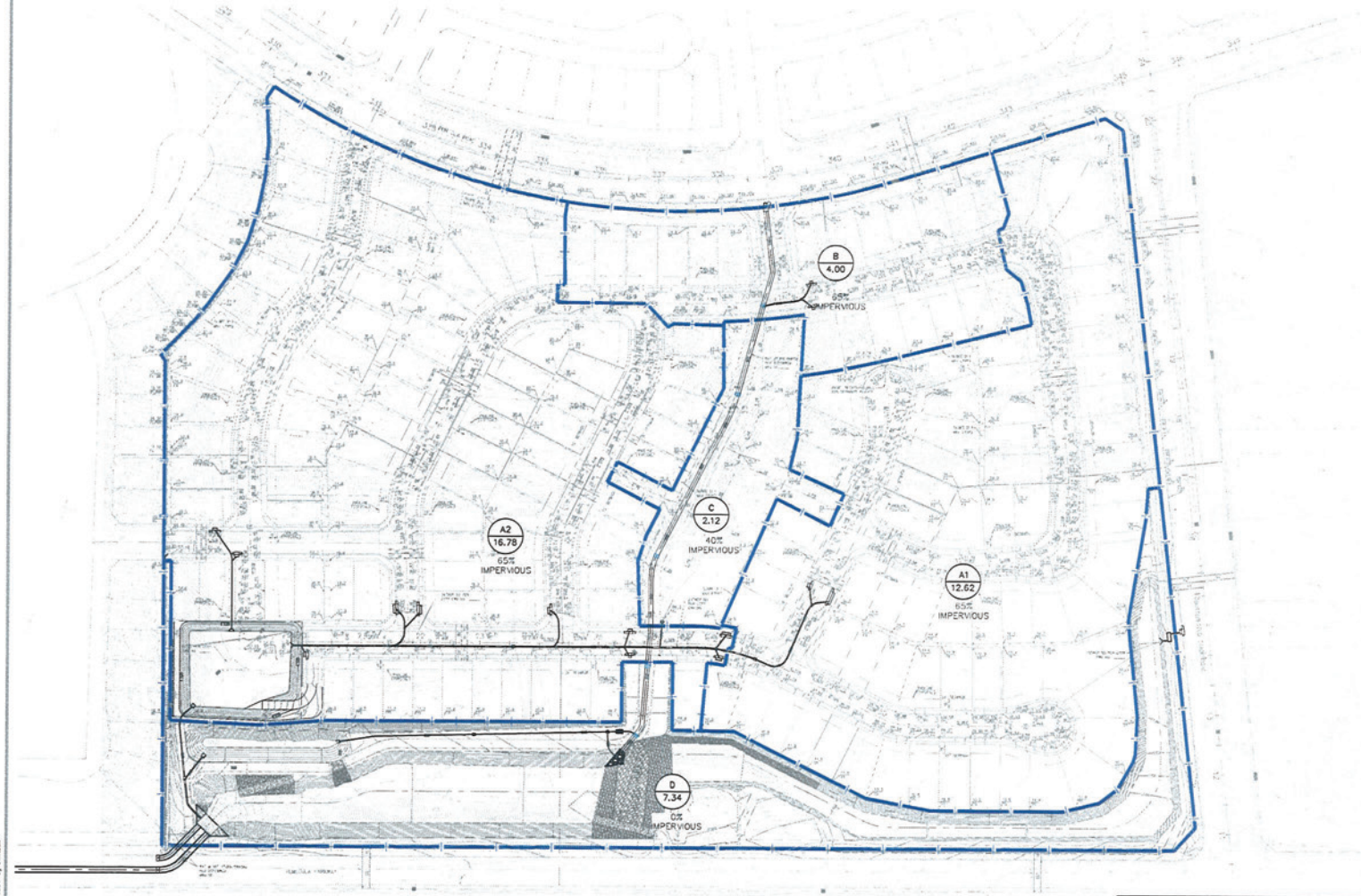
Section Sketches

SHEET 1 OF 1

TENTATIVE TRACT MAP NO. XXXXX

IN THE CITY OF XXXXX, COUNTY OF XXXXX, STATE OF CALIFORNIA

POST-PROJECT CONDITION SITE HYDROLOGY MAP



LEGEND:

- X.X / X.X — NODE/CONCENTRATION POINT / FLOWLINE ELEVATION
- XXXX.X — APPROXIMATE INVERT ELEVATION
- XXX / X.X — SUB AREA / ACRES
- L=XXX' — FLOW DISTANCE
- FLOW PATH
- WATERSHED SUB-BOUNDARY
- WATERSHED BOUNDARY

N

GRAPHIC SCALE
80' 0 40' 80' 160'
1" = 80'

EXHIBIT "A"

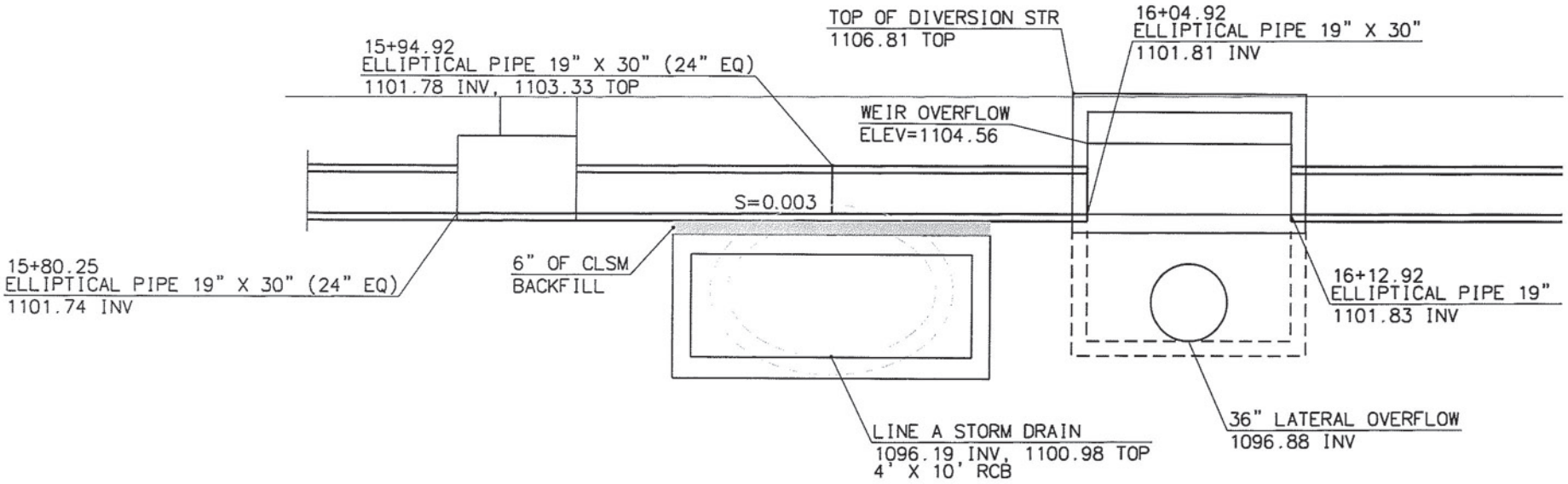
TTM NO. XXXXX

POST-PROJECT CONDITION SITE HYDROLOGY MAP

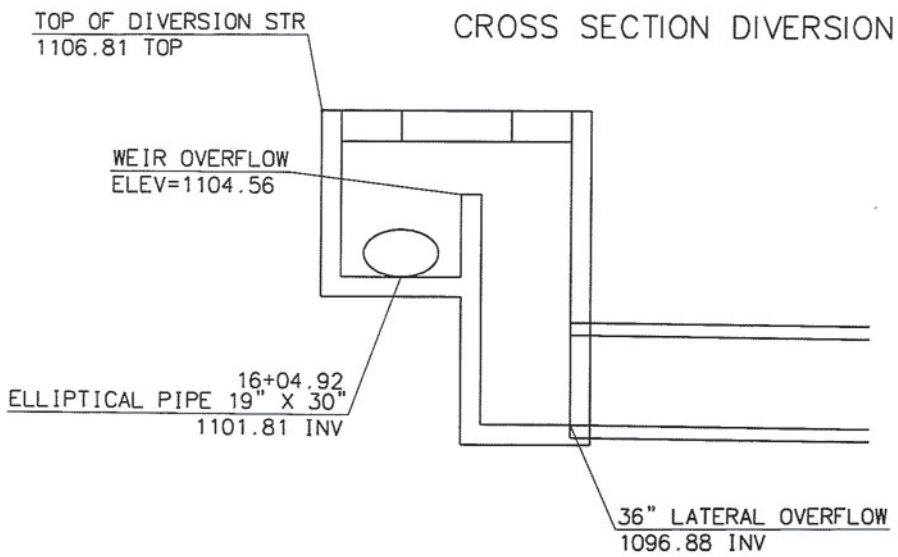
JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

Drawing Name: G:\JOB 2015\Engineering\MAPS\PCHM Map.dwg
Last Opened: Oct 19, 2018 - 10:57am by bwilkins

LINE A PROFILE



CROSS SECTION DIVERSION STRUCTURE



ATTACHMENT 6

SWMM Input Data in Input Format (Existing & Proposed Models)

PRE_DEV_POC-1

```
[TITLE]

[OPTIONS]
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
START_DATE           07/30/1974
START_TIME           00:00:00
REPORT_START_DATE    07/30/1974
REPORT_START_TIME    00:00:00
END_DATE             07/29/2012
END_TIME             23:45:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:15:00
WET_STEP             00:15:00
DRY_STEP             01:00:00
ROUTING_STEP         0:01:00
ALLOW_PONDING        NO
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  H-W
LINK_OFFSETS         DEPTH
MIN_SLOPE            0

[EVAPORATION]
;;Type       Parameters
;;---------- ----------
MONTHLY      0.06   0.08   0.11   0.16   0.18   0.21   0.21   0.20   0.16   0.12   0.08   0.06
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
Temecu-rain      VOLUME    0:15   1.0    TIMESERIES Temecu

[SUBCATCHMENTS]
;;                                                  Total     Pcnt.             Pcnt.     Curb      Snow
;;Name           Raingage         Outlet           Area      Imperv    Width   Slope     Length    Pack
;;-------------- ---------------- ---------------- --------- --------- ------- --------- --------- ---------
DMA-1-A          Temecu-rain      POC-1            0.92      0         190     8.5       0
DMA-1-D          Temecu-rain      POC-1            34.6      0         7010    5         0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
DMA-1-A          0.012      0.05       0.05       0.1        25         OUTLET
DMA-1-D          0.012      0.05       0.05       0.1        25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    HydCon     IMDmax
;;-------------- ---------- ---------- ----------
DMA-1-A          1.5        0.225      0.30
DMA-1-D          9          0.01875    0.33

[LID_CONTROLS]
;;               Type/Layer Parameters
;;-------------- ---------- ----------
BR-1             BC
BR-1             SURFACE    55.21      0.05       0.0        0.0        5
BR-1             SOIL       18         0.392      0.196      0.098      5          5          3.5
BR-1             STORAGE    18         0.602      0.15       0
BR-1             DRAIN      0.2583     0.5        0          6

[LID_USAGE]
```

PRE_DEV_POC-1

```
;;Subcatchment   LID Process      Number  Area       Width      InitSatur  FromImprv  ToPerv     Report File
;;-------------- ---------------- ------- ---------- ---------- ---------- ---------- ---------- -----------

[OUTFALLS]
;;               Invert     Outfall    Stage/Table      Tide
;;Name           Elev.      Type       Time Series      Gate
;;-------------- ---------- ---------- ---------------- ----
POC-1            0          FREE                        NO

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
Temecu           FILE "Temecu-rain.txt"

[REPORT]
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 3129.510 454.206 4680.290 9161.674
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC-1            4600.000           850.000

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA-1-A          3214.674           6206.090
DMA-1-D          5562.745           6168.482

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Temecu-rain      2699.527           7560.507
```

POST_DEV_POC_1

```
[TITLE]

[OPTIONS]
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
START_DATE           07/30/1974
START_TIME           00:00:00
REPORT_START_DATE    07/30/1974
REPORT_START_TIME    00:00:00
END_DATE             07/29/2012
END_TIME             23:45:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:15:00
WET_STEP             00:15:00
DRY_STEP             01:00:00
ROUTING_STEP         0:01:00
ALLOW_PONDING        NO
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  H-W
LINK_OFFSETS         DEPTH
MIN_SLOPE            0

[EVAPORATION]
;;Type       Parameters
;;---------- ----------
MONTHLY      0.06   0.08   0.11   0.16   0.18   0.21   0.21   0.20   0.16   0.12   0.08   0.06
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
Temecu-rain      VOLUME    0:15   1.0    TIMESERIES Temecu
Aux-rain         VOLUME    0:15   1.0    TIMESERIES Aux-rain

[SUBCATCHMENTS]
;;                                                    Total     Pcnt.             Pcnt.     Curb      Snow
;;Name           Raingage         Outlet              Area      Imperv   Width    Slope     Length    Pack
;;-------------- ---------------- ------------------ -------- -------- -------- -------- --------- --------
A2-SoilA         Temecu-rain      BMP-1               0.92     65       300      1.5       0
A2-SoilD         Temecu-rain      BMP-1               15.3656  67.1     5220     1.5       0
Area-A1          Temecu-rain      Div-high            12.62    65       3760     1.5       0
Area-B           Temecu-rain      BMP-1               4.00     65       1600     2         0
Area-C           Temecu-rain      Div-high            2.12     40       1000     2         0
Area-Aux         Aux-rain         BMP-1               0.247934 100      50000    50        0
BMP-1            Temecu-rain      Div-1               0.4944   0        160      0         0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
A2-SoilA         0.012      0.05       0.05       0.1        25         OUTLET
A2-SoilD         0.012      0.05       0.05       0.1        25         OUTLET
Area-A1          0.012      0.05       0.05       0.1        25         OUTLET
Area-B           0.012      0.05       0.05       0.1        25         OUTLET
Area-C           0.012      0.05       0.05       0.1        25         OUTLET
Area-Aux         0.001      0.1        0          0          100        OUTLET
BMP-1            0.012      0.05       0.05       0.1        25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    HydCon     IMDmax
;;-------------- ---------- ---------- ----------
A2-SoilA         1.5        0.225      0.30
A2-SoilD         9          0.01875    0.33
```

```
Area-A1          9          0.01875    0.33
Area-B           9          0.01875    0.33
Area-C           9          0.01875    0.33
Area-Aux         3.0        0.001      0.3
BMP-1            9          0.01875    0.33

[LID_CONTROLS]
;;               Type/Layer Parameters
;;-------------- ---------- ----------
BR-1             BC
BR-1             SURFACE    7.47       0.05       0.0        0.0        5
BR-1             SOIL       24         0.4        0.2        0.1        5          5          1.5
BR-1             STORAGE    21         0.67       0.01875    0
BR-1             DRAIN      0.3866     0.5        3          6

[LID_USAGE]
;;Subcatchment   LID Process      Number  Area       Width      InitSatur  FromImprv  ToPerv     Report File
;;-------------- ---------------- ------- ---------- ---------- ---------- ---------- ---------- -----------
BMP-1            BR-1             1       21534      0          0          100        0

[OUTFALLS]
;;               Invert     Outfall    Stage/Table      Tide
;;Name           Elev.      Type       Time Series      Gate
;;-------------- ---------- ---------- ---------------- ----
POC-1            0          FREE                        NO
Aux              0          FREE                        NO

[DIVIDERS]
;;               Invert     Diverted         Divider
;;Name           Elev.      Link             Type       Parameters
;;-------------- ---------- ---------------- ---------- ----------
Div-high         0          Low-flow         TABULAR    Div-high        0          0          0          0
Div-1            0          Pond-1           CUTOFF     0.8175     0          0          0          0

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve                    Ponded   Evap.
;;Name           Elev.    Depth    Depth    Curve      Params                   Area     Frac.    Infiltration
Parameters
;;-------------- -------- -------- -------- ---------- -------- -------- -------- -------- -------- ----------
------
Basin-1          0        5        0        TABULAR    Basin1                   31944    1

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet      Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset     Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----------
High-flow        Div-high         POC-1            400        0.01       0          0          0          0
Low-flow         Div-high         Aux              400        0.01       0          0          0          0
Pond-1           Div-1            Basin-1          400        0.01       0          0          0          0
By-Pass-1        Div-1            POC-1            400        0.01       0          0          0          0

[OUTLETS]
;;               Inlet            Outlet           Outflow    Outlet           Qcoeff/                    Flap
;;Name           Node             Node             Height     Type             QTable           Qexpon    Gate
;;-------------- ---------------- ---------------- ---------- ---------------- ---------------- ---------- ----
Out-1            Basin-1          POC-1            0          TABULAR/DEPTH    OUTLET-1                    NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
High-flow        DUMMY        0                0          0          0          1
Low-flow         DUMMY        0                0          0          0          1
Pond-1           DUMMY        0                0          0          0          1
By-Pass-1        CIRCULAR     1                0          0          0          1

[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate
;;-------------- ---------- ---------- ---------- ----------

[CURVES]
;;Name           Type       X-Value    Y-Value
```

POST_DEV_POC_1

```
;;--------------- ---------- ---------- ----------
Div-high         Diversion  0.0        0.0
Div-high                    19.88      19.88
Div-high                    21.55      20.62
Div-high                    27.03      22.05
Div-high                    42.17      24.15
Div-high                    56.73      25.14

OUTLET-1         Rating     0.000      0.000
OUTLET-1                    0.083      0.186
OUTLET-1                    0.167      0.527
OUTLET-1                    0.250      0.969
OUTLET-1                    0.333      1.396
OUTLET-1                    0.417      1.652
OUTLET-1                    0.500      1.874
OUTLET-1                    0.583      2.071
OUTLET-1                    0.667      2.252
OUTLET-1                    0.750      2.419
OUTLET-1                    0.833      2.575
OUTLET-1                    0.917      2.722
OUTLET-1                    1.000      2.862
OUTLET-1                    1.083      2.995
OUTLET-1                    1.167      3.123
OUTLET-1                    1.250      3.245
OUTLET-1                    1.333      3.960
OUTLET-1                    1.417      5.165
OUTLET-1                    1.500      6.688
OUTLET-1                    1.583      8.467
OUTLET-1                    1.667      10.469
OUTLET-1                    1.750      12.668
OUTLET-1                    1.833      15.048
OUTLET-1                    1.917      16.735
OUTLET-1                    2.000      18.035
OUTLET-1                    2.083      19.237
OUTLET-1                    2.167      20.359
OUTLET-1                    2.250      21.418
OUTLET-1                    2.333      23.615
OUTLET-1                    2.417      26.754
OUTLET-1                    2.500      30.496
OUTLET-1                    2.583      34.723
OUTLET-1                    2.667      39.368
OUTLET-1                    2.750      44.385
OUTLET-1                    2.833      49.743
OUTLET-1                    2.917      55.417
OUTLET-1                    3.000      61.385
OUTLET-1                    3.083      67.633
OUTLET-1                    3.167      74.146
OUTLET-1                    3.250      80.912
OUTLET-1                    3.333      87.920
OUTLET-1                    3.417      95.162
OUTLET-1                    3.500      102.63
OUTLET-1                    3.583      110.32
OUTLET-1                    3.667      118.21
OUTLET-1                    3.750      126.32
OUTLET-1                    3.833      134.62
OUTLET-1                    3.917      143.12
OUTLET-1                    4.000      151.81
OUTLET-1                    4.083      160.68
OUTLET-1                    4.167      169.74
OUTLET-1                    4.250      178.98

Basin1           Storage    0          22949
Basin1                      0.25       23431
Basin1                      1.25       25430
Basin1                      2.25       27497
Basin1                      3.25       29632
Basin1                      4.25       31944

[TIMESERIES]
;;Name           Date       Time       Value
;;--------------- ---------- ---------- ----------
```

POST_DEV_POC_1

```
Temecu           FILE "Temecu-rain.txt"

Aux-rain         FILE "aux-rain.txt"

[REPORT]
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS -450.000 -350.000 9450.000 7350.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC-1            7000.000           0.000
Aux              9000.000           2000.000
Div-high         7000.000           4000.000
Div-1            0.000              2000.000
Basin-1          0.000              0.000

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
A2-SoilA         0.000              6000.000
A2-SoilD         2000.000           6000.000
Area-A1          9000.000           6000.000
Area-B           4000.000           6000.000
Area-C           7000.000           6000.000
Area-Aux         4000.000           4000.000
BMP-1            0.000              4000.000

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Temecu-rain      3000.000           7000.000
Aux-rain         6000.000           7000.000
```

ATTACHMENT 7

EPA SWMM FIGURES AND EXPLANATIONS

ATTACHMENT 7

EPA SWMM FIGURES AND EXPLANATIONS

Per the attached, the reader can see the screens associated with the EPA-SWMM Model in both pre-development and post-development conditions. Each portion, i.e., sub-catchments, outfalls, storage units, weir as a discharge, and outfalls (point of compliance), are also shown.

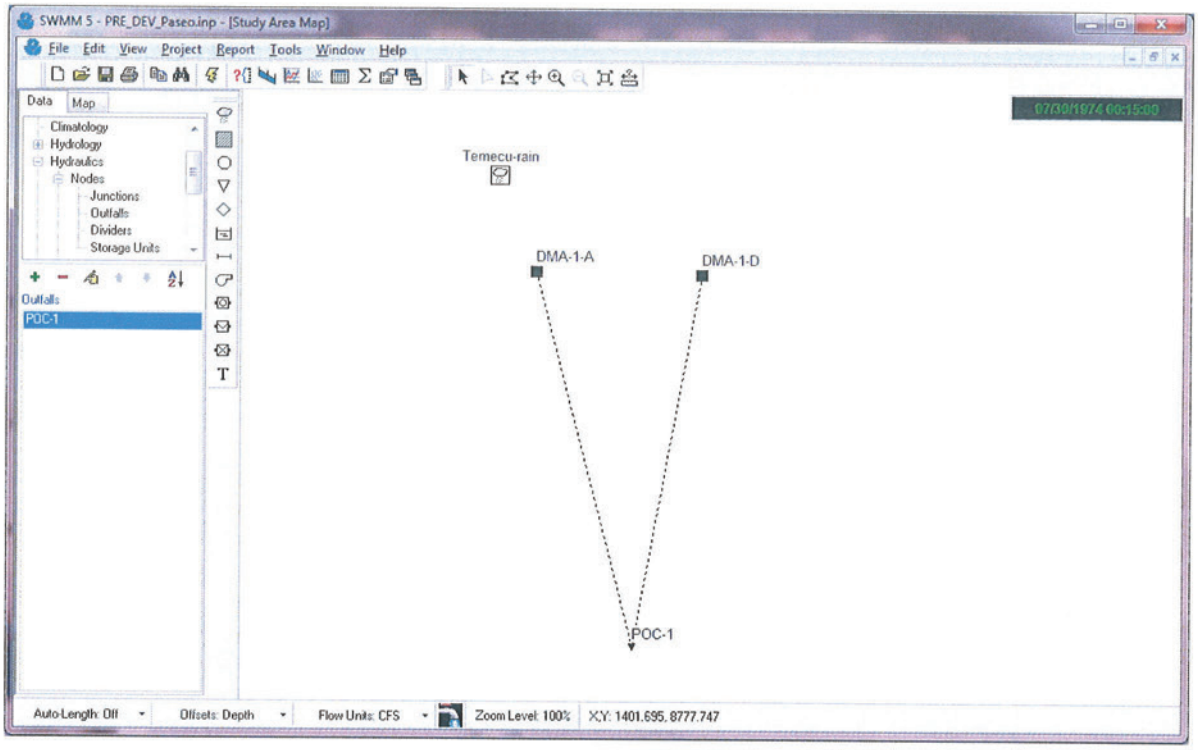
Variables for modeling are associated with typical recommended values by the EPA-SWMM model, typical values found in technical literature (such as Maidment's Handbook of Hydrology). Recommended values for the SWMM model have been attained from the interim Orange County criteria established for their SWMM calibration and for the Model BMP Design Manual, San Diego Region (2015) not yet approved and in process of public review. Currently, no recommended values have been established by the SMRHMP document for the SWMM Model.

Soil characteristics of the existing soils were determined from the NRCS Web Soil Survey Exhibit (located in Attachment 8 of this report).

Some values incorporated within the SWMM model have been determined from the professional experience of REC using conservative assumptions that have a tendency to increase the size of the needed BMP and also generate a long-term runoff as a percentage of rainfall similar to those measured in gage stations in Southern California by the USGS.

A Technical document prepared by Tory R Walker Engineering for the Cities of San Marcos, Oceanside and Vista (Reference [1]) can be also consulted for additional information regarding typical values for SWMM parameters.

PRE-DEVELOPED CONDITION POC-1



Rain Gage Temecu-rain

Property	Value
Name	Temecu-rain
X-Coordinate	2699.527
Y-Coordinate	7560.507
Description	
Tag	
Rain Format	VOLUME
Time Interval	0:15
Snow Catch Factor	1.0
Data Source	TIMESERIES
TIME SERIES:	
- Series Name	Temecu
DATA FILE:	
- File Name	*
- Station ID	*
- Rain Units	IN

User-assigned name of rain gage

Outfall POC-1

Property	Value
Name	POC-1
X-Coordinate	4600.000
Y-Coordinate	850.000
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Tide Gate	NO
Type	FREE
Fixed Outfall	
Fixed Stage	0
Tidal Outfall	
Curve Name	*
Time Series Outfall	
Series Name	*

User-assigned name of outfall

Subcatchment DMA-1-A

Property	Value
Name	DMA-1-A
X-Coordinate	3214.674
Y-Coordinate	6206.090
Description	
Tag	
Rain Gage	Temecu-rain
Outlet	POC-1
Area	0.92
Width	190
% Slope	8.5
% Imperv	0
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.05
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Subcatchment DMA-1-D

Property	Value
Name	DMA-1-D
X-Coordinate	5562.745
Y-Coordinate	6168.482
Description	
Tag	
Rain Gage	Temecu-rain
Outlet	POC-1
Area	34.6
Width	7010
% Slope	5
% Imperv	0
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.05
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Infiltration Editor

Infiltration Method: GREEN_AMPT

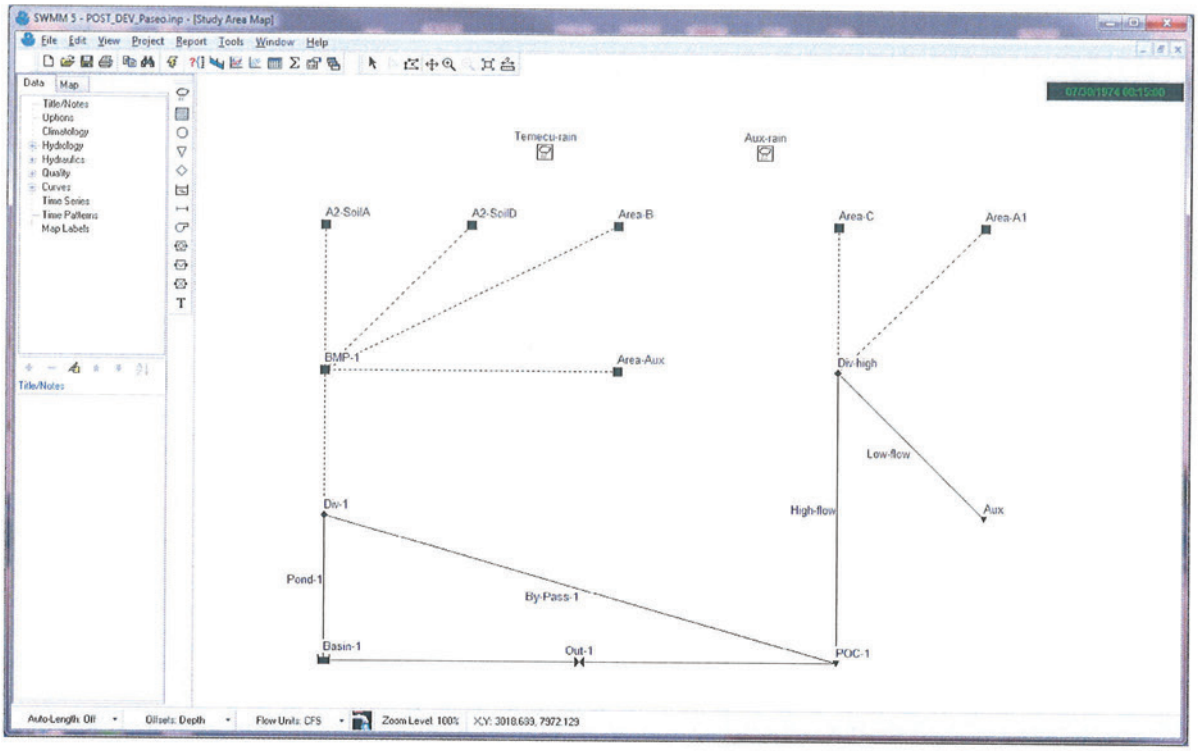
Property	Value
Suction Head	1.5
Conductivity	0.225
Initial Deficit	0.30

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.33

POST-DEVELOPED CONDITION POC-1



Rain Gage Temecu-rain

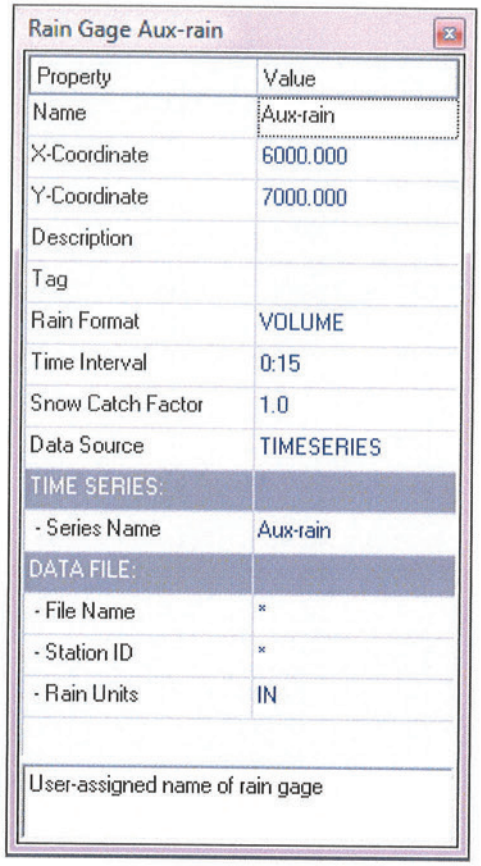
Property	Value
Name	Temecu-rain
X-Coordinate	3000.000
Y-Coordinate	7000.000
Description	
Tag	
Rain Format	VOLUME
Time Interval	0:15
Snow Catch Factor	1.0
Data Source	TIMESERIES
TIME SERIES:	
- Series Name	Temecu
DATA FILE:	
- File Name	*
- Station ID	*
- Rain Units	IN

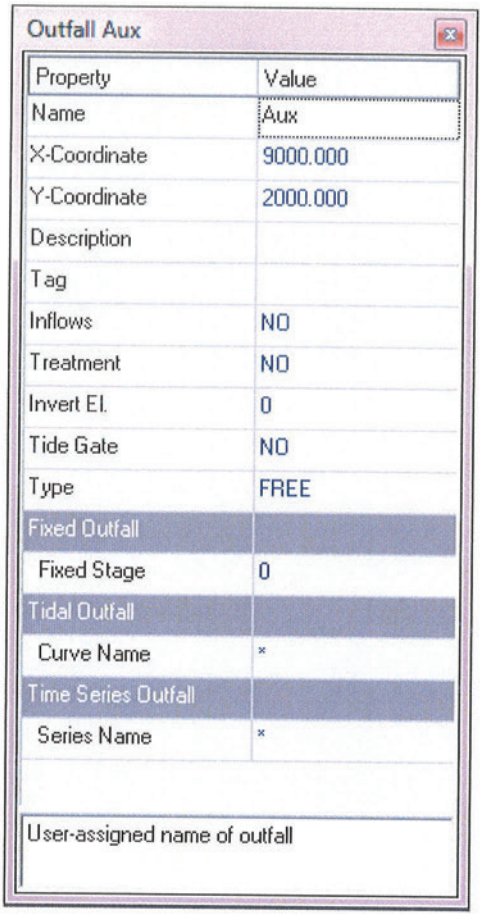
User-assigned name of rain gage

Outfall POC-1

Property	Value
Name	POC-1
X-Coordinate	7000.000
Y-Coordinate	0.000
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Tide Gate	NO
Type	FREE
Fixed Outfall	
Fixed Stage	0
Tidal Outfall	
Curve Name	*
Time Series Outfall	
Series Name	*

User-assigned name of outfall


Rain Gage Aux-rain
Property
Value
Name
Aux-rain
X-Coordinate
6000.000
Y-Coordinate
7000.000
Description
Tag
Rain Format
VOLUME
Time Interval
0:15
Snow Catch Factor
1.0
Data Source
TIMESERIES
TIME SERIES:
- Series Name
Aux-rain
DATA FILE:
- File Name
*
- Station ID
*
- Rain Units
IN
User-assigned name of rain gage


Outfall Aux
Property
Value
Name
Aux
X-Coordinate
9000.000
Y-Coordinate
2000.000
Description
Tag
Inflows
NO
Treatment
NO
Invert El.
0
Tide Gate
NO
Type
FREE
Fixed Outfall
Fixed Stage
0
Tidal Outfall
Curve Name
*
Time Series Outfall
Series Name
*
User-assigned name of outfall

Subcatchment Area-A1

Property	Value
Name	Area-A1
X-Coordinate	9000.000
Y-Coordinate	6000.000
Description	
Tag	
Rain Gage	Temecu-rain
Outlet	Div-high
Area	12.62
Width	3760
% Slope	1.5
% Imperv	65
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.05
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Subcatchment Area-B

Property	Value
Name	Area-B
X-Coordinate	4000.000
Y-Coordinate	6000.000
Description	
Tag	
Rain Gage	Temecu-rain
Outlet	BMP-1
Area	4.00
Width	1600
% Slope	2
% Imperv	65
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.05
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.33

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.33

Subcatchment Area-C

Property	Value
Name	Area-C
X-Coordinate	7000.000
Y-Coordinate	6000.000
Description	
Tag	
Rain Gage	Temecu-rain
Outlet	Div-high
Area	2.12
Width	1000
% Slope	2
% Imperv	40
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.05
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Subcatchment A2-SoilA

Property	Value
Name	A2-SoilA
X-Coordinate	0.000
Y-Coordinate	6000.000
Description	
Tag	
Rain Gage	Temecu-rain
Outlet	BMP-1
Area	0.92
Width	300
% Slope	1.5
% Imperv	65
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.05
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.33

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	1.5
Conductivity	0.225
Initial Deficit	0.30

Subcatchment A2-SoilD

Property	Value
Name	A2-SoilD
X-Coordinate	2000.000
Y-Coordinate	6000.000
Description	
Tag	
Rain Gage	Temecu-rain
Outlet	BMP-1
Area	15.3656
Width	5220
% Slope	1.5
% Imperv	67.1
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.05
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.33

Subcatchment BMP-1

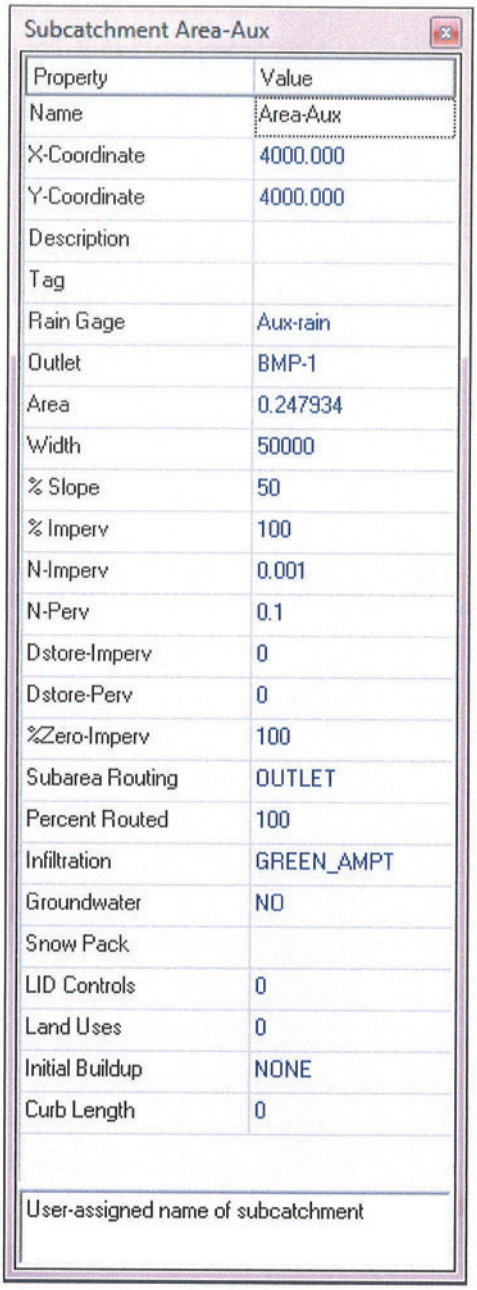
Property	Value
Name	BMP-1
X-Coordinate	0.000
Y-Coordinate	4000.000
Description	
Tag	
Rain Gage	Temecu-rain
Outlet	Div-1
Area	0.4944
Width	160
% Slope	0
% Imperv	0
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.05
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	1
Land Uses	0
Initial Buildup	NONE
Curb Length	0

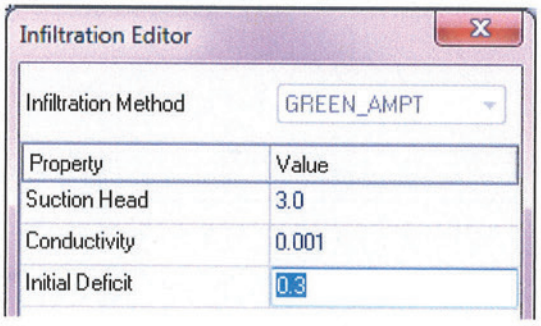
User-assigned name of subcatchment

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.33


Subcatchment Area-Aux
Property
Value
Name
Area-Aux
X-Coordinate
4000.000
Y-Coordinate
4000.000
Description
Tag
Rain Gage
Aux-rain
Outlet
BMP-1
Area
0.247934
Width
50000
% Slope
50
% Imperv
100
N-Imperv
0.001
N-Perv
0.1
Dstore-Imperv
0
Dstore-Perv
0
%Zero-Imperv
100
Subarea Routing
OUTLET
Percent Routed
100
Infiltration
GREEN_AMPT
Groundwater
NO
Snow Pack
LID Controls
0
Land Uses
0
Initial Buildup
NONE
Curb Length
0
User-assigned name of subcatchment


Infiltration Editor
Infiltration Method
GREEN_AMPT
Property
Value
Suction Head
3.0
Conductivity
0.001
Initial Deficit
0.3

Basin 1

Storage Unit Basin-1

Property	Value
Name	Basin-1
X-Coordinate	0.000
Y-Coordinate	0.000
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Max. Depth	5
Initial Depth	0
Ponded Area	31944
Evap. Factor	1
Infiltration	NO
Storage Curve	TABULAR
Functional Curve	
Coefficient	1000
Exponent	0
Constant	0
Tabular Curve	
Curve Name	Basin1

User-assigned name of storage unit

Outlet Out-1

Property	Value
Name	Out-1
Inlet Node	Basin-1
Outlet Node	POC-1
Description	
Tag	
Inlet Offset	0
Flap Gate	NO
Rating Curve	TABULAR/DEPTH
Functional Curve	
Coefficient	10.0
Exponent	0.5
Tabular Curve	
Curve Name	OUTLET-1

User-assigned name of outlet

Storage Curve Editor

Curve Name: Basin1

Description:

	Depth (ft)	Area (ft2)
1	0	22949
2	0.25	23431
3	1.25	25430
4	2.25	27497
5	3.25	29632
6	4.25	31944
7		
8		
9		

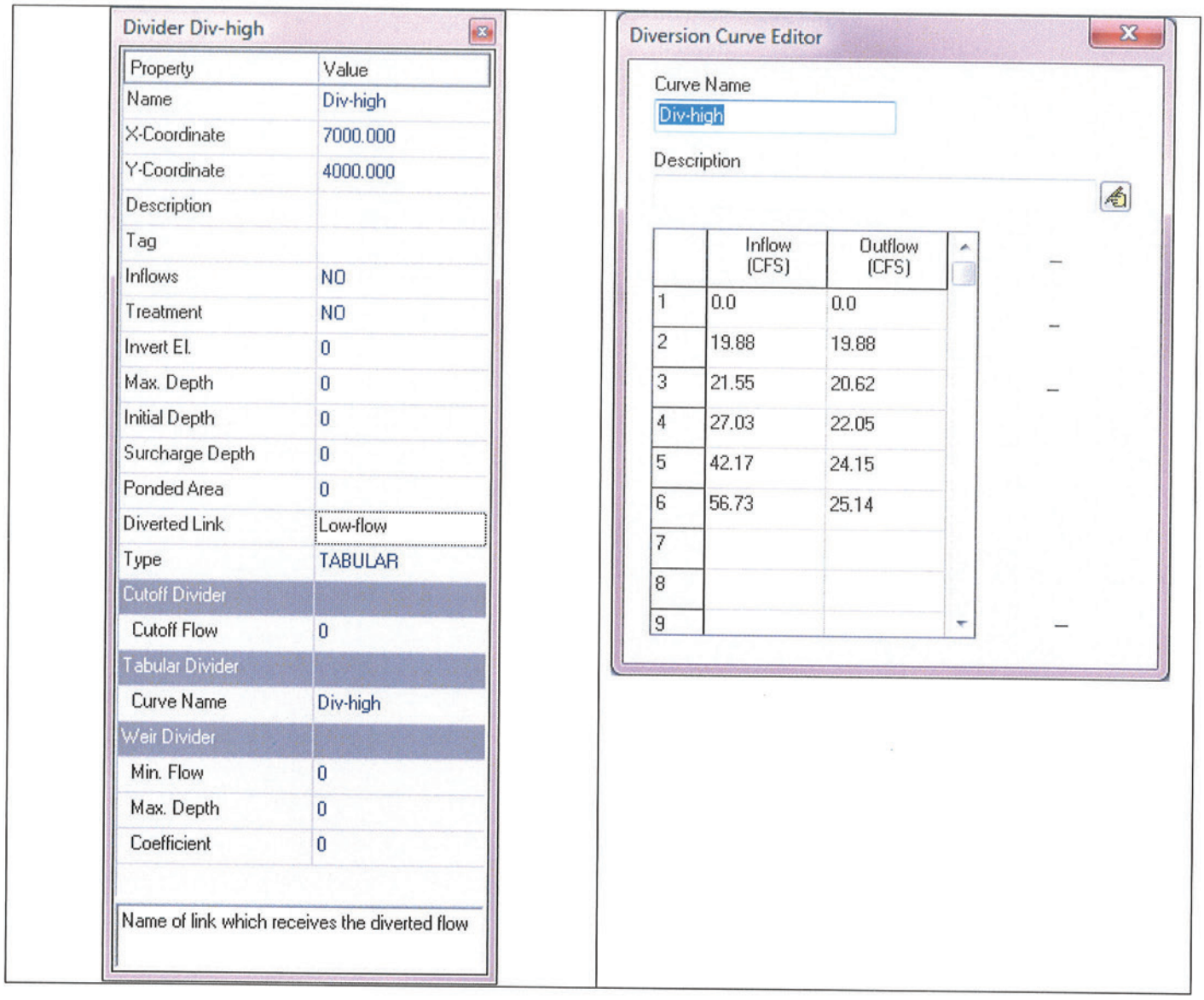
Rating Curve Editor

Curve Name: OUTLET-1

Description:

	Head (ft)	Outflow (CFS)
1	0.000	0.000
2	0.083	0.186
3	0.167	0.527
4	0.250	0.969
5	0.333	1.396
6	0.417	1.652
7	0.500	1.874
8	0.583	2.071
9	0.667	2.252

Diversion Structure



Divider Div-high

Property	Value
Name	Div-high
X-Coordinate	7000.000
Y-Coordinate	4000.000
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Max. Depth	0
Initial Depth	0
Surcharge Depth	0
Ponded Area	0
Diverted Link	Low-flow
Type	TABULAR
Cutoff Divider	
Cutoff Flow	0
Tabular Divider	
Curve Name	Div-high
Weir Divider	
Min. Flow	0
Max. Depth	0
Coefficient	0

Name of link which receives the diverted flow

Diversion Curve Editor

Curve Name: Div-high

Description

	Inflow (CFS)	Outflow (CFS)
1	0.0	0.0
2	19.88	19.88
3	21.55	20.62
4	27.03	22.05
5	42.17	24.15
6	56.73	25.14
7		
8		
9		

EXPLANATION OF SELECTED VARIABLES

Sub Catchment Areas:

Please refer to the attached diagrams that indicate the DMA and detention BMPs (BMP) sub areas modeled within the project site at both the pre and post developed conditions draining to the POC.

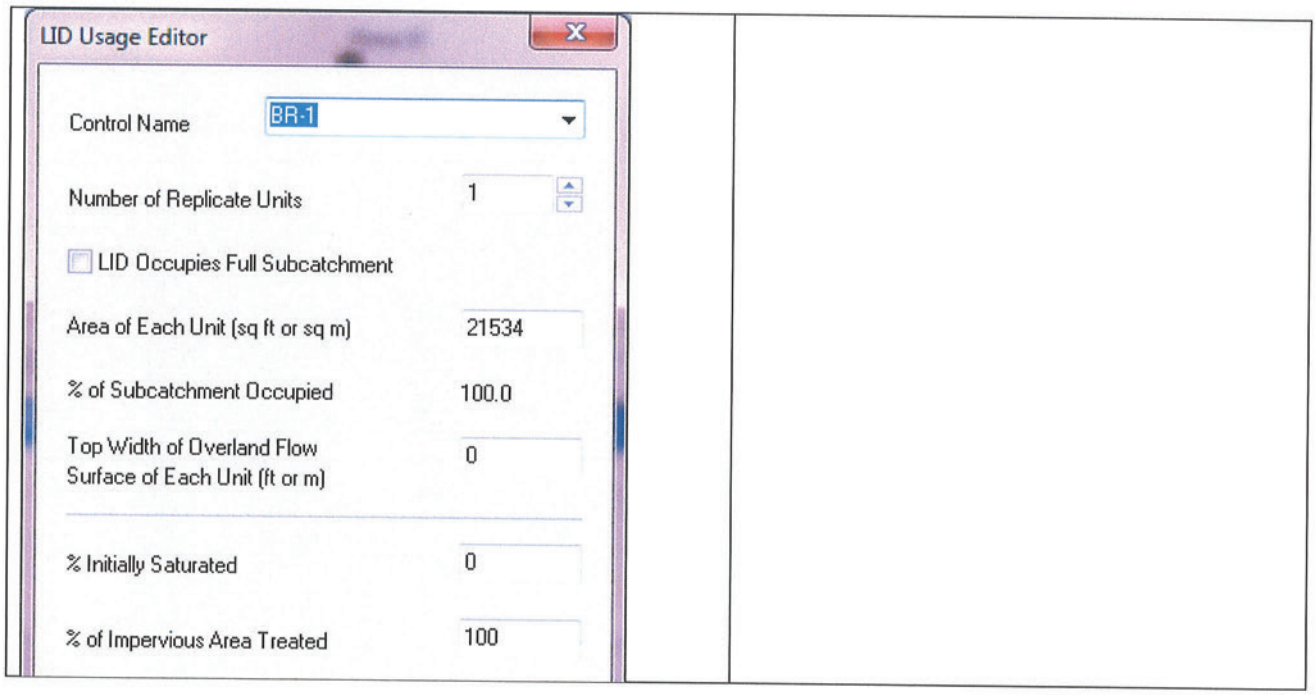
Parameters for the pre- and post-developed models include soil types A & D as determined from the NRCS websoil survey review (attached at the end of this appendix). Suction head, conductivity and initial deficit corresponds to average values expected for these soils types, according to sources consulted, professional experience, and approximate values obtained by the interim Orange County modeling approach.

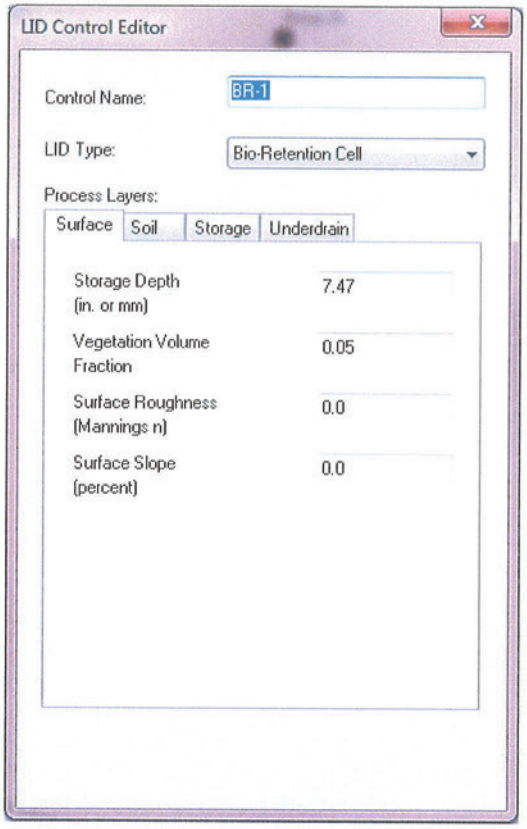
REC selected infiltration values, such that the percentage of total precipitation that becomes runoff, is realistic for the soil types and slightly smaller than measured values for Southern California watersheds.

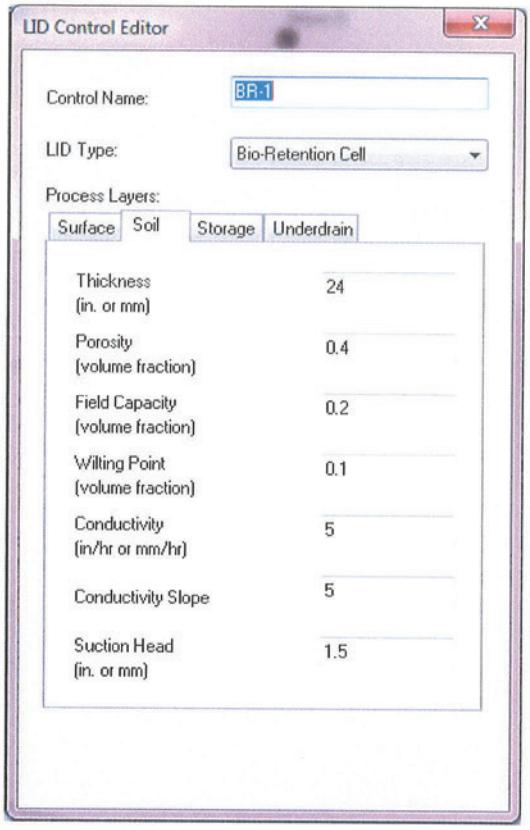
Selection of a Kinematic Approach: As the continuous model is based on hourly rainfall, and the time of concentration for the pre-development and post-development conditions is significantly smaller than 60 minutes, precise routing of the flows through the impervious surfaces, the underdrain pipe system, and the discharge pipe was considered unnecessary. The truncation error of the precipitation into hourly steps is much more significant than the precise routing in a system where the time of concentration is much smaller than 1 hour.

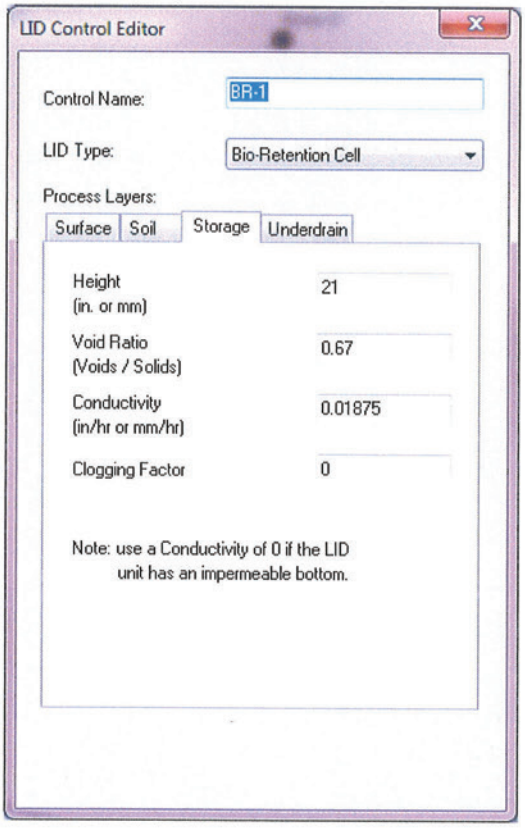
Sub-catchment BMP:

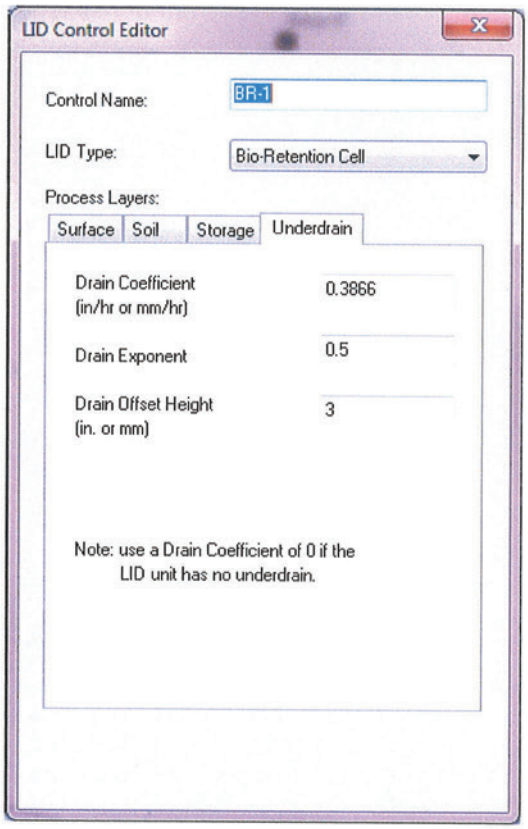
The area of biofiltration must be equal to the area of the development tributary to the biofiltration facility (area that drains into the biofiltration, equal external area plus bio-retention itself). Five (5) decimal places were given regarding the areas of the biofiltration to insure that the area used by the program for the LID subroutine corresponds exactly with this tributary.




LID Control Editor
Control Name:
BR-1
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Storage Depth
(in. or mm)
7.47
Vegetation Volume
Fraction
0.05
Surface Roughness
(Mannings n)
0.0
Surface Slope
(percent)
0.0


LID Control Editor
Control Name:
BR-1
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Thickness
(in. or mm)
24
Porosity
(volume fraction)
0.4
Field Capacity
(volume fraction)
0.2
Wilting Point
(volume fraction)
0.1
Conductivity
(in/hr or mm/hr)
5
Conductivity Slope
5
Suction Head
(in. or mm)
1.5


LID Control Editor
Control Name:
BR-1
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Height
(in. or mm)
21
Void Ratio
(Voids / Solids)
0.67
Conductivity
(in/hr or mm/hr)
0.01875
Clogging Factor
0
Note: use a Conductivity of 0 if the LID
unit has an impermeable bottom.


LID Control Editor
Control Name:
BR-1
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Drain Coefficient
(in/hr or mm/hr)
0.3866
Drain Exponent
0.5
Drain Offset Height
(in. or mm)
3
Note: use a Drain Coefficient of 0 if the
LID unit has no underdrain.

LID Control Editor: Explanation of Significant Variables

Storage Depth:

The storage depth variable within the SWMM model is representative of the storage volume provided beneath the surface riser outlet and the surface of the bio filtration facility.

In those cases where the surface storage has a variable area that is also different to the area of the gravel and amended soil, the SWMM model needs to be calibrated as the LID module will use the storage depth multiplied by the BMP area as the amount of volume stored at the surface.

Let A_{BMP} be the area of the BMP (area of amended soil and area of gravel). The proper value of the storage depth S_D to be included in the LID module can be calculated by using geometric properties of the surface volume. Let A_0 be the surface area at the bottom of the surface pond, and let A_i be the surface area at the elevation of the invert of the first row of orifices (or at the invert of the riser if not surface orifices are included). Finally, let h_i be the difference in elevation between A_0 and A_i. By volumetric definition:

$$A_{BMP} \cdot S_D = \frac{(A_0 + A_i)}{2} h_i \qquad (1)$$

Equation (1) allows the determination of S_D to be included as Storage Depth in the LID module. The 3-inches of gravel volume (3-inches x volume of voids (0.4) = 1.2-inches) is then subtracted to this volume.

Porosity: A porosity value of 0.4 has been selected for the model. The amended soil is to be highly sandy in content in order to have a saturated hydraulic conductivity of approximately 5 in/hr.

REC considers such a value to be slightly high; however, in order to comply with the HMP Permit, the value recommended by the Copermittees for the porosity of amended soil is 0.4, per Appendix A of the Final Hydromodification Management Plan by Brown & Caldwell, dated March 2011. Such porosity is equal to the porosity of the gravel per the same document.

Void Ratio: The ratio of the void volume divided by the soil volume is directly related to porosity as n/(1-n). As the underdrain layer is composed of gravel, a porosity value of 0.4 has been selected (also per Appendix A of the Final HMP document), which results in a void ratio of 0.4/(1-0.4) = 0.67 for the gravel detention layer.

Conductivity: Per the site specific geotechnical investigation for the project site, the design infiltration rate determined by SWQMP Form D-5.1 is 0.110 in/hr.

Clogging factor: A clogging factor was not used (0 indicates that there is no clogging assumed within the model). The reason for this is related to the fairness of a comparison with the SDHM model and the HMP sizing tables: a clogging factor was not considered, and instead, a conservative value of infiltration was recommended.

Drain (Flow) coefficient: The flow coefficient C in the SWMM Model is the coefficient needed to transform the orifice equation into a general power law equation of the form:

$$q = C(H - H_D)^n \quad (2)$$

where q is the peak flow in in/hr, n is the exponent (typically 0.5 for orifice equation), H_D is the elevation of the centroid of the orifice in inches (assumed equal to the invert of the orifice for small orifices and in our design equal to 0) and H is the depth of the water in inches.

The general orifice equation can be expressed as:

$$Q = \frac{\pi}{4} c_g \frac{D^2}{144} \sqrt{2g \frac{(H-H_D)}{12}} \quad (3)$$

where Q is the peak flow in cfs, D is the diameter in inches, c_g is the typical discharge coefficient for orifices (0.61-0.63 for thin walls and around 0.75-0.8 for thick walls), g is the acceleration of gravity in ft/s^2, and H and H_D are defined above and are also used in inches in Equation (3).

It is clear that:

$$q \left(\frac{in}{hr}\right) X \frac{A_{BMP}}{12\ X\ 3600} = Q\ (cfs) \quad (4)$$

Cut-Off Flow: Q (cfs) and q (in/hr) are also the cutoff flow. For numerical reasons to insure the LID is full, the model uses cut-off = 1.01 Q.

ATTACHMENT 8

Soils Maps

Hydrologic Soil Group—Western Riverside Area, California
(Paseo del Sol)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

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

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

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

Soil Survey Area: Western Riverside Area, California
Survey Area Data: Version 11, Sep 12, 2018

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

Date(s) aerial images were photographed: Feb 24, 2015—Feb 26, 2015

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Cf	Chino silt loam, drained, saline-alkali	C/D	1.5	4.6%
GpB	Grangeville sandy loam, drained, saline-alkali, 0 to 5 percent slopes	A/D	5.7	17.2%
GtA	Grangeville fine sandy loam, drained, 0 to 2 percent sl opes	A/D	10.7	32.3%
GuB	Grangeville fine sandy loam, poorly drained, saline-alk ali, 0 to 5 percent slopes	B/D	8.2	24.5%
GvB	Grangeville fine sandy loam, saline-alkali, 0 to 5 percent slopes	B/D	4.6	13.9%
GyC2	Greenfield sandy loam, 2 to 8 percent slopes, eroded	A	1.3	3.9%
HcC	Hanford coarse sandy loam, 2 to 8 percent slopes	A	0.8	2.4%
HcD2	Hanford coarse sandy loam, 8 to 15 percent slopes, eroded	A	0.1	0.2%
RuF	Rough broken land		0.4	1.1%
Totals for Area of Interest			**33.2**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

ATTACHMENT 9

Summary Files from the SWMM Model

PRE_DEV_POC-1

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.022)

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... YES
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Starting Date JUL-30-1974 00:00:00
Ending Date JUL-29-2012 23:45:00
Antecedent Dry Days 0.0
Report Time Step 00:15:00
Wet Time Step 00:15:00
Dry Time Step 01:00:00

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	1761.422	595.075
Evaporation Loss	52.967	17.894
Infiltration Loss	1116.963	377.352
Surface Runoff	618.635	208.998
Final Surface Storage	0.000	0.000
Continuity Error (%)	-1.541	

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	618.635	201.591
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	618.635	201.591
Internal Outflow	0.000	0.000
Storage Losses	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
DMA-1-A	595.08	0.00	2.07	565.37	32.46	0.81	1.62	0.055
DMA-1-D	595.08	0.00	18.32	372.35	213.69	200.77	68.25	0.359

Analysis begun on: Mon Nov 19 15:21:10 2018
Analysis ended on: Mon Nov 19 15:21:36 2018
Total elapsed time: 00:00:26

POST_DEV_POC-1

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.022)
--------------------------------------------------------------

***********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
***********************************************************

****************
Analysis Options
****************
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... YES
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... KINWAVE
Starting Date ..... JUL-30-1974 00:00:00
Ending Date ..... JUL-29-2012 23:45:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:15:00
Wet Time Step ..... 00:15:00
Dry Time Step ..... 01:00:00
Routing Time Step ..... 60.00 sec


WARNING 04: minimum elevation drop used for Conduit High-flow

WARNING 04: minimum elevation drop used for Conduit Low-flow

WARNING 04: minimum elevation drop used for Conduit Pond-1

WARNING 04: minimum elevation drop used for Conduit By-Pass-1

**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......       2284.141       766.320
Evaporation Loss .........        160.785        53.943
Infiltration Loss ........        428.393       143.724
Surface Runoff ...........       1768.220       593.231
Final Surface Storage ....          0.000         0.000
Continuity Error (%) .....         -3.207


**************************        Volume         Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......          0.000         0.000
Wet Weather Inflow .......       1767.840       576.077
Groundwater Inflow .......          0.000         0.000
RDII Inflow ..............          0.000         0.000
External Inflow ..........          0.000         0.000
External Outflow .........       1193.531       388.930
Internal Outflow .........        575.514       187.540
Storage Losses ...........          1.199         0.391
Initial Stored Volume ....          0.000         0.000
Final Stored Volume ......          0.000         0.000
Continuity Error (%) .....         -0.136


*******************************
Highest Flow Instability Indexes
*******************************
All links are stable.


************************
Routing Time Step Summary
************************
```

Minimum Time Step	:	60.00 sec
Average Time Step	:	60.00 sec
Maximum Time Step	:	60.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	1.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
A2-SoilA	595.08	0.00	40.45	197.50	373.96	9.34	1.78	0.628
A2-SoilD	595.08	0.00	46.64	121.36	445.97	186.07	30.74	0.749
Area-A1	595.07	0.00	45.84	129.26	438.13	150.14	25.24	0.736
Area-B	595.07	0.00	45.35	128.93	440.33	47.83	8.00	0.740
Area-C	595.07	0.00	34.13	221.50	355.66	20.47	4.22	0.598
Area-Aux	25299.58	0.00	5.78	0.00	25294.84	170.29	22.39	1.000
BMP-1	595.07	30803.70	691.45	966.16	30209.23	405.55	63.37	0.962

****
LID Performance Summary
****

Subcatchment	LID Control	Total Inflow in	Evap Loss in	Infil Loss in	Surface Outflow in	Drain Outflow in	Init. Storage in	Final Storage in	Pcnt. Error
BMP-1	BR-1	31398.77	691.55	966.29	14371.12	15842.11	0.00	0.00	-1.50

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days	hr:min
POC-1	OUTFALL	0.04	1.00	1.00	127	05:06
Aux	OUTFALL	0.00	0.00	0.00	0	00:00
Div-high	DIVIDER	0.00	0.00	0.00	0	00:00
Div-1	DIVIDER	0.04	1.00	1.00	127	04:39
Basin-1	STORAGE	0.01	2.95	2.95	1254	22:18

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal
POC-1	OUTFALL	0.00	57.58	1254	22:18	0.000	218.435
Aux	OUTFALL	0.00	22.39	1254	22:00	0.000	170.466
Div-high	DIVIDER	29.46	29.46	1254	22:00	170.610	170.610
Div-1	DIVIDER	63.37	63.37	1254	22:15	405.424	405.424
Basin-1	STORAGE	0.00	62.56	1254	22:15	0.000	190.576

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
Div-high	DIVIDER	333119.77	0.000	0.000
Div-1	DIVIDER	13500.97	0.000	0.000
Basin-1	STORAGE	333119.77	2.946	2.054

****
Node Flooding Summary
****

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CFS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 gal	Maximum Ponded Volume 1000 ft3
Div-1	13500.72	0.74	127 06:58	187.526	0.000

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	E&I Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
Basin-1	0.134	0	0	76.391	54	1254 22:17	57.50

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
POC-1	4.98	0.49	57.58	218.435
Aux	2.44	0.78	22.39	170.466
System	3.71	1.27	65.92	388.901

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
High-flow	DUMMY	7.07	1254 22:00			
Low-flow	DUMMY	22.39	1254 22:00			
Pond-1	DUMMY	62.56	1254 22:15			
By-Pass-1	CONDUIT	0.08	5274 15:01	0.25	1.08	1.00
Out-1	DUMMY	57.50	1254 22:18			

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited

POST_DEV_POC-1

High-flow	0.01	0.01	0.01	333119.77	0.01
Low-flow	0.01	0.01	0.01	333119.77	0.01
Pond-1	0.01	0.01	0.01	333119.77	0.01
By-Pass-1	13150.07	13489.92	13465.00	148.77	13489.92

Analysis begun on: Mon Nov 19 15:51:17 2018
Analysis ended on: Mon Nov 19 15:53:00 2018
Total elapsed time: 00:01:43

ATTACHMENT 3

Structural BMP Maintenance Information

Indicate which Items are Included behind this cover sheet:

Maintenance Responsibility has been assigned to:

- X Property Owner
- ☐ Special District
- ☐ City of Temecula

☐ Attachment 3 is not required because the project does not propose structural BMPs

☐ Not applicable at this time – Discretionary Project

Attachment Sequence	Contents	Checklist
Attachment 3	Standard Structural BMP Water Quality Management Plan Operation and Maintenance Agreement (BMP Design Manual Appendix A.3)	X Included ☐ Signed, Notarized, and Recorded* ☐ City Maintained – Do Not Record, must be reviewed & accepted by City Maintenance Dept.
Exhibit A	Legal Description	X Included
Exhibit B	Individual Structural BMP DMA Mapbook (WQMP Exhibits)	X Included X Place each map on 8.5"x11" paper X BMP Site layout – Clearly depict location of each BMP ☐ Legible construction details of each BMP.
Exhibit C	Structural BMP Maintenance Plan (Required)	☒ Included See Structural BMP Maintenance Information Checklist on the back of this Attachment cover sheet.
Exhibit D	Structural BMP Design Fact Sheets (Appendix E)	X Included

Note* Do not notarize & record until City staff has reviewed and approved the final Water Quality Management Plan Operation and Maintenance Agreement.

Preparation Date:_____

Template Date: February 22nd, 2019

Use this checklist to ensure the required information has been included in the Structural BMP Maintenance Plan Exhibit:

Attachment 3 Exhibit C must identify:

- X Purpose of the Operation and Maintenance Manual
- X General description and function of all Structural BMPs implemented
- X Inspection & Maintenance Documentation. Refer to Chapter 7.4
- X Inspection, Maintenance, & Reporting Frequency: Refer to Chapter 7.5
- ☐ Measures to Control Maintenance Costs. Refer to Chapter 7.6
- X Maintenance indicators and actions for structural BMP(s). Refer to Chapter 7.7
- X Structural BMP Life Cycle Cost Analysis including Inspection, Maintenance, documentation, reporting, and replacement.

RECORDING REQUESTED BY:

_____

(Property Owner's Name)

AND WHEN RECORDED MAIL TO:

_____

(Property Owner's Mailing Address)

_____

SPACE ABOVE THIS LINE FOR RECORDER'S USE

RECORDING OF A

WATER QUALITY MANAGEMENT PLAN

OPERATION AND MAINTENANCE AGREEMENT

FOR

_____

(Name of Project)

_____

(Address or Tract Map/Lot No.)

_____

Water Quality Management Plan
Operation and Maintenance Agreement

Property Owner Name: _____

Property Owner Mailing Address: _____

_____

Project Address or Location: _____

_____

Project's Assessor Parcel Number: _____

This Operation and Maintenance Agreement (Agreement) is made in The City of Temecula (City), a municipal agency, located in the County of Riverside, State of California, by (insert property owner) _____ (Owner), this (insert day) _____ of (insert month and year) _____;

WHEREAS, the Owner owns real property (Property) as described in Exhibit "A" and depicted in Exhibit "B", each of which exhibit is attached hereto and incorporated by reference, and has proposed that the Property be developed in accordance with governmental approvals issued by the City and other agencies having jurisdiction over the Property;

WHEREAS, at the time of initial approval of the development project (Project) known as (insert name of project) _____ within the Property, the City required the Project to generate a Water Quality Management Plan (WQMP). The WQMP describes how the Project proposes to remove pollutants and minimize any adverse impacts from the discharge of storm water and non-storm water runoff generated as a result of the Project, and includes structural and non-structural treatment devices, also known as "Best Management Practices" (BMPs), that will be constructed, or installed, or implemented for this purpose. The precise location(s) of these BMPs are depicted in the WQMP, on file with the City;

WHEREAS, the Owner signed and certified the WQMP and accepted the requirement to routinely inspect, clean, maintain, repair, reconstruct, and replace the BMPs associated with the Project in order to retain their original intent and effectiveness;

WHEREAS, this Agreement is transferable onto subsequent owners, heirs, executors, administrators, representatives, and assigns (collectively "Successors") of this Property, Project, and all associated BMPs;

WHEREAS, the Owner and Successors are aware that such operation and maintenance requirements are in accordance with, and enforceable under, the City's Municipal Code and State and Federal environmental laws regulating the discharge of pollutants in storm water and non-stormwater runoff, and may also require compliance with Local, State, and Federal laws and regulations pertaining to confined space entry and waste disposal methods in effect at the time such maintenance occurs;

NOW THEREFORE, the Owner and Successors shall be subject to the following conditions:

1. This Agreement shall be recorded in the Office of the Recorder of Riverside County, California, at the expense of the Owner and shall constitute notice to the Owner and all Successors of the title to said Property of the obligations required by this Agreement. This Agreement shall also be accompanied by a copy of an 'Operation and Maintenance Manual', included in Exhibit "C", providing detailed instructions on how and when each treatment BMP proposed for construction, or installation, or implementation must be inspected, cleaned, maintained, repaired, reconstructed, and replaced, if necessary, (collectively "Maintained") in order to retain their original intent and effectiveness.

2. Owner shall, at their sole cost, expense, and liability, routinely maintain all BMPs in a manner assuring peak performance at all times without request or demand from the City or other agency. All reasonable precautions shall be exercised in the removal of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time of the recording of this Agreement. As may be requested from time to time by the City, the Owner shall provide the City with documentation identifying the inspections, maintenance activities, material(s) and quantity(ies) removed, and disposal destinations.

3. Owner hereby provides the City complete access at any time and of any duration during business hours to the BMPs, their immediate vicinity, and all legally accessible areas draining to them upon reasonable notice, or in case of emergency as determined by the City without advance notice, for the purpose of inspecting the BMPs and/or sampling runoff into and/or from the BMPs. The City shall make every effort to minimize interference with the Owner's use of the Property during these inspections and sampling activities.

4. In the event the Owner fails to accomplish the necessary operation and maintenance obligations required by this Agreement, the Owner hereby authorizes the City to perform any maintenance necessary to restore the BMPs to their original intent and effectiveness. Owner shall reimburse all expenses associated with the City's maintenance activities to the City, including administrative costs, attorney fees, and interest thereon at the maximum rate authorized by the Civil Code. The City may also opt to use the proceeds from any securities posted for the project, or place a lien on the Property in such amount as will fully reimburse the City, to pay for such maintenance in order to guarantee the continued performance of the BMPs.

5. Owner shall notify any successor to title of all or part of the Property about the existence of this Agreement and provide such notice and a copy of this Agreement prior to such Successor obtaining an interest in all or part of the Property.

IN WITNESS THEREOF, the Owner hereto affixes their signature as of the date first written above.

OWNER 1:	**OWNER 2 (If more than one owner):**
_____	_____
Name	Name
_____	_____
Signature	Signature
_____	_____
Title	Title

A notary acknowledgement is required for recordation (attach appropriate acknowledgement).

EXHIBIT A
(Legal Description of Property)

EXHIBIT B
(WQMP Exhibits)

Exhibits shall include: a) a BMP site layout that clearly depicts the location of each BMP, and b) legible construction details of each BMP. Ensure all exhibits are 8.5"X11". Do not include color exhibits.

EXHIBIT C
(Operation and Maintenance Manual)

Please refer to the attached example.
It shows the necessary requirements for the O&M Manual.

EXHIBIT C

Operations and Maintenance Manual

I. Inspection and Maintenance Log

Inspection and maintenance of stormwater facilities must be conducted periodically to ensure that facilities are functioning as designed. The inspection will determine the appropriate maintenance that is required for the facility.

All stormwater management facilities are required to be inspected by a qualified individual at a minimum of once per year. Detailed inspection activities are included in Section VII of this document. Inspection forms for each facility have been included in Appendix A of this document.

Stormwater facilities must be property maintained in order to ensure that they operate correctly and provide the water quality treatment for which they were designed for. Routine maintenance performed on a frequently scheduled basis, can help avoid more costly rehabilitation maintenance that results when facilities are not adequately maintained. Maintenance personnel must be qualified to properly maintain stormwater management facilities. Inadequately trained personnel can cause additional problems resulting in additional maintenance costs. Maintenance activities for each facility are included in Section VII of this document, and maintenance forms for each facility have been included in Appendix B of this document.

II. Updates, Revisions, and Errata

Updates, revisions and corrections to this Operations and Maintenance Plan shall be documented in Appendix C. These updates, revisions or corrections shall reference the specific portion of the Operations and Maintenance Plan for which it is revising. Additionally, major updates to this Operation and Maintenance Plan may require re-recording of the Water Quality Management Plan. Updates and Revisions shall be transmitted to the City of Temecula to determine whether the approved Water Quality Management Plan will require revising and re-recording.

III. Introduction

Planning Area 4 is a proposed medium-high density residential development that will construct a biofiltration basin, two Filterra units (or equivalent) and subsurface storm drain. The project site will treat flows prior to discharging into the existing Line "S" Storm Drain system.

IV. Responsibility for Maintenance

A. General

The party responsible for the maintenance for the biofiltration basin and filterra units will be the HOA. A copy of the executed BMP Agreement will be included during final engineering in Appendix D.

Funding for the ongoing maintenance of the BMPs shall be provided by the HOA.

B. Staff Training Programs

Staff training programs shall be coordinated by the HOA.

C. Records

Records of funding and staff training shall be maintained by the HOA.

D. Safety

Safety shall be at the forefront of staff training and inspection procedures at all times. Likely hazards should be anticipated and avoided. Never enter a confined space (outlet structure, manhole, etc) without proper training or equipment. A confined space should never be entered without at least one additional person present.

If a toxic or flammable substance is discovered, leave the immediate area and contact the local Police at 911.

Potentially dangerous (e.g., fuel, chemicals, hazardous materials) substances found in the area must be referred to the local Police Department immediately for response by the Hazardous Material Unit. The emergency contact number is 911.

Vertical drops may be encountered in areas located within and around the facility. Avoid walking on top of retaining walls or other structures that have a significant vertical drop. If a vertical drop is identified within the pond that is greater than 48" in height, make the appropriate note/comment on the maintenance inspection form.

If any hazard is found within the facility area that poses an immediate threat to public safety, contact the local Police Department immediately.

V. Summary of Drainage Management Areas and Stormwater BMPs

A. Drainage Areas

The tributary drainage areas to the biofiltration basin and subsurface basin/modular wetland are shown on the Structural BMP DMA Mapbook, included in Attachment 3c of the WQMP.

B. Structural Post-Construction BMPs

The project site incorporates a biofiltration basin, a subsurface basin, and a modular wetlands to treat the required water quality volume and address Low-Impact Development. The location of these facilities is included on the WQMP DMA Exhibit.

C. Self-Retaining Areas or Other

The project site includes one self-retaining DMAs (DMAs D, E, and F) as well as self-mitigating DMA G.

VI. Stormwater BMP Design Documentation

A. Construction Drawings

Improvement Plans for the project site will be included in Attachment 5 of the WQMP during final engineering.

B. Manufacturer's Data, Manuals, and Maintenance Requirements

Manufacturer's data will be provided during BMP implementation, if required.

C. Specific Operation and Maintenance Concerns and Troubleshooting

Specific Operation and Maintenance Concerns are described in Section VII.

VII. Inspection and Maintenance Schedule

A. Inspection Activities for Each Facility

i. Biofiltration Basin

Biofiltration Basins have a number of features that are designed to serve a particular function. Many times the proper function of one feature depends on another. It is important for maintenance personnel to understand the function of each of these features to prevent damage to any feature during maintenance operations. Below is a list and description of the most common features within a Biofiltration Basin and the corresponding maintenance inspection items that can be anticipated:

- Inflow points – the Biofiltration Basins will have inflow points that may incorporate riprap to protect the slopes, or other impervious material to prevent erosion. Inspect inflow points for evidence of erosion or damage.
- Soil media – The soil media is the main pollutant removal component of the Biofiltration basin. The soil media consists of 18 to 36 inches of soil media, which removes pollutants through several different processes. Inspect soil media for weeds or other unwanted vegetation, accumulated sediment, and infiltration rates. Infiltration testing must be performed on the soil media during annual inspections to ensure proper filtration of the water through the soil media. The Biofiltration Basins need to drain completely within 72 hours.
- Underdrain System – The underdrain system should require minimal maintenance should the filter media be properly maintained. However, inspect underdrain system (where feasible) for clogging.
- Outlet Structures – The basin outlet structures allow for flows in excess of the water quality volume to exit. Additionally, this structure mitigates flows associated with the 2-year, 24-hour storm duration for increased runoff to

meet the hydromodification requirements. Inspect the structure to ensure they are not clogged or blocked by debris or trash. Inspect the overflow opening within the structure to ensure that there are no obstructions. Inspect structure for any damage.

- Embankments – Inspect basin embankments for any locations of sparse vegetation, erosion, trash/debris, or unwanted vegetative growth.
- Graffiti/Vandalism – Inspect for Graffiti or Vandalism.
- Public Hazards – Inspect Biofiltration Basins for any additional public hazards, such as vertical drops greater than 4 feet, containers with unknown/suspicious substances, and exposed metal or jagged edges.

ii. Subsurface System

The plastic chamber design of the subsurface system will allow for storage of runoff. Additionally, the surrounding gravel will provide additional storage volume. The subsurface system consists of perforated 96" diameter pipes, called barrels. These systems provide solutions for infiltration, retention and detention on project sites with limited space available for typical surface and landscaped systems. Below is a list and description of the most common features within a subsurface system and the corresponding maintenance inspection items that can be anticipated:

- Inflow points – the landscaped areas along the northerly portion of the project site and adjacent to the northerly side of the warehouse will incorporate inlets that will connect to the subsurface system. Inspect for clogging or blocked inlets.
- Barrels – the barrels store the water, including the surrounding gravel. Inspect for clogging.
- Outlet – The subsurface outlet structure will incorporate a pump. Inspect the outlet for clogging, and ensure functionality of the pump system.
- Mosquito abatement – prevention of mosquitos within any of the standing water of the subsurface system.

iii. Modular Wetlands

The modular Subsurface Flow Wetland Systems (MSFWS) are used for filtration of stormwater runoff including dry weather flows. The MSFWS is a pre-engineered biofiltration system composed of a pretreatment chamber containing filtration cartridges, a horizontal flow biofiltration chamber with a peripheral void area and a centralized and vertically extending underdrain, the biofiltration chamber containing a sorptive media mix which does not contain any organic material and a layer of plant establishment media, and a discharge chamber containing an orifice control structure. Treated water flows horizontally in series through the pretreatment chamber cartridges, biofiltration chamber and orifice control structure.

Below is a list and description of the most common features within modular wetlands:

- Pretreatment Chamber Components – The pretreatment chamber includes filter cartridges and a downdrain system.
- Biofilter Chamber Components – The biofilter chamber includes media, planting and plant support media.
- Discharge Chamber – The discharge chamber includes a flow control orifice plate that restricts flows greater than the designed treatment flow rate.

B. Maintenance Schedule for Each Facility

- **Biofiltration Basins** – the following maintenance activities should be performed for the Biofiltration Basins at the frequency indicated to ensure proper function of the Biofiltration basin.
  a. Routine Maintenance
     - Mowing – Routine mowing of the turf grass embankments is necessary to improve the overall appearance of the Biofiltration basin and ensure proper performance. Turf grass should be mowed to a height of 2 to 4 inches and shall be bagged to prevent potential contamination of the soil media. Mowing shall occur at a minimum of twice annually depending on aesthetics.
     - Trash / Debris Removal – Trash and debris must be removed from the entire Biofiltration basin area to minimize outlet clogging and to improve aesthetics. This must be performed before mowing operations at a minimum of twice annually.
     - Woody Growth Control / Weed Removal – Noxious weeds and other unwanted vegetation must be treated as needed throughout the Biofiltration Basins. Weeding should be limited to invasive and exotic species, which can overwhelm the desired plant community. However, native non-invasive volunteer species are often desirable, as they add to the diversity of the plant community. Weeding should occur once a week during the summer and at least once a month during the remainder of the growing season. Non-chemical methods (hand pulling and hoeing) are preferable. Chemical herbicides should be avoided.
  b. Minor Maintenance
     - Sediment / Pollutant Removal – Sediment removal is necessary to ensure proper function of the soil media. If drain times for the Biofiltration basin exceed the 72 hour maximum drain time, then maintenance of the soil media shall be required. At a minimum, the top 3-inches of soil media should be removed at each removal period. Additional amounts of soil media may need to be removed if deeper sections of the soil media are contaminated. New soil media will need to be placed back into the Biofiltration basin when the total amount of media removed reaches 9-

inches. This maintenance activity should be performed "as needed", which is typically every 1 – 2 years.

- Erosion Repair – The repair of eroded areas is necessary to ensure the proper functioning of the Biofiltration basin, to minimize sediment transport, and to reduce potential impacts to other features. Erosion can vary in magnitude from minor reparis to soil media and embankments, to rills, and gullies in the embankments and inflow points. The repair of eroded areas may require the use of excavators, earthmoving equipment, riprap, concrete and sod. Extreme care should be taken when utilizing motorized or heavy equipment to ensure damage to the underdrain system does not occur. This maintenance activity should occur "as needed", as determined by the inspections.
- Jet-Vac/Clearing Drains – The underdrain systems in the Biofiltration basin can develop blockages that can result in a decrease of hydraulic capacity and also create standing water. Many times the blockage to this infrastructure can be difficult to access and /or clean. Specialized equipment (jet-vac machines) may be necessary to clear debris from these difficult areas. This maintenance activity should be performed "as needed" as determined by the inspections.

c. Major Maintenance Activities

- Major Sediment / Pollutant Removal – Major sediment/pollutant removal consists of removal of large quantities of sediment/soil media. Extreme care should be taken when utilizing motorized or heavy equipment to ensure damage to the underdrain system does not occur. The sediment/soil media needs to be carefully removed, transported and properly disposed. Vegetated areas need special care to ensure design volumes and grades are preserved or may need to be replaced due to the removal activities. Stormwater sediments removed from the Biofiltration basin do not meet the regulatory definition of "hazardous waste". However, these sediments can be contaminated with a wide array of organic and inorganic pollutants and handling must be done with care to insure proper removal and disposal. Sediments should be transported by motor vehicle only after they are dewatered. All sediments must be taken to a licensed landfill for proper disposal. Should a spill occur during transportation, prompt cleanup and disposal is imperative. This maintenance activity shall be performed "as needed" based upon inspections.
- Major Erosion Repair – Major erosion repair consists of filling and revegetating areas of severe erosion. Determining the cause of the erosion as well as correcting the condition that caused the erosion should also be part of the erosion repair. Care should be given to ensure design grades and volumes are preserved. Extreme care should be taken when utilizing motorized or heavy equipment to ensure damage to the underdrain system

does not occur. This maintenance activity should be performed "as needed" as determined by inspections.

- Structural Repair – The Biofiltration Basins include inlets for large storm flows and emergencies. These structures are constructed of steel and concrete that can degrade or be damaged and may need to be repaired or re-constructed from time to time. Major repairs to structures may require input from a structural engineer and specialized contractors. Consultation with the County of Riverside Staff shall take place prior to all structural repairs. These maintenance activity should be performed "as needed" as determined by inspections.
- Biofiltration Basin Rebuild – In very rare cases, the Biofiltration basin may need to be rebuilt. Generally, the need for a complete rebuild is a result of improper construction, improper maintenance resulting in structural damage to the underdrain system, or extensive contamination of the Biofiltration basin. Consultation with the County of Riverside Engineering Staff shall take place prior to any rebuild project. These maintenance activity should be performed "as needed" as determined by inspections.

- **Subsurface System** – Underground stormwater retention/detention systems should be inspected at regular intervals and maintained when necessary to ensure optimum performance. If accumulated silt is interfering with the operation of the system (i.e. blocking outlet pipes or deposits significantly reduce the storage capacity of the system) it should be removed.

  It is easiest to maintain a system when there is no flow entering. For this reason, cleanout should be scheduled during dry weather.

  A vacuum truck or other similar devices can be used to remove sediment. Starting upstream, maintain manholes. Once maintenance is complete, replace all caps, lids and covers. It is important to document maintenance events on the Inspection and Maintenance Log.

  If maintenance is required on the Header System (area adjacent to inflows), use a high pressure nozzle with rear facing jets to wash the sediments and debris into the diversion manhole. Use the vacuum hose stinger nozzle to remove the washed sediments from the sump of the diversion manhole. It is important not to flush sediments into the chamber system during the maintenance process. See PGP plans for details.

  If maintenance is required on the Containment Row (rows of 96" pipe of the subsurface system), a JetVac truck utilizing a high pressure nozzle (sledge dredging tool) with rear facing jets will be required. Insert the nozzle from the diversion manhole into the Containment Row through the inlet pipe. Turn the water feed hose

on and feed the supply hose until the nozzle has reached the end of the Containment Row. Withdraw the nozzle slowly. The tool will back flush the Containment Row forcing debris into the diversion manhole sump. Use the stringer vacuum hose to remove the sediments and debris from the sump of the diversion manhole. Multiple passes may be required to fully cleanout the Containment Row. Vacuum out the diversion manhole and remove all debris that may be clogging the drain down orifice.

Larvicides shall be utilized in order to prevent mosquitos within any of the standing water in the subsurface system. Three types of larvicides that can be utilized are biorationals, growth regulators, and surface films.

NOTE: DEPENDING ON THE MANUFACTURER DETERMINED DURING CONSTRUCTION, ADDITIONAL MAINTENANCE ACTIVITIES MAY BE REQUIRED. CONSULT THE MANUFACTURER FOR ADDITIONAL REQUIREMENTS.

- **Modular Wetlands**

The following maintenance activities should be performed for the modular wetlands at the frequency indicated to ensure proper functioning of the units:

a. Remove trash from screening device – average maintenance is monthly.
b. Remove sediment from separation chamber – average maintenance is before and after rainy season (twice a year).
c. Replace cartridge filter media – average maintenance is before and after rainy season (twice a year).
d. Replace drain down filter media – average maintenance is before and after rainy season (twice a year).
e. Trim vegetation – average maintenance is twice a year (every 6 months).

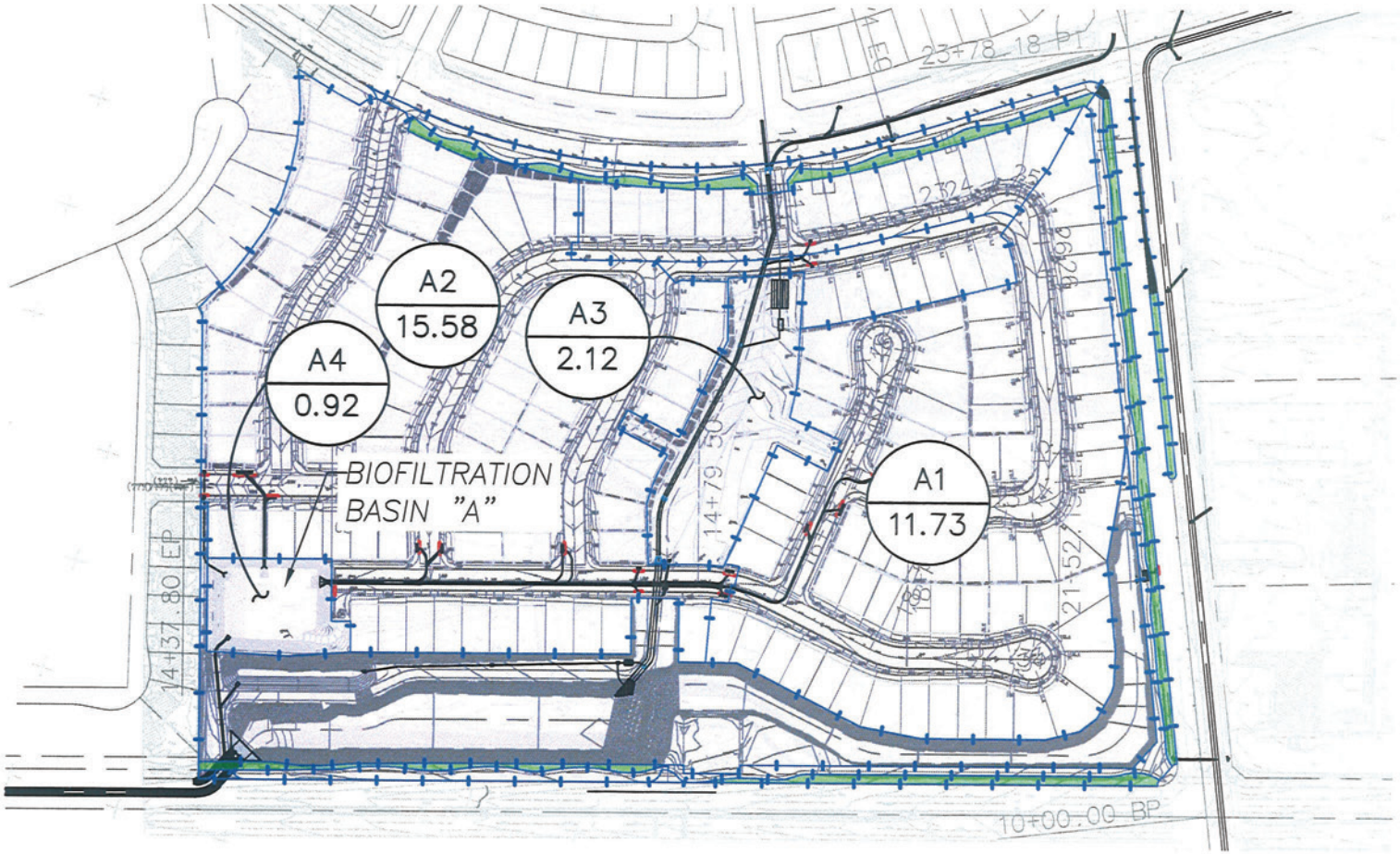
BMP Costs

BMP	BMP Type	Cost
A	Biofiltration Basin	$240,000
B	Filterra Unit	$15,000
C	Filterra Unit	$15,000

TTM36483 - PA 4

IN THE CITY OF TEMECULA, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

DMA MAP BOOK - DMA A



SELF-MITIGATING AREAS

JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

ATTACHMENT 3C

TTM 36483 - PA 4

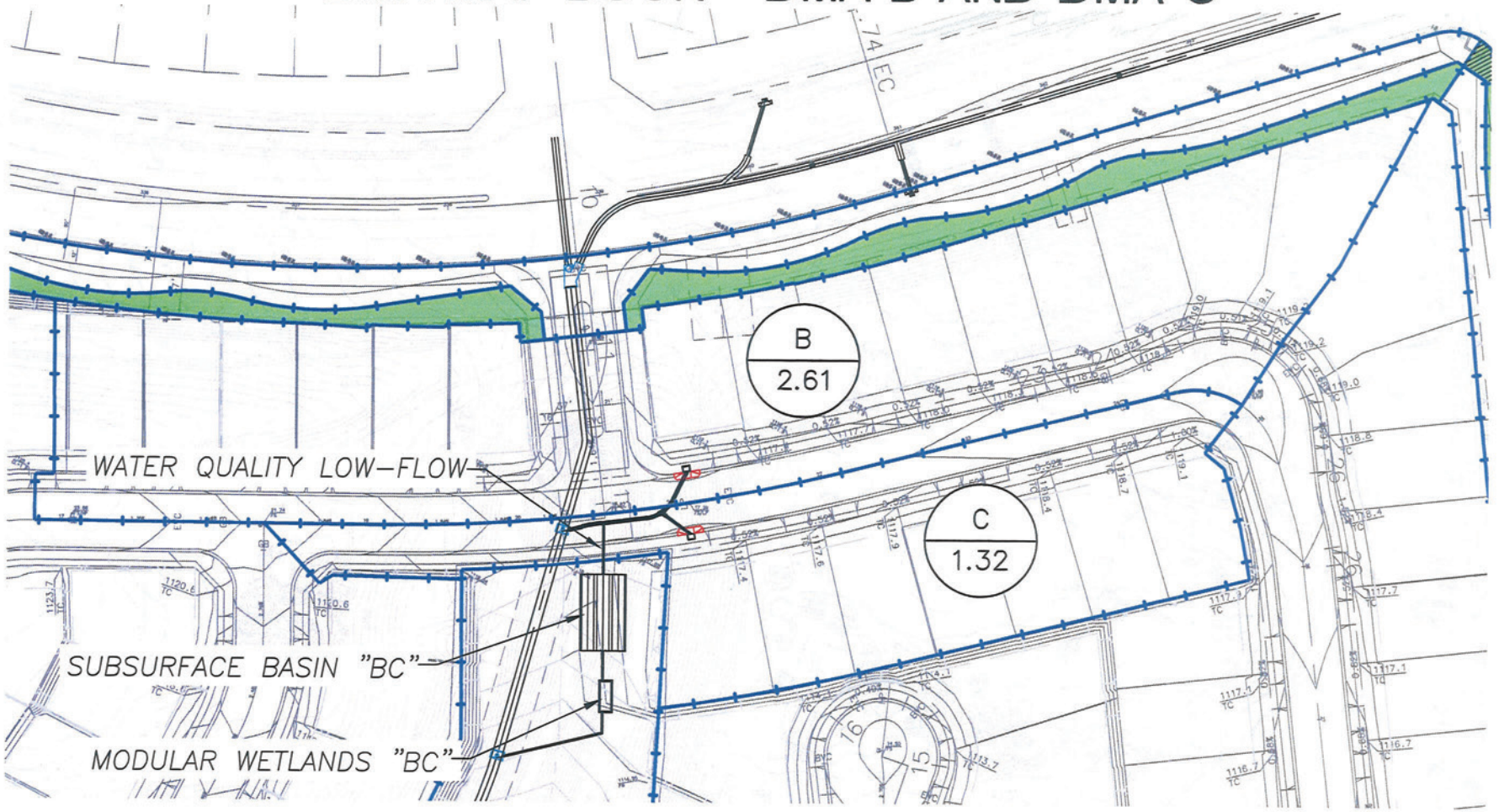
DMA MAP BOOK
DMA A

Drawing Name: D:\108.30.13\Engineering\WQMP\Attachment 3\DMA MAP BOOK.dwg
Last Opened: Jun 06, 2019 - 2:59pm by jcarver

TTM36483 - PA 4

IN THE CITY OF TEMECULA, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

DMA MAP BOOK - DMA B AND DMA C



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MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

ATTACHMENT 3C

TTM 36483 - PA 4

DMA MAP BOOK
DMA B AND DMA C

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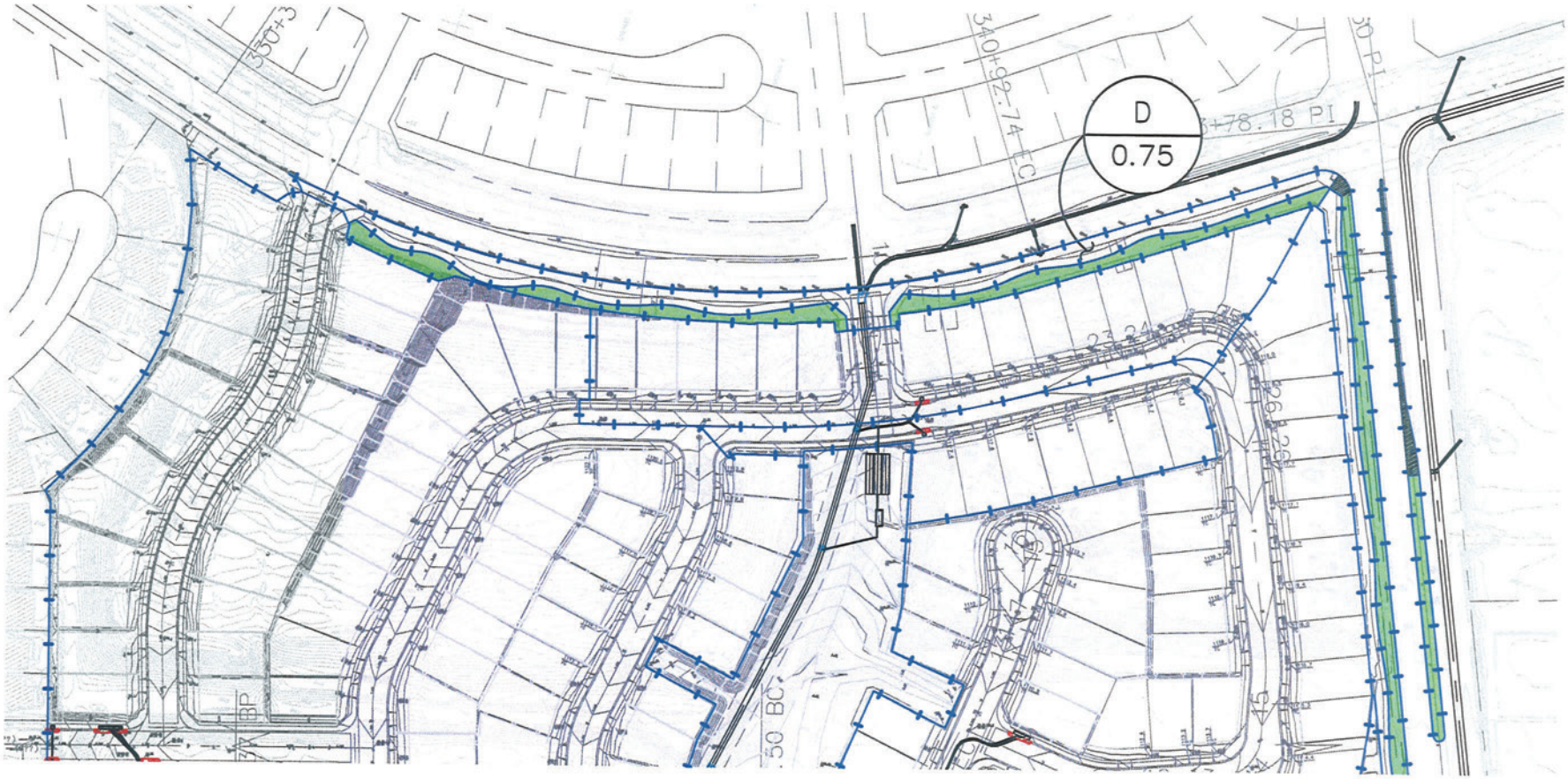
Last Opened: Jun 06, 2019 - 3:00pm by jcarver

TTM36483 - PA 4

IN THE CITY OF TEMECULA, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

DMA MAP BOOK - DMA D



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41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

ATTACHMENT 3C

TTM 36483 - PA 4

DMA MAP BOOK
DMA D

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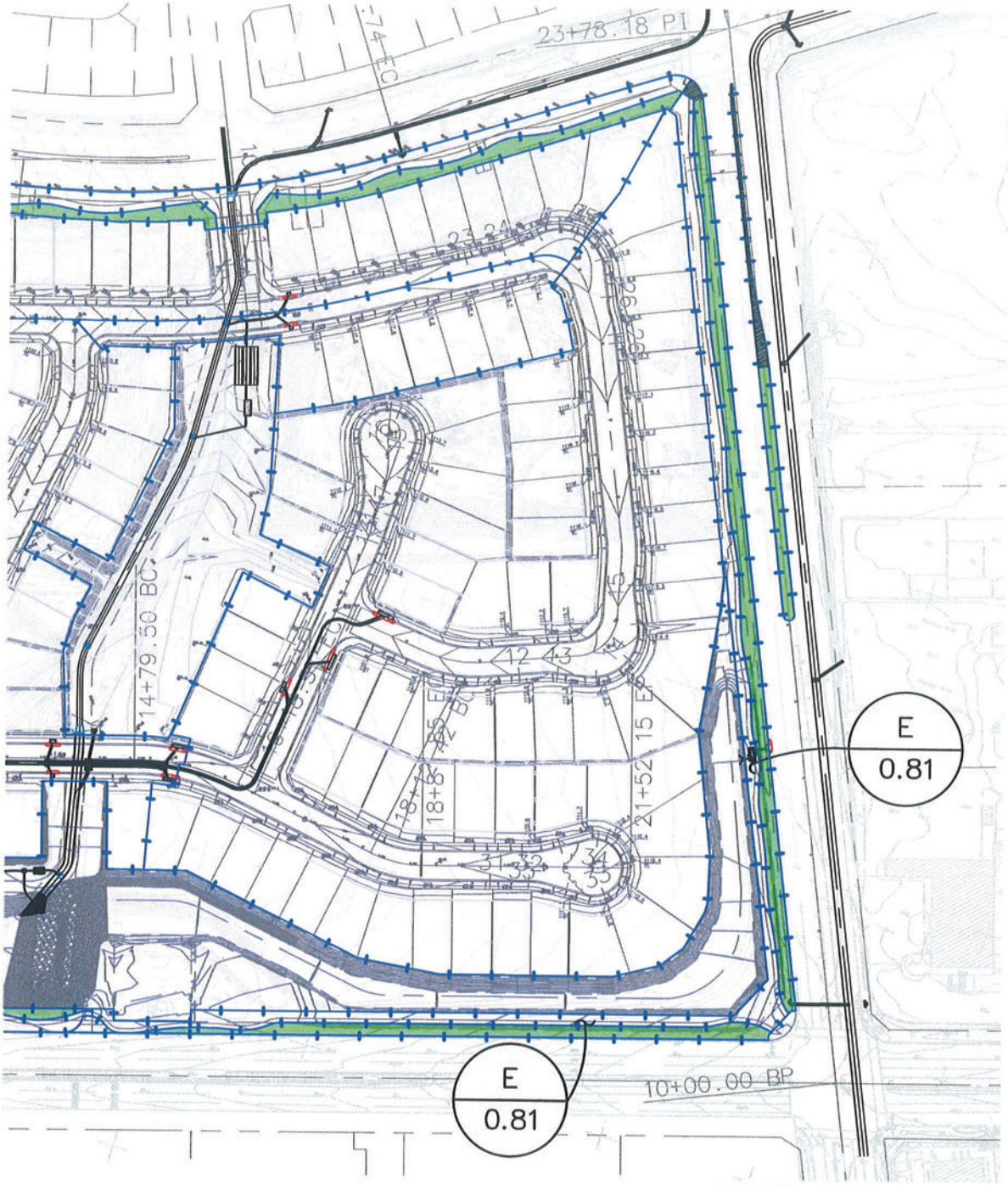
TTM36483 - PA 4

IN THE CITY OF TEMECULA, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

DMA MAP BOOK - DMA E



SELF-MITIGATING AREAS

JLC Engineering & Consulting, Inc.
36263 CALLE DE LOBO
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

ATTACHMENT 3C

TTM 36483 - PA 4

DMA MAP BOOK
DMA E

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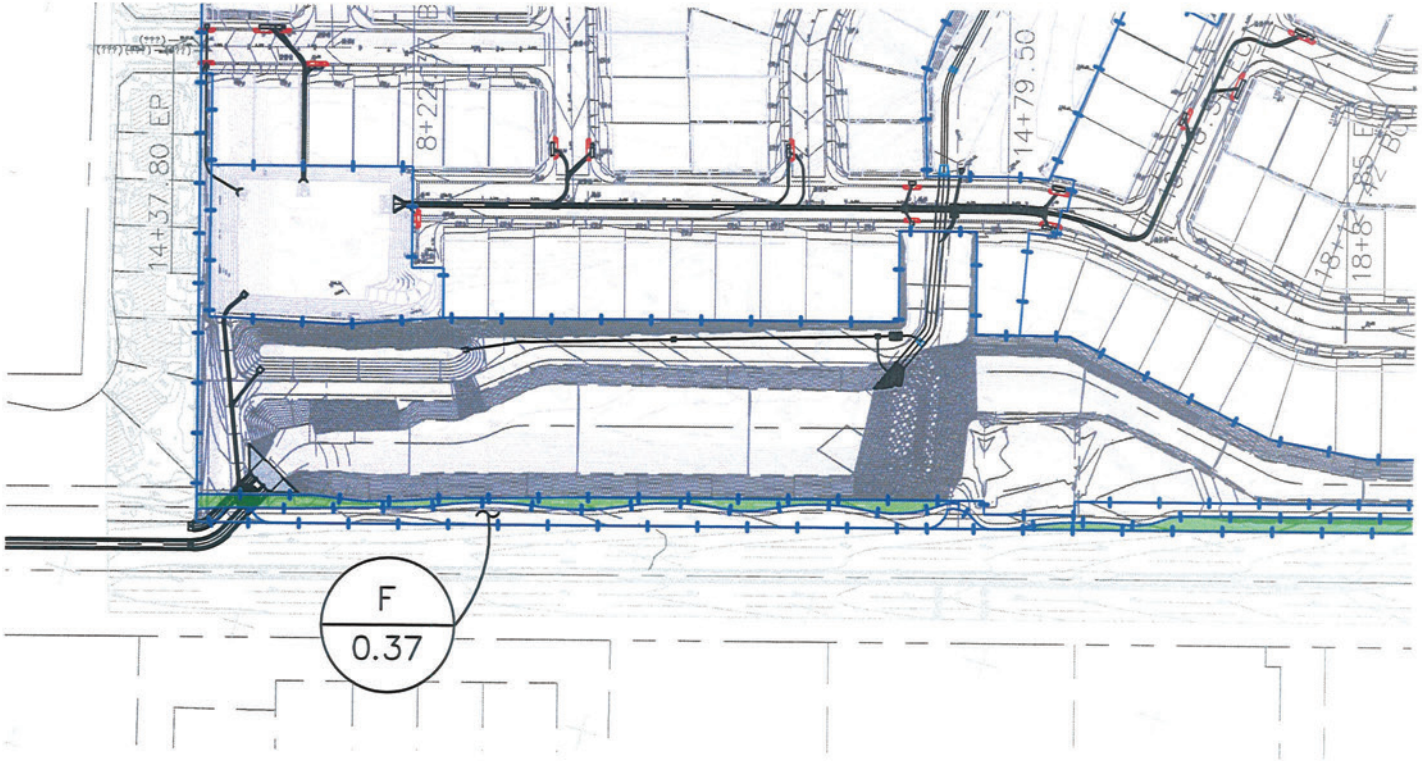
Last Opened: Jun 06, 2019 - 3:00pm by joarver

TTM36483 - PA 4

IN THE CITY OF TEMECULA, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

DMA MAP BOOK - DMA F



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41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

ATTACHMENT 3C

TTM 36483 - PA 4

DMA MAP BOOK
DMA F

Drawing Name: G:\108.30.13\Engineering\WQMP\Attachment 3\DMA MAP BOOK.dwg
Last Opened: Jun 06, 2019 - 3:01pm by jserver

ATTACHMENT 4

City of Temecula PDP Structural BMP Verification for Permitted Land Development Projects

☐ Not applicable at this time – Discretionary Project

☐ Attachment 4 is not required because the project does not propose structural BMPs

Preparation Date:_____

Template Date: February 22nd, 2019

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City of Temecula Structural BMP Verification Form	
Project Summary Information	
Project Name	Planning Area 4 of Specific Plan #219
Record ID (e.g., grading/improvement plan number)	Tentative Tract Map 36483
Project Address	North west corner of Temecula Parkway and Butterfield Stage Road, Temecula, CA
Assessor's Parcel Number(s) (APN(s))	959-400-001, 959-400-002
Project Watershed (Complete Hydrologic Unit, Area, and Subarea Name with Numeric Identifier)	Santa Margarita Watershed (HA 902.00), Temecula Creek Sub-watershed (HAS 902.51 and 902.52)
Responsible Party for Construction Phase	
Developer's Name	Cal-Paseo Del Sol, LLC
Address	4790 Eastgate Mall, Suite 150 San Diego, CA 92121
Email Address	
Phone Number	858-674-1300
Engineer of Work	Joseph L. Castaneda
Engineer's Phone Number	951-304-9552
Responsible Party for Ongoing Maintenance	
Owner's Name(s)*	Paseo del Sol HOA
Address	TBD
Email Address	TBD
Phone Number	TBD
*Note: If a corporation or LLC, provide information for principal partner or Agent for Service of Process. If an HOA, provide information for the Board or property manager at time of project closeout.	

Preparation Date:_____ Template Date: February 22nd, 2019

City of Temecula Structural BMP Verification Form Page 2 of 4 Stormwater Structural Pollutant Control & Hydromodification Control BMPs* (List all from WQMP)				
Description/Type of Structural BMP	Plan Sheet #	STRUCT-URAL BMP ID#	Maintenance Agreement Recorded Doc #	Revisions
Biofiltration Basin	TBD	A	TBD	
Filterra Unit (or equivalent)	TBD	B	TBD	
Filterra Unit (or equivalent)	TBD	C	TBD	

Note: If this is a partial verification of Structural BMPs, provide a list and map denoting Structural BMPs that have already been submitted, those for this submission, and those anticipated in future submissions.

City of Temecula Structural BMP Verification Form Page 3 of 4

Checklist for Applicant to submit to City inspector:

- ☐ Copy of the final accepted WQMP and any accepted addendum.
- ☐ Copy of the most current plan showing the construction detail sheets of the Structural BMPs and the location of each verified as-built Structural BMP.
- ☐ Photograph of each Structural BMP.
- ☐ Photograph(s) of each Structural BMP during the construction process to illustrate proper construction.
- ☐ Copy of the approved Water Quality Management Plan Operation and Maintenance Agreement(s).

By signing below, I certify that the Structural BMP(s) for this project have been constructed and all BMPs are in substantial conformance with the approved plans and applicable regulations. I understand the City reserves the right to inspect the above BMPs to verify compliance with the approved plans and City Ordinances. Should it be determined that the BMPs were not constructed to plan or code, corrective actions may be necessary before permits can be closed.

Please sign your name and seal.

Professional Engineer's Printed Name:

_____

Professional Engineer's Signed Name:

_____

Date:_____

Preparation Date:_____

Template Date: February 22nd, 2019

City of Temecula Structural BMP Verification Form Page 4 of 4

City - OFFICIAL USE ONLY:

For City Inspector: Verification Package #: _____

City Inspector: _____

Date Project has/expects to close: _____

Date verification received from EOW: _____

By signing below, City Inspector concurs that every noted Structural BMP has been installed per plan.

City Inspector's Signature: _____ Date: _____

For Land Development Staff:

Date Received from City Inspector: _____

Land Development Submittal Reviewer: _____

Land Development Reviewer concurs that the information provided for the following Structural BMPs is acceptable to enter into the Structural BMP Maintenance verification inventory:

List **acceptable** Structural BMPs:

Land Development Reviewer's Signature: _____ Date: _____

ATTACHMENT 5

Copy of Plan Sheets Showing Permanent Stormwater BMPs, Source Control, and Site Design

Use this checklist to ensure the required information has been included on the plans:

The plans must identify:

☒ Structural BMP(s) with ID numbers
☒ The grading and drainage design shown on the plans must be consistent with the delineation of DMAs shown on the DMA exhibit
☒ Improvements within City Public Right-of-Way have been designed in accordance with Appendix K: Guidance on Green Infrastructure.
☐ Details and specifications for construction of structural BMP(s).
☐ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable.
☐ Signage indicating the location and boundary of source control, site design, and structural BMP(s) as required by City staff.
☐ How to access the structural BMP(s) to inspect and perform maintenance.
☐ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, benchmarks or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
☐ Include landscaping plan sheets showing vegetation and amended soil requirements for vegetated structural BMP(s), amended soil areas, dispersion areas, tree-wells, and self-mitigating areas
☐ All BMPs must be fully dimensioned on the plans
☐ Include all Construction stormwater, source control, and site design measures described in the WQMP. Can be included as separate plan sheets as necessary.
☐ When proprietary BMPs are used, site-specific cross section with outflow, inflow, and model number must be provided. Photocopies of general brochures are not acceptable.

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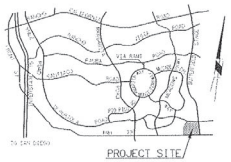
VILLAGES AT PASEO DEL SOL

DEVELOPMENT PLAN

TTM 36483, PLANNING AREA 4A
CITY OF TEMECULA, COUNTY OF RIVERSIDE
STATE OF CALIFORNIA



VICINITY MAP
NOT TO SCALE

SHEET INDEX

1) COVER SHEET
2) CROSS SECTIONS AND DETAILS
3) SP-1 SITE PLAN
4) SP-2 SITE PLAN
5) SP-3 SITE PLAN
6) SP-4 SITE PLAN
7) GR-1 GRADING AND STORM DRAIN PLAN
8) GR-2 GRADING AND STORM DRAIN PLAN
9) GR-3 GRADING AND STORM DRAIN PLAN
10) GR-4 GRADING AND STORM DRAIN PLAN
11) GR-5 GRADING AND OFFSITE STORM DRAIN PLAN
12) FIRE DEPARTMENT PLAN

PROJECT INFORMATION

ASSESSORS PARCEL NUMBER: 958-405-001 & 002
STREET ADDRESS: NW CORNER OF TEMECULA PARKWAY AND BUTTERFIELD STAGE ROAD
LEGAL DESCRIPTION:
PARCELS 45 AND 46 OF PARCEL MAP NO. 23432, IN THE CITY OF TEMECULA, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AS SHOWN BY MAP ON FILE IN BOOK 159, PAGES 28 THROUGH 61, INCLUSIVE, OF PARCEL MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY

ZONING DESIGNATION	SP4 PALOMA DEL SOL SPECIFIC PLAN
GENERAL PLAN DESIGNATION	LM=LOW MEDIUM RESIDENTIAL
EXISTING LAND USE	VACANT
PROPOSED LAND USE	RESIDENTIAL

TOTAL NET SITE AREA 1,857,482 SF = 42.64 ACRES

DENSITY: 174 DWELLING UNITS/42.64 ACRES = 4.08 DU/ACRE

OCCUPANCY	R-2 & U
TYPE OF CONSTRUCTION	V-B
BUILDING HEIGHTS / STORIES	2 STORY
HEIGHT OF BUILDING	29' 3" MAX
FIRE SPRINKLER AND/OR ALARM	YES

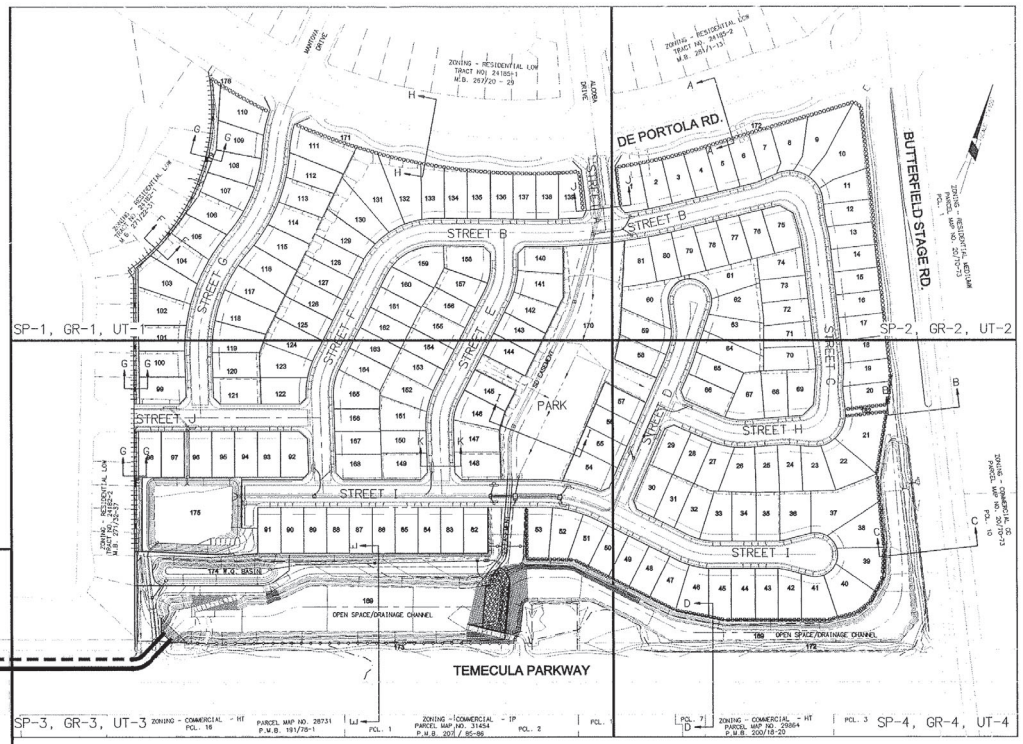
TOPOGRAPHY

PROFESSIONAL MAPPING SERVICES
43214 EL ROBLES UNIT #101
TEMECULA, CA 92200
PH: (951) 296-1192
FAX: (951) 296-1194
SCALE 1"=40'
CONTOUR INTERVAL: 1'
DATE PREPARED: 06/09/2009

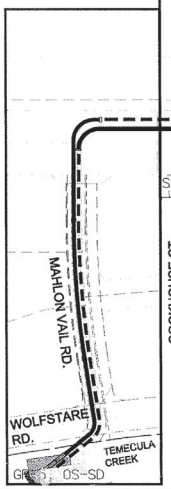
UPDATED SURVEYING COMPLETED ON 09/21/2013

NOTES

The dwelling units in this project shall comply with Chapter 11A of the 2010 California Building Code. The common use areas of this project shall comply with Chapter 11B of the 2010 California Building Code and shall be accessible to persons with disabilities. The Project shall also comply with the provisions of the
2010 California Building Code (CBC)/ 2010 International Building Code (IBC) 2010 California Mechanical Code (CMC)/ 2009 Uniform Mechanical Code (UMC)
2010 California Plumbing Code (CPC)/ 2009 Uniform Plumbing Code (UPC)
2010 California Electrical Code (CEC)/ 2009 National Electrical Code (NEC)
2010 California Fire Code (CFC)/ 2009 International Fire Code (IFC)
2010 Building Energy Efficiency Standards
Driveway slopes shall not exceed 15%



INDEX MAP
SCALE: 1"=100'



PROPOSED OFFSITE STORM DRAIN IMPROVEMENTS PER SEPARATE PLAN

OWNER AND DEVELOPER

CAL-PASEO DEL SOL, LLC
4795 EASTGATE MALL SUITE 150
SAN DIEGO, CA 92121
PH: (858) 217-2708

UNADJUSTED EARTHWORK QUANTITIES

CUT------254,500 CY
FILL-----184,500 CY
NET FILL--70,000 CY

SOUND WALL REQUIREMENTS

SOUND WALLS WILL BE BUILT PER THE WALL AND FENCE PLAN PER THE ACOUSTICAL ASSESSMENT THE SOUND WALL REQUIREMENTS ARE AS FOLLOWS:

6' HIGH BARRIERS AT LOTS 21-25, 44-54, 83-86,101 AND 163
7' FOOT HIGH BARRIERS AT LOTS 110, 111, 137-145, 1-8, 13-20, 38-45, AND 163
8' FOOT HIGH BARRIERS AT LOTS 9-12

UNADJUSTED TOTAL EARTHWORK QUANTITIES

CUT	259,454	C.Y.
FILL	228,265	C.Y.
IMPORT	18,811	C.Y.

PROPOSED EASEMENT NOTES:

1. INDICATES STORM DRAIN CONSTRUCTION AND MAINTENANCE EASEMENT TO RIVERSIDE COUNTY FLOOD CONTROL DISTRICT TO BE DEDICATED ON FINAL MAP
2. INDICATES EASEMENT FOR SIDEWALK MAINTENANCE AND PEDESTRIAN ACCESS PURPOSES OVER CONSTRUCTED SIDEWALKS TO BE DEDICATED TO CITY OF TEMECULA ON FINAL MAP. LOT WILL BE OWNED BY HOA AND LANDSCAPING WILL BE MAINTAINED BY HOA
3. INDICATES ACCESS EASEMENT TO RIVERSIDE COUNTY FLOOD CONTROL DISTRICT TO BE DEDICATED ON FINAL MAP
4. INDICATED SEWER EASEMENT TO EASTERN MUNICIPAL WATER DISTRICT TO BE DEDICATED ON FINAL MAP
5. INDICATES STORM DRAIN CONSTRUCTION AND MAINTENANCE EASEMENT TO RIVERSIDE COUNTY FLOOD CONTROL DISTRICT TO BE DEDICATED ON FINAL MAP
6. INDICATES DRAINAGE EASEMENT TO HOA TO BE DEDICATED ON FINAL MAP
7. INDICATES ACCESS EASEMENT TO RIVERSIDE COUNTY FLOOD CONTROL DISTRICT TO BE DEDICATED ON FINAL MAP
8. INDICATES EMERGENCY FIRE ACCESS EASEMENT TO CITY OF TEMECULA FIRE DEPARTMENT

EXISTING EASEMENT NOTES

(A) EASEMENT TO SOUTHERN CALIFORNIA EDISON COMPANY PER DOCUMENT RECORDED APRIL 14, 1971 AS INST NO. 38305 O.R. AND RE-RECORDED JUNE 17, 1971 AS INST NO. 65611 O.R. (WITHIN BUTTERFIELD STAGE ROAD)

(B) INDICATES EASEMENT FOR DRAINAGE AND FLOWAGE PURPOSES TO THE PUBLIC PER DOCUMENT RECORDED JUNE 16, 1989 AS INST NO. 199287 O.R. TO BE VACATED

EASEMENT FOR UNRESTRICTED ACCESS PER DOCUMENT RECORDED JULY 2, 2008 AS INST NO. 2008-0361003 O.R. (BLANKET EASEMENT OVER PARCELS 45 AND 46 OF P.M. NO. 23432

(D) INDICATES EASEMENT FOR STORM DRAIN FACILITIES PER DOCUMENT RECORDED JULY 2, 2008 AS INST NO. 2008-0361204 O.R. TO BE VACATED

(E) INDICATES EASEMENT FOR STORM DRAIN FACILITIES PER DOCUMENT RECORDED JULY 2, 2008 AS INST NO. 2008-0361205 O.R. TO BE VACATED

(F) INDICATES EASEMENT FOR STORM DRAIN FACILITIES PER DOCUMENT RECORDED JULY 2, 2008 AS INST NO. 2008-0361206 O.R. TO BE VACATED.

LEGEND

RIGHT OF WAY	ROW
TOP OF CURB	TC
FLOW LINE	FL
PROPERTY LINE	P
CENTER LINE	℄
HIGH POINT	HP
LOW POINT	LP
FINISHED GRADE	FG
FINISHED SURFACE	FS
FINISHED FLOOR	FF
GRADE BREAK	GB
FIRE HYDRANT	FH
CURB & GUTTER	C&G
SIDEWALK	S/W
EDGE OF PAVEMENT	EP
STORM DRAIN	SD
EXISTING	EX
PROPOSED	PROP
EXISTING ELEVATION	(1158)
FINISHED CONTOUR	1150
EXISTING CONTOUR	
TOP	
TOE	
RIGHT OF WAY	
CENTERLINE	
RETAINING WALL	
SIDEWALK	
SEWER LINE	SS
EXISTING SEWER LINE	
DOMESTIC WATER LINE	DW
EXISTING WATER LINE	
STORM DRAIN LINE	
EXISTING STORM DRAIN LINE	
SOUND WALL	
EX. WOOD FENCE	
TUBULAR STEEL FENCE	
ADA PATH OF TRAVEL	
FEMA FLOODPLAIN LIMITS	
PAD ELEVATION	XXXX.X
FIRE HYDRANT	FH
FIRE DEPT. CONNECTION/ POST INDICATOR VALVE	
SEWER MANHOLE	S
STORM MANHOLE	S
STORM DRAIN INLET	
STORM DRAIN OUTLET	
JUNCTION STRUCTURE	JS
LOT NUMBER	106
STREET LIGHTS	SL
UNDER SIDEWALK DRAIN	
PROPOSED LANDSCAPED/ IRRIGATED AREAS	

DATE	BY	REVISIONS	DATE	ACC'D

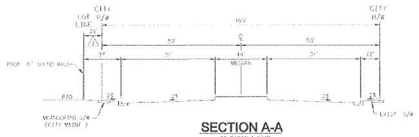
Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

CITY OF TEMECULA DEPARTMENT OF PUBLIC WORKS

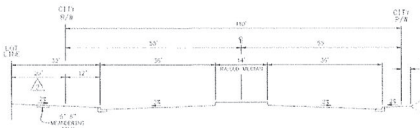
PASEO DEL SOL
COVER SHEET
PLANNING AREA 4
TPM 36483
CITY OF TEMECULA

SHEET NO. 1 OF 12 SHEETS

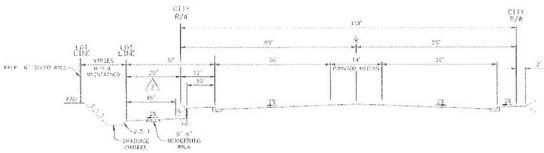
\\TEMDATA\TEM_PROJECTS\13900-CAD\LAND DEV\PLANNING\DEVELOPMENT PLAN\13900-DP1.MWG 12/10/18 1:41 PM



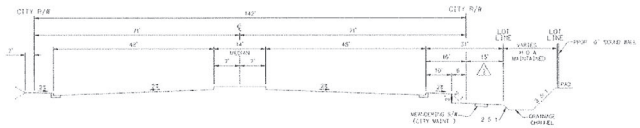
SECTION A-A
DE PORTOLA ROAD
N.T.S.
(PER THE PALOMA DEL SOL SPECIFIC PLAN, PA#1)



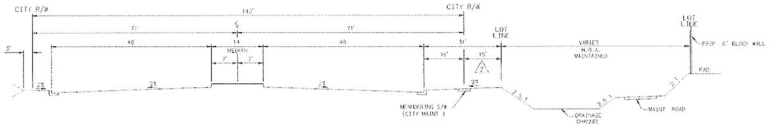
SECTION B-B
BUTTERFIELD STAGE ROAD
N.T.S.
(PER THE PALOMA DEL SOL SPECIFIC PLAN, PA#1)



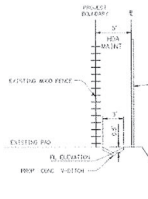
SECTION C-C
BUTTON DELL STAGE ROAD
N.T.S.
(PER THE PALOMA DEL SOL SPECIFIC PLAN, PA#1)



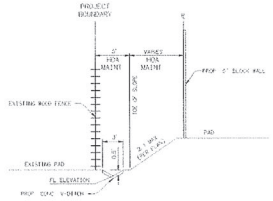
SECTION D-D
TEMECULA PARKWAY
N.T.S.
(PER THE PALOMA DEL SOL SPECIFIC PLAN, PA#1)



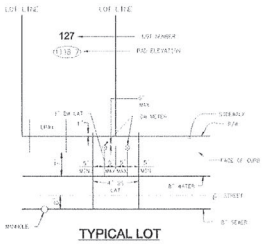
SECTION E-E
TEMECULA PARKWAY
N.T.S.



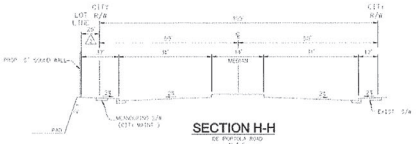
SECTION F-F
N.T.S.



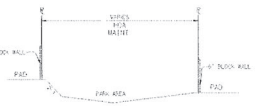
SECTION G-G
N.T.S.



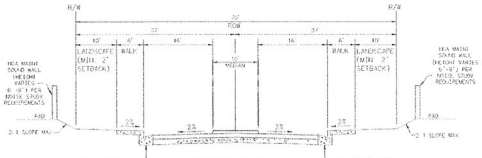
TYPICAL LOT



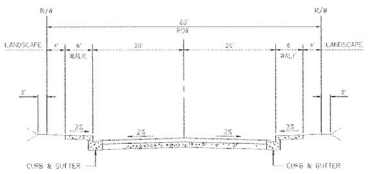
SECTION H-H
DE PORTOLA ROAD
N.T.S.
(PER THE PALOMA DEL SOL SPECIFIC PLAN, PA#1)



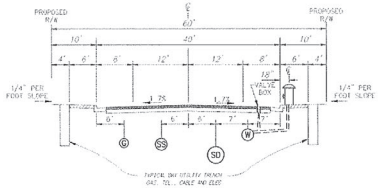
SECTION I-I
N.T.S.



SECTION J-J
PUBLIC STREET
N.T.S.



SECTION K-K
(STREETS B, C, D, E, F, G, H, I, J)
PUBLIC STREET-TYPICAL
N.T.S.



SECTION L-L
TYPICAL UTILITY LOCATION
N.T.S.

DATE	BY	REVISIONS	DATE	ACC'D

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

CITY OF TEMECULA — DEPARTMENT OF PUBLIC WORKS

PASEO DEL SOL
CROSS SECTIONS AND DETAILS
PLANNING AREA 4
TPM 36485
CITY OF TEMECULA

SHEET NO
2
OF 12 SHEETS

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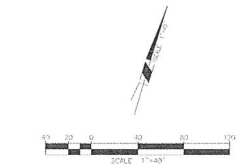
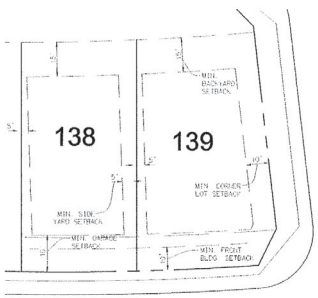




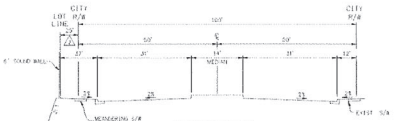
TYPICAL MINIMUM LOT SETBACKS PER SP 4
1"=20'

TYPICAL PLOTTING RULES

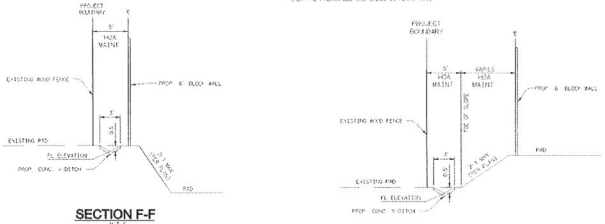
1) NO IDENTICAL FLOORPLAN AND ELEVATION DIRECTLY ADJACENT OR DIRECTLY ACROSS THE STREET, OR AS APPROVED
2) NO MORE THAN 2 OF THE SAME FLOORPLAN DIRECTLY ADJACENT OR ACROSS THE STREET, OR AS APPROVED
3) NO MORE THAN 3 OF THE SAME ELEVATION DIRECTLY ADJACENT OR ACROSS THE STREET, OR AS APPROVED
4) WHERE ALLOWABLE, ADJACENT HOMES SHALL HAVE A SETBACK VARIANCE OF 1'-0" FEET MINIMUM

SETBACK CRITERIA PER SP4

FRONT YARD	GARAGE	18'
	LIVING SPACE	10'
SIDE YARD	LIVING SPACE (INTERNAL LOT)	5'
	LIVING SPACE (CORNER LOT)	10'
REAR YARD	LIVING SPACE	15'

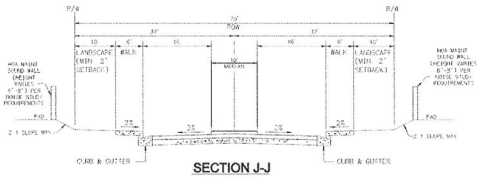


SECTION H-H
DE PORTOLA ROAD
N.T.S.
(PER THE PALMA DEL SOL SPECIFIC PLAN, PA4)

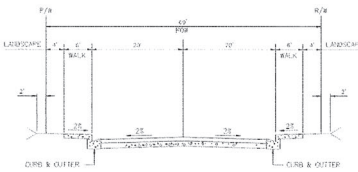


SECTION F-F
N.T.S.

SECTION G-G
N.T.S.



SECTION J-J
PUBLIC STREET
N.T.S.



SECTION K-K
(STREETS B, C, D, E, F, G, H, I, J)
PUBLIC STREET-TYPICAL
N.T.S.

DRAWING SP-1

DATE	BY	REVISIONS	DATE	ACC'D

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

CITY OF TEMECULA DEPARTMENT OF PUBLIC WORKS

PASEO DEL SOL
SITE PLAN
PLANNING AREA 4
TPM 36483
CITY OF TEMECULA

SHEET NO. 3 OF 12 SHEETS

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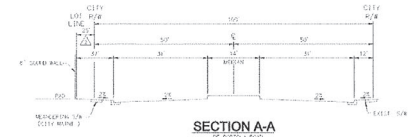
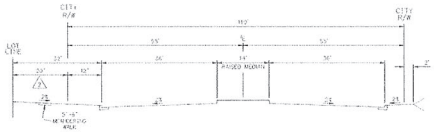
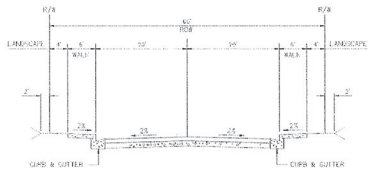


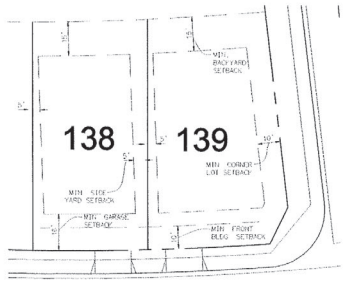
SECTION A-A
DE PORTOLA ROAD
N.T.S.
(SEE THE PALOMA DEL SOL SPECIFIC PLAN, PSP)



SECTION B-B
BUTTERFIELD STAGE ROAD
N.T.S.
(SEE THE PALOMA DEL SOL SPECIFIC PLAN, PSP)



SECTION K-K
(STREETS B, C, D, E, F, G, H, I, J)
PUBLIC STREET-TYPICAL
N.T.S.



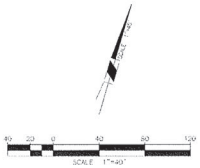
TYPICAL MINIMUM LOT SETBACKS PER SP 4
1"=20'

TYPICAL PLOTTING RULES

1) NO IDENTICAL FLOORPLAN AND ELEVATION DIRECTLY ACROSS OR DIRECTLY ACROSS THE STREET, OR AS APPROVED.
2) NO MORE THAN 3 OF THE SAME FLOORPLAN DIRECTLY ADJACENT OR ACROSS THE STREET, OR AS APPROVED.
3) NO MORE THAN 1 OF THE SAME ELEVATION DIRECTLY ADJACENT OR ACROSS THE STREET, OR AS APPROVED.
4) WHERE ALLOWABLE, ADJACENT HOMES SHALL HAVE A SETBACK VARIANCE OF 1'-3' FEET MINIMUM.

SETBACK CRITERIA PER SP4

FRONT YARD	GARAGE	18'
	LIVING SPACE	10'
SIDE YARD	LIVING SPACE (INTERNAL LOT)	5'
	LIVING SPACE (CORNER LOT)	10'
BACK YARD	LIVING SPACE	15'



DRAWING SP-2

DATE	BY	REVISIONS	DATE	ACC'D

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

CITY OF TEMECULA — DEPARTMENT OF PUBLIC WORKS

PASEO DEL SOL
SITE PLAN
PLANNING AREA 4
TPM 36485
CITY OF TEMECULA

SHEET NO. 4 OF 12 SHEETS

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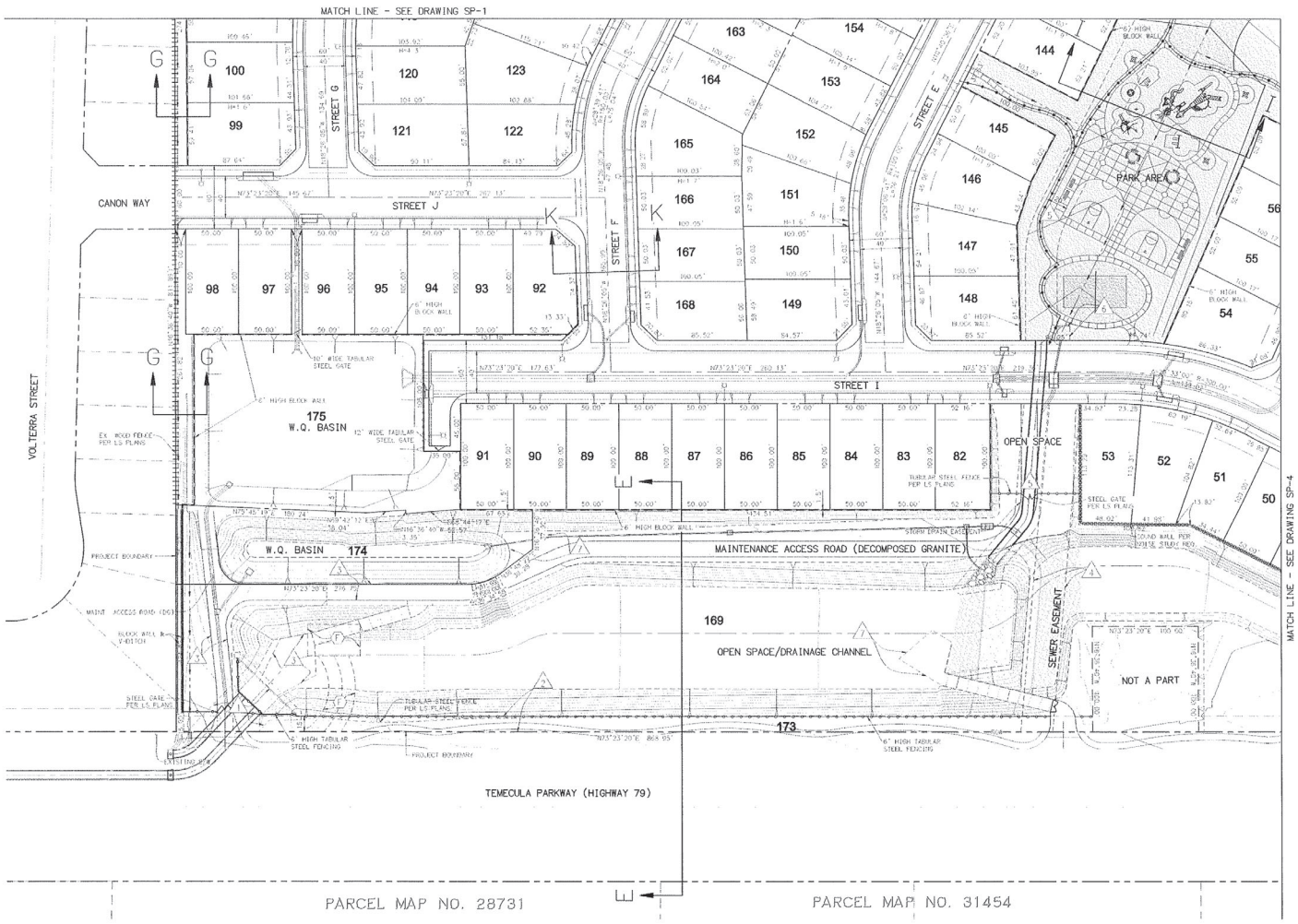
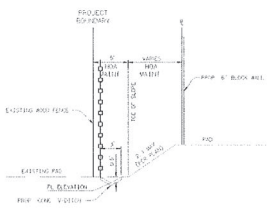
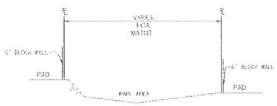
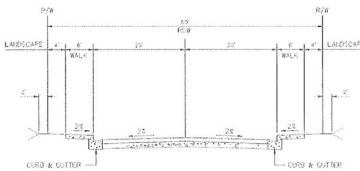




SECTION G-G

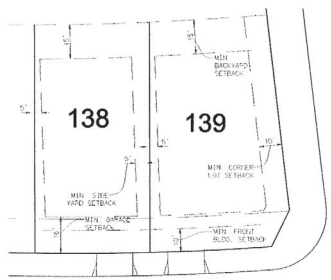


SECTION I-I

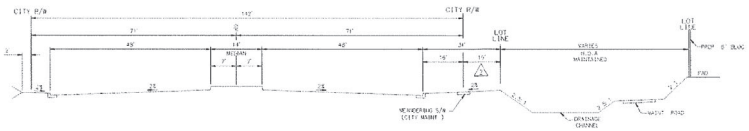


SECTION K-K

(STREETS B, C, D, E, F, G, H, I, J)
PUBLIC STREET TYPICAL



TYPICAL MINIMUM LOT SETBACKS PER SP 4



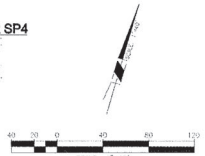
SECTION E-E

TYPICAL PLOTTING RULES

1) NO ISOMETRICS, PLUMBING AND ELEVATION DIRECTLY ADJACENT, OR DIRECTLY ACROSS THE STREET, OR AS APPROVED
2) NO MORE THAN 5 OF THE SAME FLOORPLAN DIRECTLY ADJACENT OR ACROSS THE STREET, OR AS APPROVED
3) NO MORE THAN 3 OF THE SAME ELEVATION DIRECTLY ADJACENT OR ACROSS THE STREET, OR AS APPROVED
4) WHERE ALLOWABLE, ADJACENT HOMES SHALL HAVE A SETBACK VARIANCE OF 1'-5" FEET MINIMUM

SETBACK CRITERIA PER SP4

FRONT YARD	GARAGE	18'
	LIVING SPACE	10'
SIDE YARD	LIVING SPACE (EXTERNAL LOT)	5'
	LIVING SPACE (CORNER LOT)	10'
BACK YARD	LIVING SPACE	15'



DRAWING SP-3

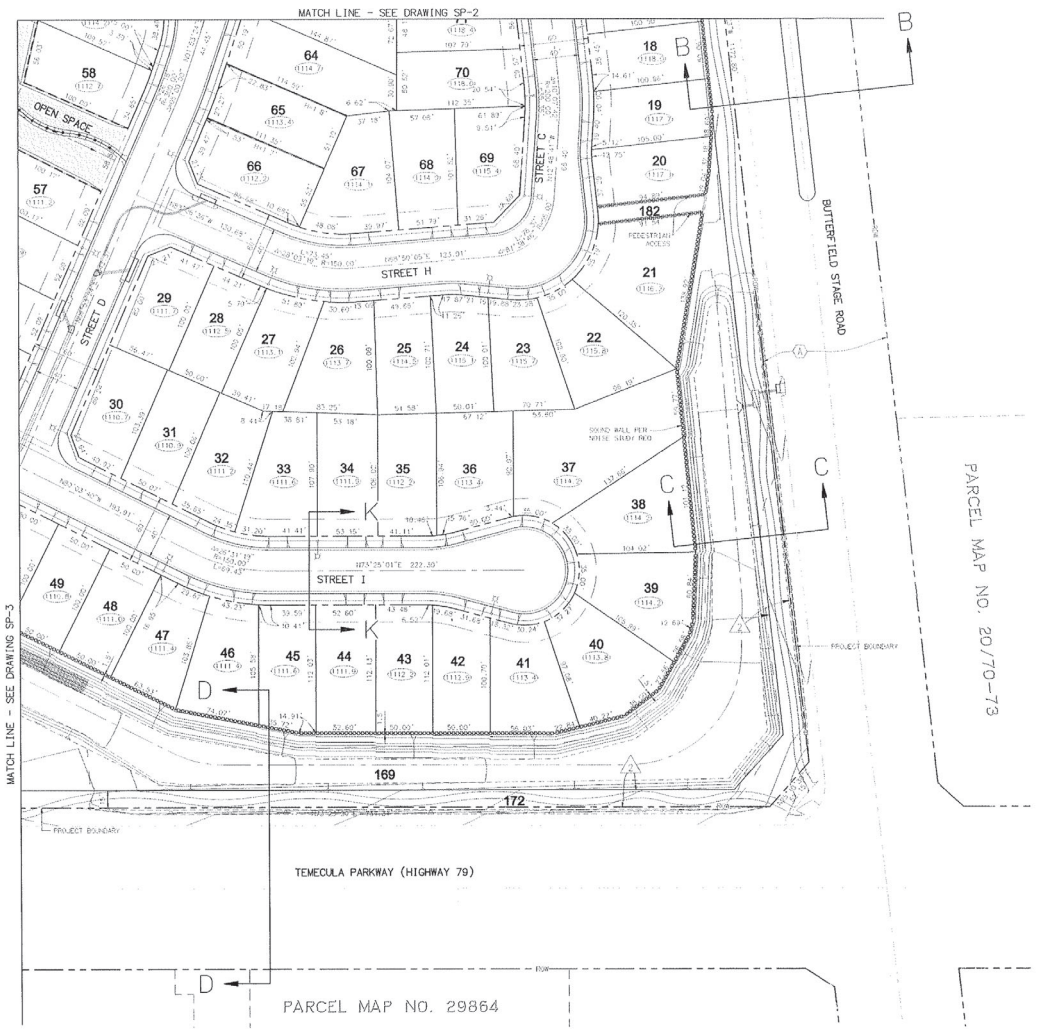
DATE	BY	REVISIONS	DATE	ACC'D

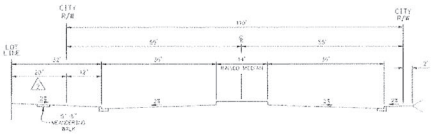
Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-3042
MBAKERINTL.COM

CITY OF TEMECULA — DEPARTMENT OF PUBLIC WORKS

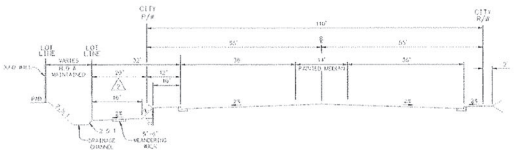
PASEO DEL SOL
SITE PLAN
PLANNING AREA 4
TPM 30483
CITY OF TEMECULA

SHEET NO. 5 OF 12 SHEETS

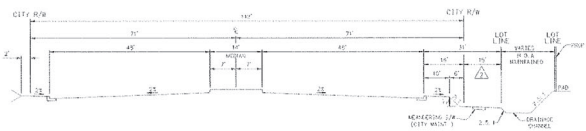




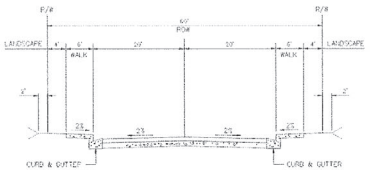
SECTION B-B
BUTTERFIELD STAGE ROAD
N.T.S.
(SEE THE PALOMA DEL SOL SPECIFIC PLAN, PA#1)



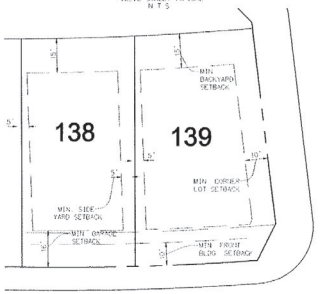
SECTION C-C
BUTTERFIELD STAGE ROAD
N.T.S.
(SEE THE PALOMA DEL SOL SPECIFIC PLAN, PA#1)



SECTION D-D
TEMECULA PARKWAY
N.T.S.
(SEE THE PALOMA DEL SOL SPECIFIC PLAN, PA#1)



SECTION K-K
(STREETS B, C, D, E, F, G, H, I, J)
PUBLIC STREET-TYPICAL
N.T.S.



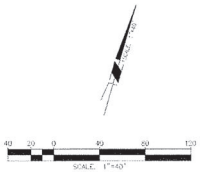
TYPICAL MINIMUM LOT SETBACKS PER SP 4
1"=20'

TYPICAL PLOTTING RULES

1) NO IDENTICAL FLOORPLAN AND ELEVATION DIRECTLY ADJACENT OR DIRECTLY ACROSS THE STREET, OR AS APPROVED.
2) NO MORE THAN 2 OF THE SAME FLOORPLAN DIRECTLY ADJACENT OR ACROSS THE STREET.
3) NO MORE THAN 3 OF THE SAME ELEVATION DIRECTLY ADJACENT OR ACROSS THE STREET, OR AS APPROVED.
4) AVOID BILLBOARDS. ADJACENT HOMES SHALL HAVE A SETBACK VARIANCE OF 1'-5' FEET MINIMUM.

SETBACK CRITERIA PER SP4

FRONT YARD	GARAGE	18'
	LIVING SPACE	10'
SIDE YARD	LIVING SPACE (INTERIOR LOT)	5'
	LIVING SPACE (CORNER LOT)	10'
REAR YARD	LIVING SPACE	15'



DATE	BY	REVISIONS	DATE	ACC'D

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-5042
MBAKERINTL.COM

CITY OF TEMECULA DEPARTMENT OF PUBLIC WORKS

PASEO DEL SOL
SITE PLAN
PLANNING AREA 4
TPM 36483
CITY OF TEMECULA

SHEET NO 6
OF 12 SHEETS

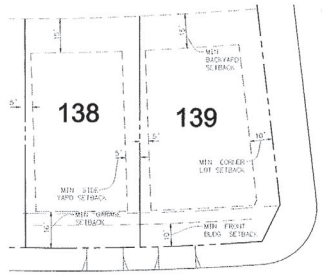
DRAWING SP-4

P:\PA#1 (PASEO DEL SOL)\PLANNING\DEVELOPMENT PLANS\SP\SHEETS\SP-4.DWG 7/27/18 11:22 am

LEGEND

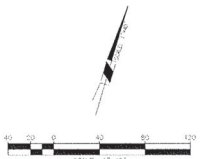
RIGHT OF WAY	ROW	TOP	
TOP OF CURB	TC	TOE	
FLOW LINE	FL	RIGHT OF WAY	
PROPERTY LINE	PL	CENTERLINE	
CENTER LINE	℄	RETAINING WALL	
HIGH POINT	HP	SIDEWALK	
LOW POINT	LP	SEWER LINE	SS
FINISHED GRADE	FG	EXISTING SEWER LINE	
FINISHED SURFACE	FS	DOMESTIC WATER LINE	DW
FINISHED FLOOR	FF	EXISTING WATER LINE	
GRADE BREAK	GB	STORM DRAIN LINE	
FIRE HYDRANT	FH	EXISTING STORM DRAIN LINE	
CURB & GUTTER	C&G	SOUND WALL	
SIDEWALK	S/W	EX. WOOD FENCE	
EDGE OF PAVEMENT	EP	TUBULAR STEEL FENCE	
STORM DRAIN	SD	PAD ELEVATION	(XXX.X)
EXISTING	EX	FIRE HYDRANT	FDC
PROPOSED	PROP	FIRE DEPT. CONNECTION/ POST INDICATOR VALVE	FDC
EXISTING ELEVATION	(1158)	SEWER MANHOLE	
FINISHED CONTOUR	1160	STORM MANHOLE	
EXISTING CONTOUR		STORM DRAIN INLET	
		STORM DRAIN OUTLET	
		JUNCTION STRUCTION	
		LOT NUMBER	106
		STREET LIGHTS	

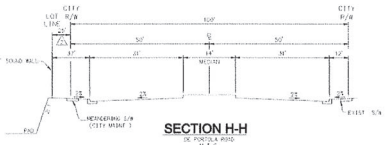
TYPICAL MINIMUM LOT SETBACKS PER SP 4



UNADJUSTED TOTAL EARTHWORK QUANTITIES

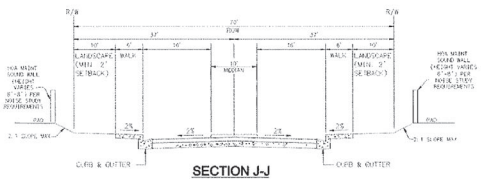
CUT	259,494	C.Y.
FILL	228,268	C.Y.
IMPORT	10,201	C.Y.





SECTION H-H

DE PORTOLA ROAD
N.T.S.
(PER THE PALOMA DEL SOL SPECIFIC PLAN, #SP)



SECTION J-J

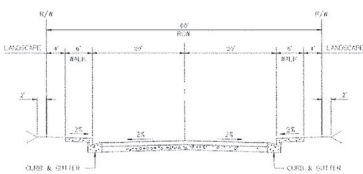
PUBLIC STREET
N.T.S.

SECTION F-F

N.T.S.

SECTION G-G

N.T.S.



SECTION K-K

(STREETS B, C, D, E, F, G, H, I, J)
PUBLIC STREET-TYPICAL
N.T.S.

DRAWING GR-1

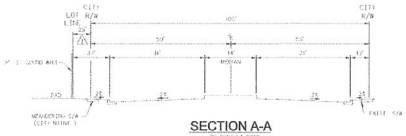
DATE	BY	REVISIONS	DATE ACC'D

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

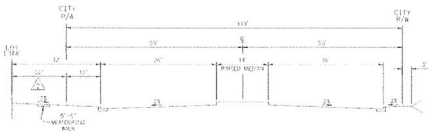
CITY OF TEMECULA — DEPARTMENT OF PUBLIC WORKS

PASEO DEL SOL
GRADING AND STORM DRAIN PLAN
PLANNING AREA 4
TPM 30455
CITY OF TEMECULA

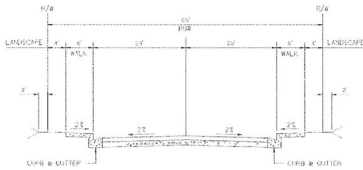
SHEET NO. 7 OF 12 SHEETS



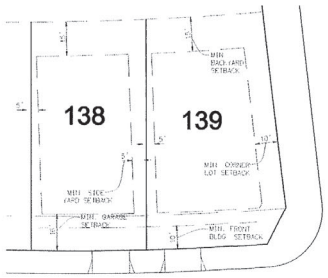
SECTION A-A



SECTION B-B



SECTION K-K



TYPICAL MINIMUM LOT SETBACKS PER SP 4

LEGEND

RIGHT OF WAY — R/W
TOP OF CURB — TC
FLOW LINE — FL
PROPERTY LINE — P
CENTER LINE — C
HIGH POINT — HP
LOW POINT — LP
FINISHED GRADE — FG
FINISHED SURFACE — FS
FINISHED FLOOR — FF
GRADE BREAK — GB
FIRE HYDRANT — FH
CURB & GUTTER — C&G
SIDEWALK — S/W
EDGE OF PAVEMENT — EP
STORM DRAIN — SD
EXISTING — EX
PROPOSED — PROP
EXISTING ELEVATION — (116)
FINISHED CONTOUR — 116
EXISTING CONTOUR
TOP
TOE
RIGHT OF WAY
CENTERLINE
RETAINING WALL
SIDEWALK
SEWER LINE — SS
EXISTING SEWER LINE
DOMESTIC WATER LINE — DW
EXISTING WATER LINE
STORM DRAIN LINE
EXISTING STORM DRAIN LINE
SOUND WALL
EX. WOOD FENCE
TUBULAR STEEL FENCE
PAD ELEVATION — XXX.X
FIRE HYDRANT — FH
FIRE DEPT. CONNECTION/ POST INDICATOR VALVE
SEWER MANHOLE — S
STORM MANHOLE — D
STORM DRAIN INLET
STORM DRAIN OUTLET
JUNCTION STRUCTION
LOT NUMBER — 106
STREET LIGHTS — SL

SCALE: 1"=40'

DRAWING GR-2

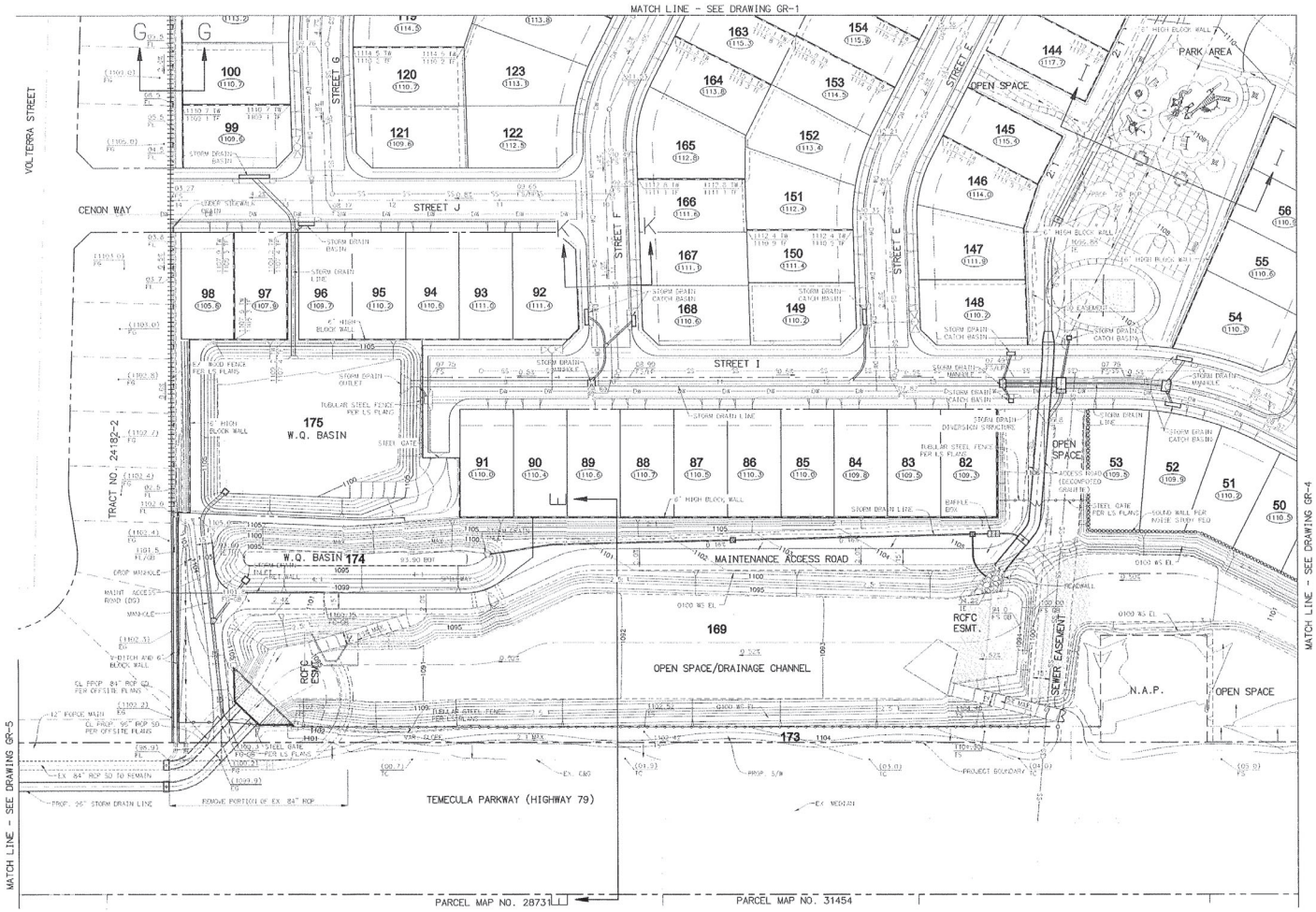
DATE	BY	REVISIONS	DATE ACC'D

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

CITY OF TEMECULA — DEPARTMENT OF PUBLIC WORKS

PASEO DEL SOL
GRADING AND STORM DRAIN PLAN
PLANNING AREA 4
TPM 36485
CITY OF TEMECULA

SHEET NO. 8 OF 12 SHEETS



SECTION G-G

SECTION I-I

SECTION K-K

TYPICAL MINIMUM LOT SETBACKS PER SP 4

SECTION E-E

LEGEND

RIGHT OF WAY — ROW
TOP OF CURB — TC
FLOW LINE — FL
PROPERTY LINE — PL
CENTER LINE — CL
HIGH POINT — HP
LOW POINT — LP
FINISHED GRADE — FG
FINISHED SURFACE — FS
GRADE BREAK — GB
FIRE HYDRANT — FH
CURB & GUTTER — C&G
SIDEWALK — S/W
EDGE OF PAVEMENT — EP
STORM DRAIN — SD
EXISTING — EX
PROPOSED — PROP

EXISTING ELEVATION — (115.8)
FINISHED FLOOR — FF
FINISHED CONTOUR — 110
EXISTING CONTOUR
TOP — T
TOE — TOE
RIGHT OF WAY
CENTERLINE
RETAINING WALL
SIDEWALK
SEWER LINE — SS
EXISTING SEWER LINE
DOMESTIC WATER LINE — DW
EXISTING WATER LINE
STORM DRAIN LINE
EXISTING STORM DRAIN LINE
SOUND WALL
EX. WOOD FENCE

TUBULAR STEEL FENCE
PAD ELEVATION — (XXXX)
FIRE HYDRANT — DOG
FIRE DEPT. CONNECTION/ POST INDICATOR VALVE — FDC
SEWER MANHOLE
STORM MANHOLE
STORM DRAIN INLET
STORM DRAIN OUTLET
JUNCTION STRUCTION — JS
LOT NUMBER — 106
STREET LIGHTS — SL
FEMA FLOODPLAIN LIMITS

SCALE: 1"=80'

DRAWING GR-3

DATE	BY	REVISIONS	DATE	ACC'D

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-5042
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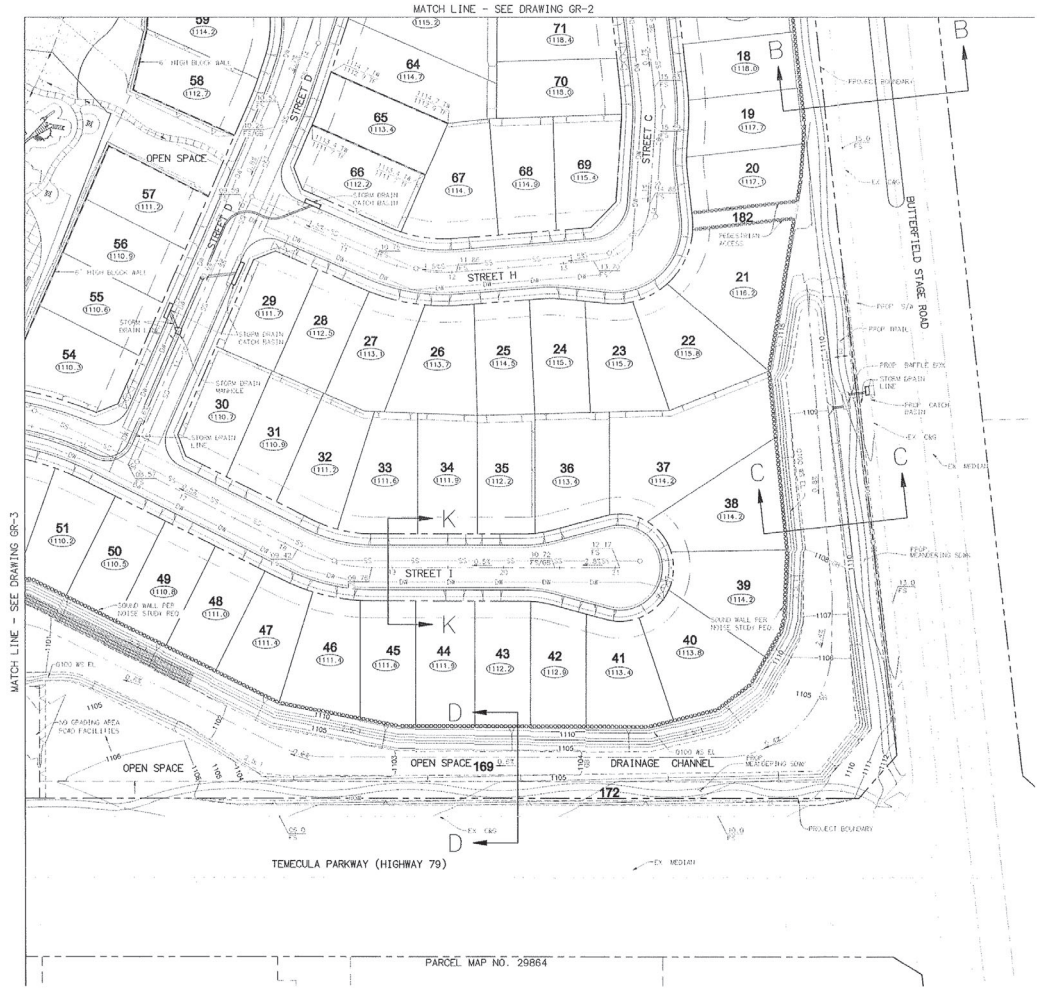
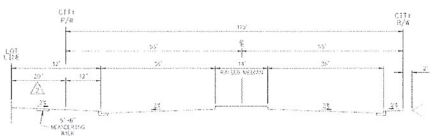
CITY OF TEMECULA — DEPARTMENT OF PUBLIC WORKS

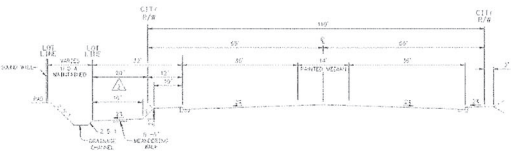
PASEO DEL SOL
GRADING AND STORM DRAIN PLAN
PLANNING AREA 4
TPM 36483
CITY OF TEMECULA

SHEET NO. 9 OF SHEETS

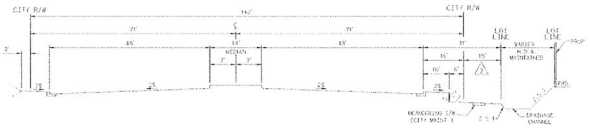




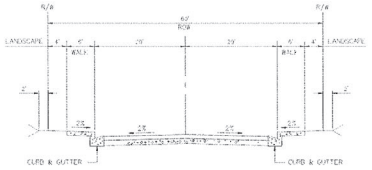
SECTION B-B
BUTTERFIELD STAGE ROAD
N.T.S.
PER THE PALOMA DEL SOL SPECIFIC PLAN, P.S.P.



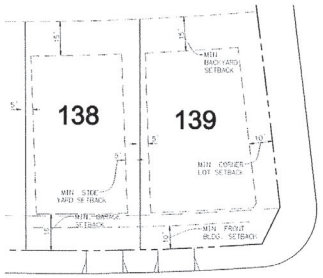
SECTION C-C
BUTTERFIELD STAGE ROAD
N.T.S.
PER THE PALOMA DEL SOL SPECIFIC PLAN, P.S.P.



SECTION D-D
TEMECULA PARKWAY
N.T.S.
PER THE PALOMA DEL SOL SPECIFIC PLAN, P.S.P.



SECTION K-K
(STREETS B, C, D, E, F, G, H, I, K)
PUBLIC STREET TYPICAL
N.T.S.

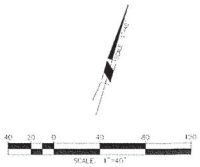


TYPICAL MINIMUM LOT SETBACKS PER SP 4
1"=20'

LEGEND

RIGHT OF WAY	ROW	EXISTING ELEVATION	(1158)
TOP OF CURB	TC	FINISHED FLOW	FF
FLOW LINE	FL	FINISHED CONTOUR	1160
PROPERTY LINE	PL	EXISTING CONTOUR	
CENTER LINE	℄	TOP	
HIGH POINT	HP	TOE	
LOW POINT	LP	RIGHT OF WAY	
FINISHED GRADE	FG	CENTERLINE	
FINISHED SURFACE	FS	RETAINING WALL	
GRADE BREAK	GB	SIDEWALK	
FIRE HYDRANT	FH	SEWER LINE	SS
CURB & GUTTER	C&G	EXISTING SEWER LINE	
SIDEWALK	S/W	DOMESTIC WATER LINE	DW
EDGE OF PAVEMENT	EP	EXISTING WATER LINE	
STORM DRAIN	SD	STORM DRAIN LINE	
EXISTING	EX	EXISTING STORM DRAIN LINE	
PROPOSED	PROP	SOUND WALL	
		EX WOOD FENCE	

MASONRY STONE FENCE	
PAD ELEVATION	XXXX.X
FIRE HYDRANT	
FIRE DEPT. CONNECTION/ POST INDICATOR VALVE	
SEWER MANHOLE	
STORM MANHOLE	
STORM DRAIN INLET	
STORM DRAIN OUTLET	
JUNCTION STRUCTURE	
LOT NUMBER	106
STREET LIGHTS	
FEMA FLOODPLAIN LIMIT	



DATE	BY	REVISIONS	DATE	ACC'D

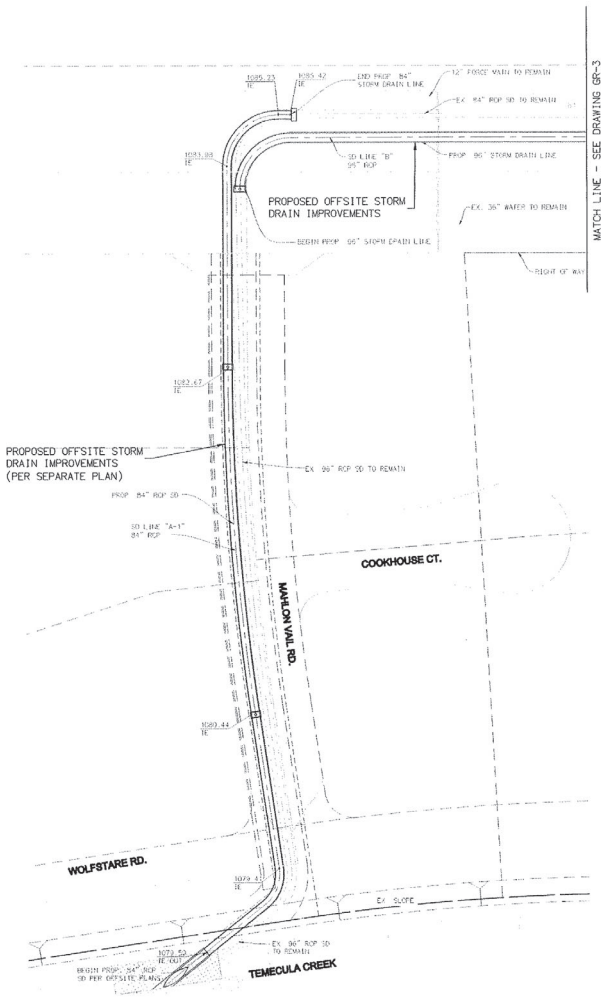
Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

CITY OF TEMECULA — DEPARTMENT OF PUBLIC WORKS

PASEO DEL SOL
GRADING AND STORM DRAIN PLAN
PLANNING AREA 4
TPM 36483
CITY OF TEMECULA

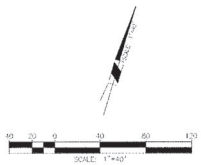
SHEET NO: 10
OF 12 SHEETS

DRAWING GR-4



LEGEND

RIGHT OF WAY	R/W
TOP OF CURB	TC
FLOW LINE	FL
PROPERTY LINE	P
CENTER LINE	℄
HIGH POINT	HP
LOW POINT	LP
FINISHED GRADE	FG
FINISHED SURFACE	FS
GRADE BREAK	GB
FIRE HYDRANT	FH
CURB & GUTTER	C&G
SIDEWALK	S/W
EDGE OF PAVEMENT	EP
STORM DRAIN	SD
EXISTING	EX
PROPOSED	PROP
EXISTING ELEVATION	(1158)
FINISHED CONTOUR	1100
EXISTING CONTOUR MAJOR	
EXISTING CONTOUR MINOR	
RIGHT OF WAY	
CENTERLINE	
RETAINING WALL	
PAD ELEVATION	XXX.X
SIDEWALK	
STORM MANHOLE	
STORM DRAIN INLET	
STORM DRAIN OUTLET	
JUNCTION STRUCTION	
SOUND WALL	
EX. BLOCK FENCE	
TUBULAR STEEL FENCE	
LOT NUMBER	106
STREET LIGHTS	



DRAWING GR-5

DATE	BY	REVISIONS	DATE	ACC'D

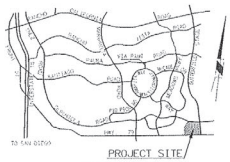
Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-5042
MBAKERINTL.COM

CITY OF TEMECULA DEPARTMENT OF PUBLIC WORKS

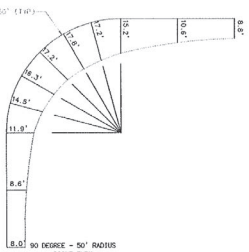
PASEO DEL SOL
GRADING AND OFFSITE STORM DRAIN PLAN
PLANNING AREA 4
TPM 36457
CITY OF TEMECULA

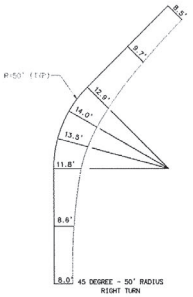
SHEET NO 11
OF 12 SHEETS

C:\TEMECULA\PROJECTS\36457 PASEO DEL SOL\GRADING\DEVELOPMENT PLAN\36457-GR-11.DWG GLUA 12/14/18 9:15 am



VICINITY MAP
NOT TO SCALE





① TRUCK TURNING RADIUS DETAIL
NOT TO SCALE

(ALL FIRE ROAD OUTSIDE TURNING RADII ARE 50' MINIMUM)

NOTE

1. FIRE HYDRANT TYPE TO BE DETERMINED BY FIRE DEPARTMENT.
2. FIRE HYDRANTS SHALL BE INSTALLED AND OPERATIONAL PRIOR TO COMBUSTIBLE MATERIALS BEING BROUGHT ONSITE. FORMING MATERIALS EXCLUDED. ACCESS ROADS SHALL BE INSTALLED PRIOR TO ANY CONSTRUCTION.

LEGEND

FIRE HYDRANT ⋈

SCALE: 1"=60'

DATE	BY	REVISIONS	DATE	ACC'D

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

CITY OF TEMECULA DEPARTMENT OF PUBLIC WORKS

PASEO DEL SOL
FIRE DEPARTMENT PLAN
PLANNING AREA 4
TPM 36483
CITY OF TEMECULA

SHEET NO
12
OF 12 SHEETS

T:\PROJECTS\14R0071\PASEO DEL SOL\GRADING\PLANNING\SITE\SHEET PLAN\36483-PA4-FD.DWG GLEN SHYVONNE 10/24/19 9:15 am

VILLAGES AT PASEO DEL SOL, TRACT 36483, PA 4
PRIVATE STORM DRAIN IMPROVEMENT PLAN

GENERAL NOTES

1. STANDARDS. ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF THE CURRENT EDITION OF THE CITY'S IMPROVEMENT STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION (AND SUBSEQUENT AMENDMENTS), THE CITY'S ENGINEERING AND CONSTRUCTION MANUAL, CITY CODES AND REQUIREMENTS.
2. EMERGENCY TELEPHONE NUMBERS. (ANSWERING MACHINE IS NOT ACCEPTABLE):

MIKE RUST	NEWLAND REAL ESTATE GROUP, LLC	858-217-2706
(RESPONSIBLE PERSON/DEVELOPER)	(COMPANY)	(24-HR PHONE NUMBER)
(RESPONSIBLE PERSON/CONTRACTOR)	(COMPANY)	(24-HR PHONE NUMBER)

3. LICENSE/PERMIT REQUIREMENT.
   a. PRIOR TO START OF ANY WORK, A BUSINESS LICENSE SHALL BE OBTAINED FROM THE CITY.
   b. A GRADING PERMIT SHALL BE OBTAINED, PRIOR TO ANY WORK ON PRIVATE DEVELOPMENT. THE PERMIT AND AN APPROVED SET OF IMPROVEMENT PLANS MUST BE PRESENT AT THE JOBSITE DURING CONSTRUCTION.
4. ERRORS OR OMISSIONS. APPROVAL OF THESE PLANS BY THE CITY DOES NOT RELIEVE THE APPLICANT AND ENGINEER OF RECORD FROM THE RESPONSIBILITY FOR THE CORRECTION OF ERRORS OR OMISSIONS DISCOVERED DURING CONSTRUCTION.
5. WORKING HOURS. CITY ORDINANCE NO. 94-25 STATES THAT NO PERSON SHALL ENGAGE IN OR CONDUCT CONSTRUCTION ACTIVITY, WHEN THE CONSTRUCTION SITE IS WITHIN ONE-QUARTER OF A MILE OF AN OCCUPIED RESIDENCE, BETWEEN THE HOURS OF 6:30 PM AND 6:30 AM, MONDAY THROUGH FRIDAY AND SHALL ONLY ENGAGE IN OR CONDUCT CONSTRUCTION ACTIVITY BETWEEN THE HOURS OF 7:00 AM AND 6:30 PM ON SATURDAY. NO CONSTRUCTION ACTIVITY SHALL BE UNDERTAKEN ON SUNDAY AND NATIONALLY RECOGNIZED HOLIDAYS.
6. REGULATORY AGENCY CLEARANCES. THE ISSUANCE OF A PERMIT BY THE CITY DOES NOT IMPLY OR PROVIDE ANY CLEARANCES FROM STATE OR FEDERAL AGENCIES REGULATING THE PROVISIONS OF STATE OR FEDERAL ENDANGERED SPECIES ACTS OR WATER QUALITY REGULATIONS. THE APPROPRIATE CLEARANCES FROM THESE AGENCIES SHALL BE OBTAINED PRIOR TO ANY SITE DISTURBANCE OR GRADING.
7. CONSTRUCTION CHANGE. ANY CONSTRUCTION CHANGE MUST BE FIRST SUBMITTED TO THE CITY AS A REDLINE REVISION FOR REVIEW AND APPROVAL PRIOR TO IMPLEMENTING THE CHANGE IN THE FIELD. REFER TO THE CITY'S ENGINEERING AND CONSTRUCTION MANUAL.
8. PRE-CONSTRUCTION MEETING. A PRE-CONSTRUCTION MEETING SHALL BE SCHEDULED TWO WORK DAYS PRIOR TO THE START OF CONSTRUCTION. DURING CONSTRUCTION, A DEPENDABLE AND RESPONSIVE CONTRACTOR'S REPRESENTATIVE SHALL BE AT THE JOB SITE AT ALL TIMES.
9. UTILITIES. APPROVAL OF THESE PLANS BY THE CITY DOES NOT CONSTITUTE A REPRESENTATION AS TO THE ACCURACY OR COMPLETENESS OF THE LOCATION, NOR THE EXISTENCE OR NON-EXISTENCE OF ANY UNDERGROUND UTILITIES WITHIN THE PROJECT LIMITS. ANY UTILITY DAMAGED DURING THE PERFORMANCE OF THE WORK SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE GOVERNING AGENCY BY THE CONTRACTOR, AT HIS EXPENSE.
10. SURVEY. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY THE ENGINEER OF RECORD AND TO INSTALL STREET CENTERLINE MONUMENTS, AS REQUIRED BY RIVERSIDE COUNTY ORDINANCE NO. 461. CENTERLINE TIES SHALL BE PROVIDED TO THE CITY ENGINEER, UPON COMPLETION OF THE PROJECT AND BEFORE ACCEPTANCE IS GRANTED. ALL EXISTING MONUMENTATION (DISTURBED OR DESTROYED DURING CONSTRUCTION) SHALL BE REPLACED TO CITY STANDARDS IN ACCORDANCE WITH THE LAND SURVEYORS ACT AND THE STREETS AND HIGHWAY CODE, AND AS APPROVED BY THE CITY ENGINEER. UPON REQUEST, SURVEY CUTS SHEETS SHALL BE PROVIDED TO THE CITY ENGINEER.
11. DUST CONTROL. DUST SHALL BE CONTROLLED BY WATERING OR OTHER METHODS, AS APPROVED BY THE CITY ENGINEER AND SHALL COMPLY WITH SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT'S (SCAQMD) RULE 403.
12. CONSTRUCTION FENCING. A SIX FOOT CHAIN LINK FENCE IS REQUIRED ON ALL INDUSTRIAL AND COMMERCIAL PROJECTS UNTIL ROOF SYSTEMS ARE COMPLETED OR AS DEEMED NECESSARY BY THE CITY ENGINEER FOR PUBLIC SAFETY. THE MAINTENANCE OF THE FENCE IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
13. INSPECTIONS. ALL WORK PERFORMED WITHOUT PROPER INSPECTION FROM THE CITY MAY BE SUBJECT TO REJECTION.
14. OTHER CONSTRUCTION NOTES. REFER TO SEPARATE NOTES FOR GRADING, EROSION AND SEDIMENT CONTROL, PAVING AND TRAFFIC REQUIREMENTS, IF APPLICABLE.

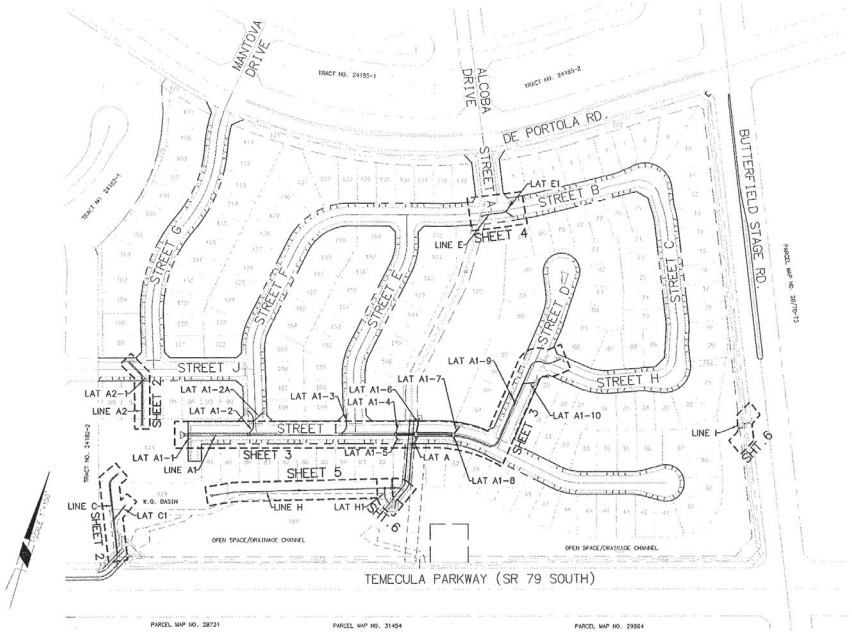
ENGINEER'S NOTICE TO CONTRACTORS

THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITIES OR STRUCTURES SHOWN ON THESE PLANS ARE OBTAINED BY SEARCH OF AVAILABLE RECORDS AND TO THE BEST OF OUR KNOWLEDGE, THERE ARE NO EXISTING UTILITIES EXCEPT THOSE SHOWN ON THIS PLAN. THE CONTRACTOR IS REQUIRED TO TAKE ALL PRECAUTIONARY MEASURES TO PROTECT THE UTILITIES SHOWN, AND ANY OTHER LINES OR STRUCTURES NOT SHOWN ON THESE PLANS, AND IS RESPONSIBLE FOR PROTECTION OF AND ANY DAMAGE TO THESE LINES OR STRUCTURES.

CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTORS WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT. INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO, DEFEND, INDEMNIFY, AND HOLD DESIGN PROFESSIONAL AND OWNER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT.

THE CONTRACTOR SHALL BE RESPONSIBLE TO REPORT DISCREPANCIES IN PLANS AND/OR FIELD CONDITIONS IMMEDIATELY TO THE DESIGN ENGINEER FOR RESOLUTION PRIOR TO CONSTRUCTION, AND SHALL BE RESPONSIBLE FOR DISCREPANCIES NOT SO REPORTED AND RESOLVED.

CAUTION: THE ENGINEER PREPARING THESE PLANS WILL NOT RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE "PLANS".



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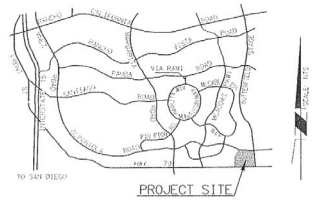
SCALE: 1"=150'

INDEX MAP
SCALE: 1"=150'


CALLE TESORO
CALLE CONTENTO
PASEO
PUEBLA
VIA RANA
VIA ANDALUCIA
VIA ENCANTO
VIA PINON
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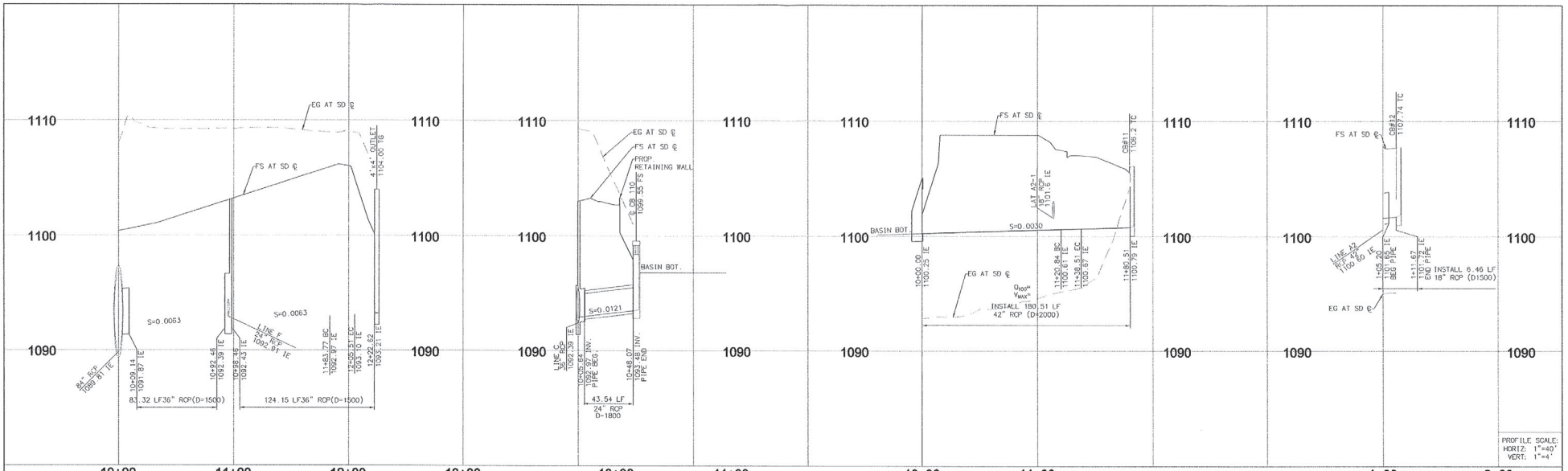
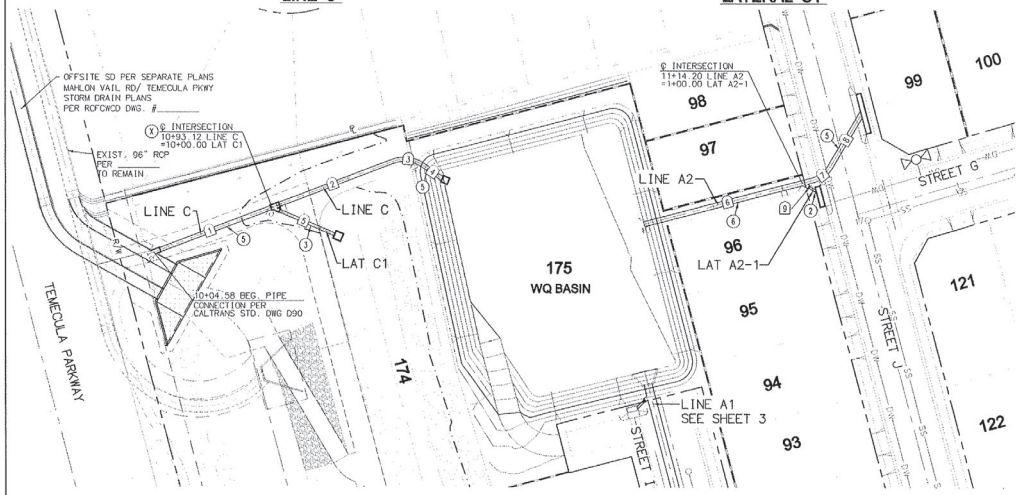


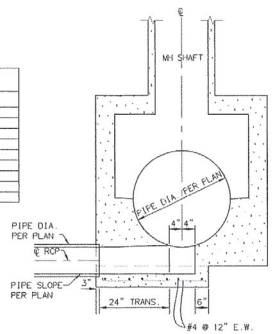


CONSTRUCTION NOTES

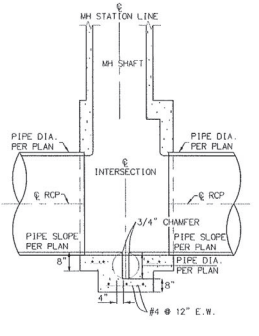
(2) INSTALL 18" RCP
(3) INSTALL 24" RCP
(5) INSTALL 36" RCP
(6) INSTALL 42" RCP

LINE/CURVE DATA TABLE

NO	BEARING/DELTA	RADIUS	LENGTH	TANGENT	NOTE
1	N22°41'53"W	---	93.12'	---	LINE C
2	N22°41'53"W	---	90.65'	---	LINE C
3	55°21'09"	22.50'	21.74'	11.80'	LINE C
4	N32°39'16"E	---	17.11'	---	LINE C
5	N21°24'49"E	---	48.07'	---	LAT C1
6	N16°56'40"W	---	120.84'	---	LINE A2
7	45°00'00"	22.50'	17.67'	9.32'	LINE A2
8	N61°56'40"W	---	42.00'	---	LINE A2
9	N28°23'20"E	---	11.67'	---	LAT A2-1



SECTION B-B
NOT TO SCALE



SECTION A-A
NOT TO SCALE

MODIFIED MANHOLE NO.1 DETAIL
NTS

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

SCALE: 1"=40'
40 20 0 40 80 120

PW17-XX

CONSTRUCTION RECORD	DATE	BY	REVISIONS	DATE	ACC'D	BENCH MARK
CONTRACTOR						RIVERSIDE COUNTY B.M. 600-6-81 INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' W OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE.
INSPECTOR						
DATE COMPLETED						

SCALE
HORIZONTAL
AS NOTED
VERTICAL
N/A

REGISTERED PROFESSIONAL ENGINEER JOHN D. TANNER III No. 60132 CIVIL STATE OF CALIFORNIA

DESIGNED BY	DRAWN BY	CHECKED BY
T.BURNSIDE	T.BURNSIDE	K. HAGHIGHI

PLANS PREPARED UNDER THE SUPERVISION OF

_____ DATE: _____

JOHN D. TANNER III
R.C.E. 60132

RECOMMENDED BY: _____ DATE: _____

ACCEPTED BY: _____ DATE: _____

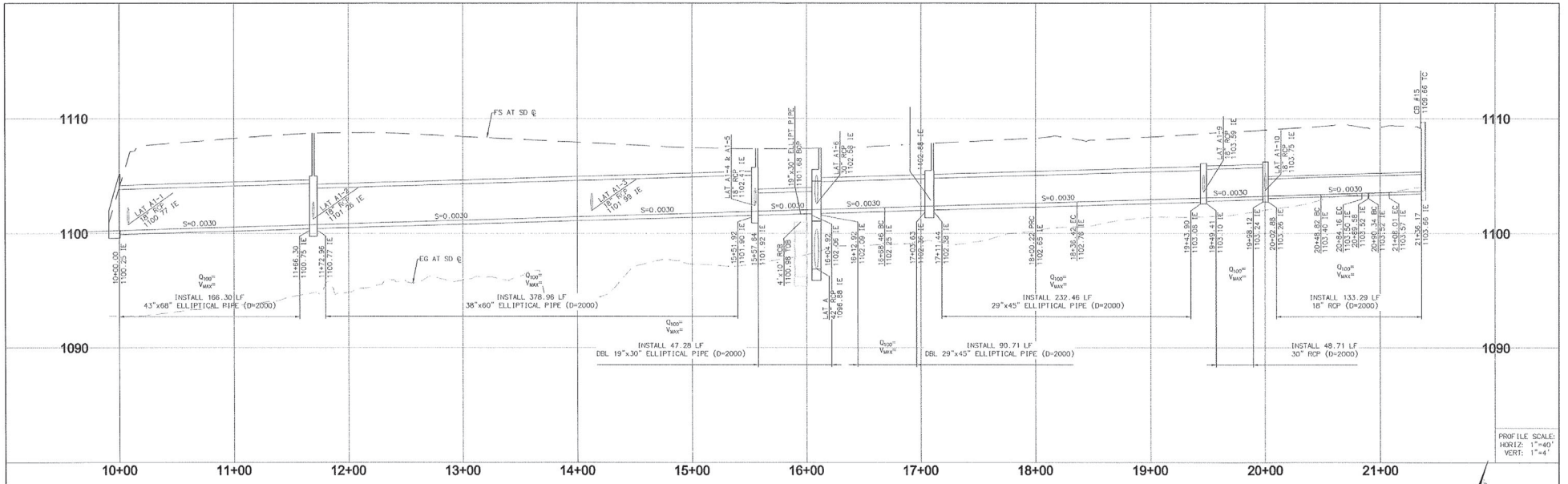
PATRICK A. THOMAS
DIRECTOR OF PUBLIC WORKS/CITY ENGINEER

CITY OF TEMECULA DEPARTMENT OF PUBLIC WORKS

PRIVATE STORM DRAIN IMPROVEMENT PLAN
VILLAGES AT PASEO DEL SOL
TRACT 36483, PA 4

SHEET NO. 2
OF 7 SHEETS

E:\EXCATS\WORKPDATA\39600\CADD\LAND D\WORKING\SD ONSITE\PRIVATE\39600-SE-002.DWG SHEVCHENKO, OLGA 12/19/2018 11:01 AM

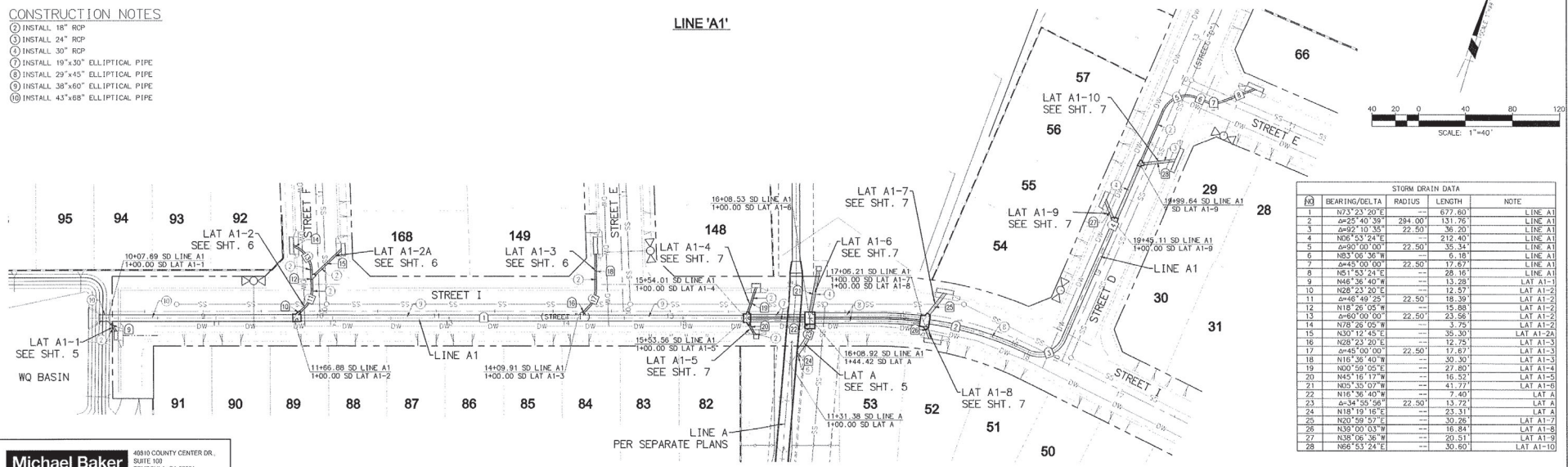


PROFILE SCALE:
HORIZ: 1"=40'
VERT: 1"=4'

CONSTRUCTION NOTES

(2) INSTALL 18" RCP
(3) INSTALL 24" RCP
(4) INSTALL 30" RCP
(7) INSTALL 19"x30" ELLIPTICAL PIPE
(8) INSTALL 29"x45" ELLIPTICAL PIPE
(9) INSTALL 38"x60" ELLIPTICAL PIPE
(10) INSTALL 43"x68" ELLIPTICAL PIPE

LINE 'A1'



STORM DRAIN DATA				
(NO)	BEARING/DELTA	RADIUS	LENGTH	NOTE
1	N73°23'20"E	---	677.60'	LINE A1
2	Δ=25°40'39"	284.00'	131.76'	LINE A1
3	Δ=92°10'35"	22.50'	36.20'	LINE A1
4	N66°53'24"E	---	212.40'	LINE A1
5	Δ=90°00'00"	22.50'	35.34'	LINE A1
6	N83°06'36"W	---	6.18'	LINE A1
7	Δ=45°00'00"	22.50'	17.67'	LINE A1
8	N51°53'24"E	---	28.16'	LINE A1
9	N46°36'40"W	---	13.28'	LAT A1-1
10	N28°23'20"E	---	12.57'	LAT A1-2
11	Δ=46°49'25"	22.50'	18.39'	LAT A1-2
12	N18°26'05"W	---	15.88'	LAT A1-2
13	Δ=60°00'00"	22.50'	23.56'	LAT A1-2
14	N78°26'05"W	---	3.75'	LAT A1-2
15	N30°12'45"E	---	35.30'	LAT A1-2A
16	N28°23'20"E	---	12.75'	LAT A1-3
17	Δ=45°00'00"	22.50'	17.67'	LAT A1-3
18	N16°36'40"W	---	30.30'	LAT A1-3
19	N00°59'05"E	---	27.80'	LAT A1-4
20	N45°16'17"W	---	16.52'	LAT A1-5
21	N05°35'07"W	---	41.77'	LAT A1-6
22	N16°36'40"W	---	7.40'	LAT A
23	Δ=34°55'56"	22.50'	13.72'	LAT A
24	N18°19'16"E	---	23.31'	LAT A
25	N20°59'57"E	---	30.26'	LAT A1-7
26	N39°00'03"W	---	16.84'	LAT A1-8
27	N38°06'36"W	---	20.51'	LAT A1-9
28	N66°53'24"E	---	30.60'	LAT A1-10

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

PW17-XX

CONSTRUCTION RECORD	DATE	BY	REVISIONS	DATE	ACC'D	BENCH MARK
CONTRACTOR						RIVERSIDE COUNTY B.M. 600-6-81 INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' W OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE
INSPECTOR						
DATE COMPLETED						

SCALE
HORIZONTAL: AS NOTED
VERTICAL: N/A

REGISTERED PROFESSIONAL ENGINEER — JOHN D. TANNER III — No. 60132 — CIVIL — STATE OF CALIFORNIA

DESIGNED BY	DRAWN BY	CHECKED BY
T.BURNSIDE	T.BURNSIDE	K. HAGHIGHI

PLANS PREPARED UNDER THE SUPERVISION OF

_____ DATE: _____

JOHN D. TANNER III
R.C.E. 60132

RECOMMENDED BY: _____ DATE: _____

ACCEPTED BY: _____ DATE: _____

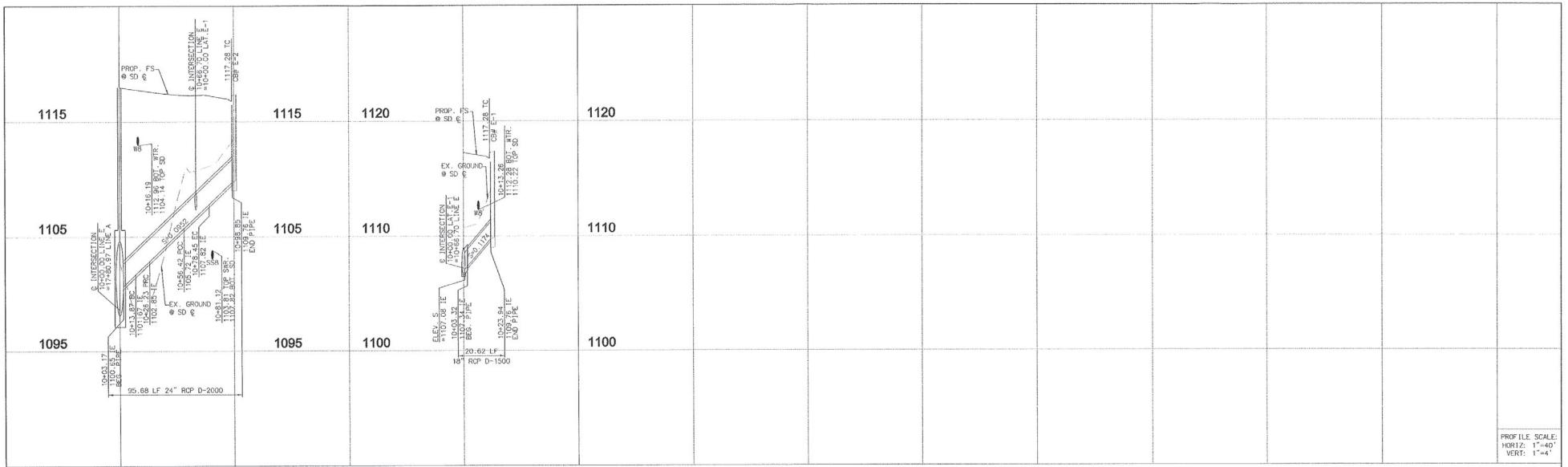
PATRICK A. THOMAS
DIRECTOR OF PUBLIC WORKS/CITY ENGINEER

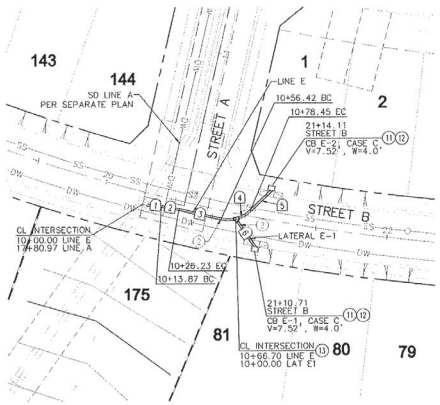
CITY OF TEMECULA — DEPARTMENT OF PUBLIC WORKS

PRIVATE STORM DRAIN IMPROVEMENT PLAN
VILLAGES AT PASEO DEL SOL
TRACT 36483, PA 4

SHEET NO. 3
OF 7 SHEETS

E:\TEMECAT\PS_HYD\TTPDATA\139600\CADD\LAND DEV\IMPROVE SD (OFFSITE PRIVATE)\139600-SD-003.DWG SHEIC-HENRY, OLIVIA 12/19/2018 10:55 AM





LINE 'E' PLAN

DIMENSIONS FOR JUNCTION STRUCTURE NO. 2 (STD. DWG. NO. JS227)											
MAIN LINE STA.	CONNECTING LAT.	A	B	C	D	E	F	G	L	ELEV. R	ELEV. S
10+66.70	LATERAL E1	69°50'	18"	3.74'	24"	1.56'	0.54'	0.44'	2.27'	1107.34	1107.08

LINE/CURVE DATA TABLE					
NO	BEARING/DELTA	RADIUS	LENGTH	TANGENT	NOTE
1	N59°10'00"E	--	13.87'	--	℄ LINE E
2	07°52'12"	90.00'	12.36'	6.19'	℄ LINE E
3	01°23'59"	1236.00'	30.20'	15.10'	℄ LINE E
4	56°05'29"	22.50'	22.03'	11.99'	℄ LINE E
5	N09°32'44"E	--	20.39'	--	℄ LINE E
6	N70°41'54"W	--	23.94'	--	℄ LAT E1

CONSTRUCTION NOTES

(2) INSTALL 18" RCP
(11) CONSTRUCT CATCH BASIN NO.1 PER RCTD STD. NO. 300 (H & W PER PLAN)
(12) CONSTRUCT LOCAL DEPRESSION PERRCTD STD. NO. 311
(13) CONSTRUCT JUNCTION STRUCTURE NO.2 PER RCTD & WCD STD. NO. JS227

40 20 0 40 80 120
SCALE: 1"=40'

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR.
SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

PW17-XX

CONSTRUCTION RECORD	DATE	BY	REVISIONS	DATE	ACC'D	BENCH MARK
CONTRACTOR						RIVERSIDE COUNTY B.M. 600-6-81
INSPECTOR						INSIDE FREEWAY R/W AT THE SW
DATE COMPLETED						CORNER OF THE INT. OF HWY. 79
						AND I-15E. 300' W OF OVERPASS
						BRIDGE, 87.9' SE OF BEG. OF 6'
						FWY. R/W FENCE, 2' N OF FWY.
						R/W FENCE 75.4' S OF LIGHT POLE.

SCALE: HORIZONTAL: AS NOTED; VERTICAL: N/A

REGISTERED PROFESSIONAL ENGINEER JOHN D. TANNER III No. 60132 CIVIL STATE OF CALIFORNIA

DESIGNED BY	DRAWN BY	CHECKED BY
T.BURNSIDE	T.BURNSIDE	K. HAGHIGHI

PLANS PREPARED UNDER THE SUPERVISION OF
DATE:
JOHN D. TANNER III
R.C.E. 60132

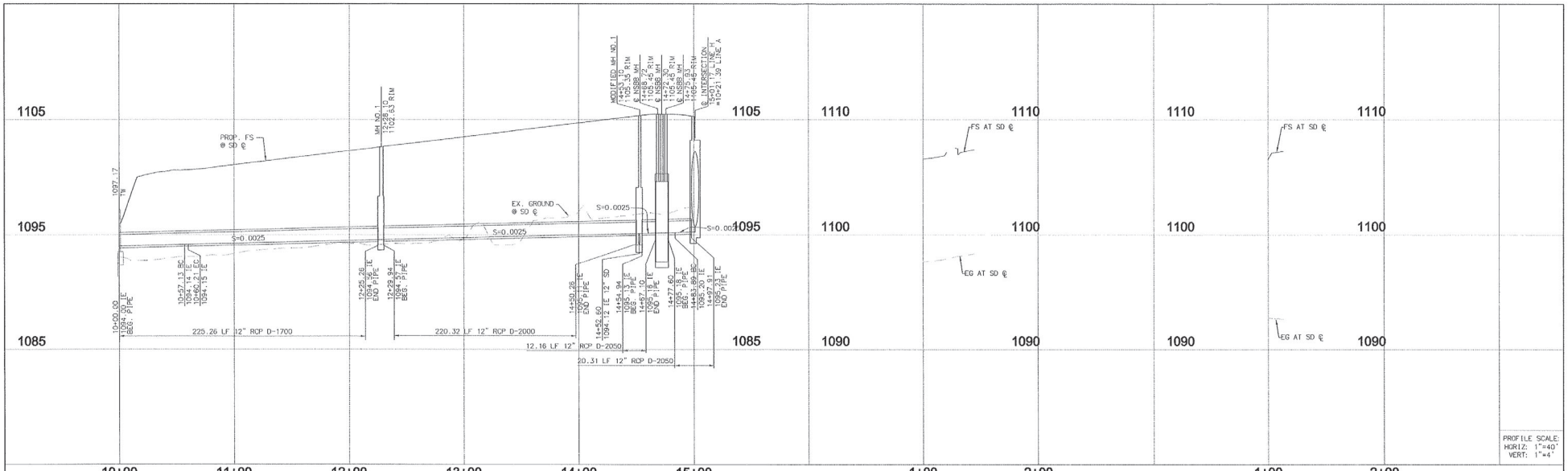
RECOMMENDED BY: DATE:
ACCEPTED BY: DATE:
PATRICK A. THOMAS
DIRECTOR OF PUBLIC WORKS/CITY ENGINEER

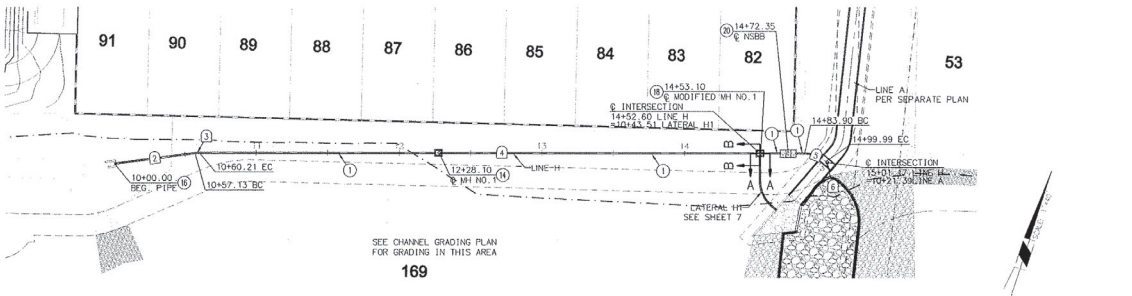
CITY OF TEMECULA DEPARTMENT OF PUBLIC WORKS

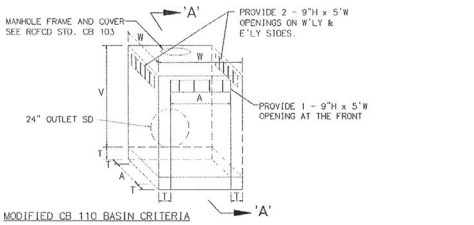
PRIVATE STORM DRAIN IMPROVEMENT PLAN
VILLAGES AT PASEO DEL SOL
TRACT 36483, PA 4

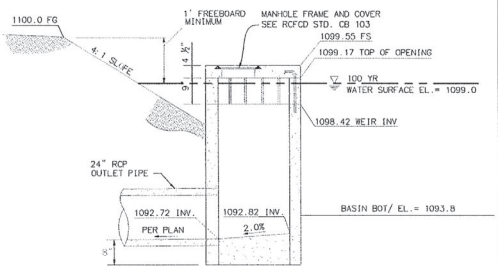
SHEET NO. 4 OF 7 SHEETS

T:\TEMECA\FSI\480071\PDATA\139603\CADD\LAND DEV\IMPROVE\SD\ONSITE\PRIVATE\139600-SD-004.DWG SHEYC-ENRO, OLGA 12/19/2019 10:56 AM









SECTION A-A
N.T.S.

LINE/CURVE DATA TABLE					
NO	BEARING/DELTA	RADIUS	LENGTH	TANGENT	NOTE
1	N21°24'49"E	--	48.07'	--	℄ LINE F
2	N64°34'27"E	--	57.13'	--	℄ LINE H
3	08°48'53"	20.00'	3.08'	1.54'	℄ LINE H
4	N72°00'32"E	--	423.69'	--	℄ LINE H
5	40°58'49"	22.50'	16.09'	8.41'	℄ LINE H
6	N67°00'43"W	--	1.17'	--	℄ LINE H

CONSTRUCTION NOTES

(1) INSTALL 12" RCP
(14) CONSTRUCT MANHOLE NO. 1 PER RCFC & WCD STD. DWG. NO. MH251
(16) CONSTRUCT PIPE CULVERT HEADWALL PER CALTRANS STD. NO. D89
(18) CONSTRUCT MODIFIED MANHOLE NO. 1 PER RCFC & WCD STD. DWG. NO. MH251 AND DETAIL ON SHEET 2
(20) INSTALL BIOCLEAN HYDRODYNAMIC SEPERATOR MODEL NSBB-5-10.5-84 PER BIOCLEAN STD. DETAIL

(XX) MODIFIED CB110 DROP INLET STRUCTURE
NOT TO SCALE

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR.
SUITE 100
TEMECULA, CA 92591
PHONE (951) 676-8042
MBAKERINTL.COM

PW17-XX

CONSTRUCTION RECORD	DATE	BY	REVISIONS	DATE	ACC'D	BENCH MARK
CONTRACTOR						RIVERSIDE COUNTY B.M. 600-6-81 INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' W OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE.
INSPECTOR						
DATE COMPLETED						

SCALE
HORIZONTAL
AS NOTED
VERTICAL
N/A

REGISTERED PROFESSIONAL ENGINEER — JOHN D. TANNER III — No. 60132 — CIVIL — STATE OF CALIFORNIA

DESIGNED BY	DRAWN BY	CHECKED BY
T.BURNSIDE	T.BURNSIDE	K. HAGHIGHI

PLANS PREPARED UNDER THE SUPERVISION OF

DATE:

JOHN D. TANNER III
R.C.E. 60132

RECOMMENDED BY: DATE:

ACCEPTED BY: DATE:

PATRICK A. THOMAS
DIRECTOR OF PUBLIC WORKS/CITY ENGINEER

CITY OF TEMECULA DEPARTMENT OF PUBLIC WORKS

PRIVATE STORM DRAIN IMPROVEMENT PLAN
VILLAGES AT PASEO DEL SOL
TRACT 36483, PA 4

SHEET NO. 5
OF 7 SHEETS

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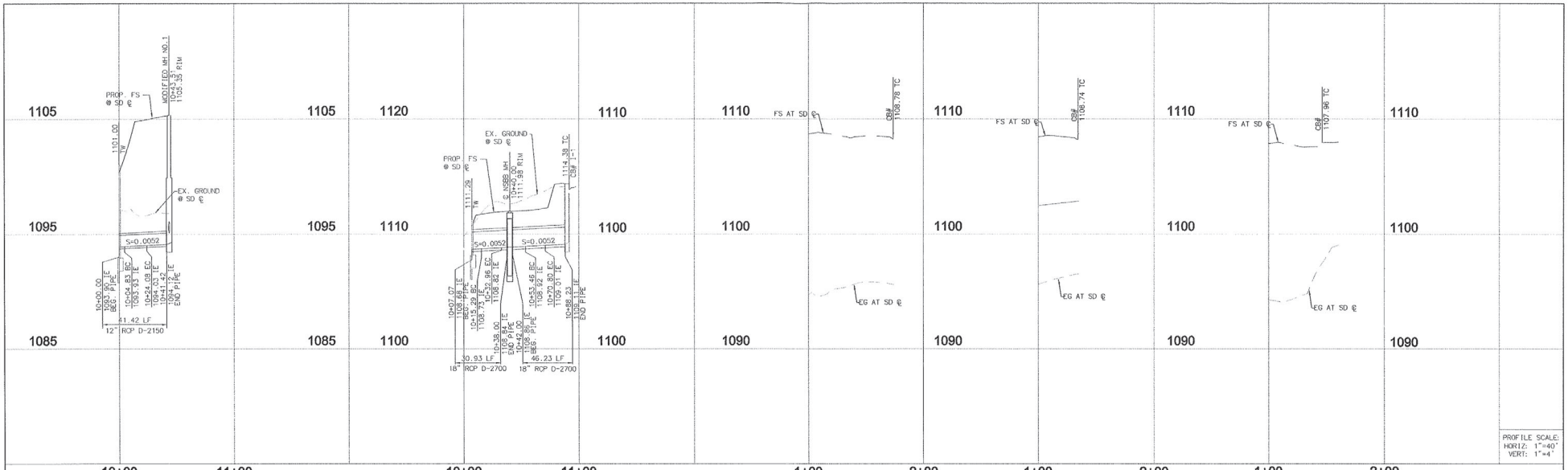

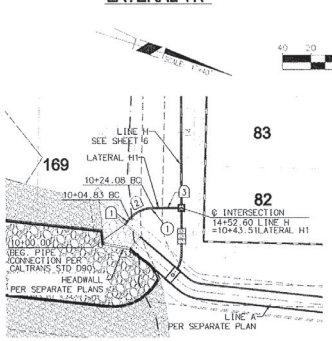

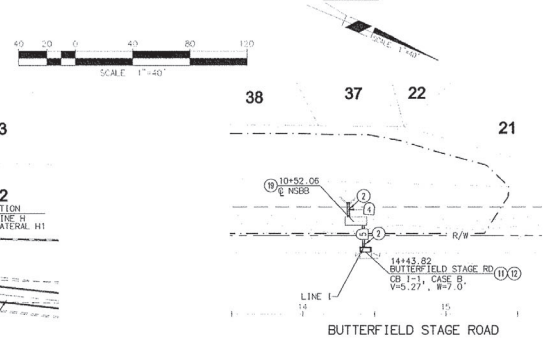

STORM DRAIN DATA				
NO	BEARING/DELTA	RADIUS	LENGTH	NOTE
1	N67°00'43"W	--	4.83'	LAT H1
2	Δ=49°01'11"	22.50'	19.25'	LAT H1
3	N17°59'32"W	--	19.43'	LAT H1
4	N66°13'25"E	--	10.02'	LINE I
5	N66°13'25"E	--	39.60'	LINE I

CONSTRUCTION NOTES

(1) INSTALL 12" RCP
(2) INSTALL 18" RCP
(11) CONSTRUCT CATCH BASIN NO.1 PER RCTD STD. NO. 300 (H & W PER PLAN)
(12) CONSTRUCT LOCAL DEPRESSION PERRCTD STD. NO. 311
(19) INSTALL BIOCLEAN HYDRODYNAMIC SEPERATOR MODEL NSBB-2.5-4-60 PER BIOCLEAN STD. DETAIL

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR.,
SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

PW17-XX

CONSTRUCTION RECORD	DATE	BY	REVISIONS	DATE	ACC'D
CONTRACTOR					
INSPECTOR					
DATE COMPLETED					

BENCH MARK
RIVERSIDE COUNTY B.M. 600-6-81
INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' W OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE.

SCALE
HORIZONTAL
AS NOTED
VERTICAL
N/A

JOHN D. TANNER III — No. 60132 — REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

DESIGNED BY	DRAWN BY	CHECKED BY
T.BURNSIDE	T.BURNSIDE	K. HAGHIGHI

PLANS PREPARED UNDER THE SUPERVISION OF

_____ DATE: _____
JOHN D. TANNER III
R.C.E. 60132

RECOMMENDED BY: _____ DATE: _____

ACCEPTED BY: _____ DATE: _____
PATRICK A. THOMAS
DIRECTOR OF PUBLIC WORKS/CITY ENGINEER

CITY OF TEMECULA DEPARTMENT OF PUBLIC WORKS

PRIVATE STORM DRAIN IMPROVEMENT PLAN
VILLAGES AT PASEO DEL SOL
TRACT 36483, PA 4

SHEET NO. 6
OF 7 SHEETS

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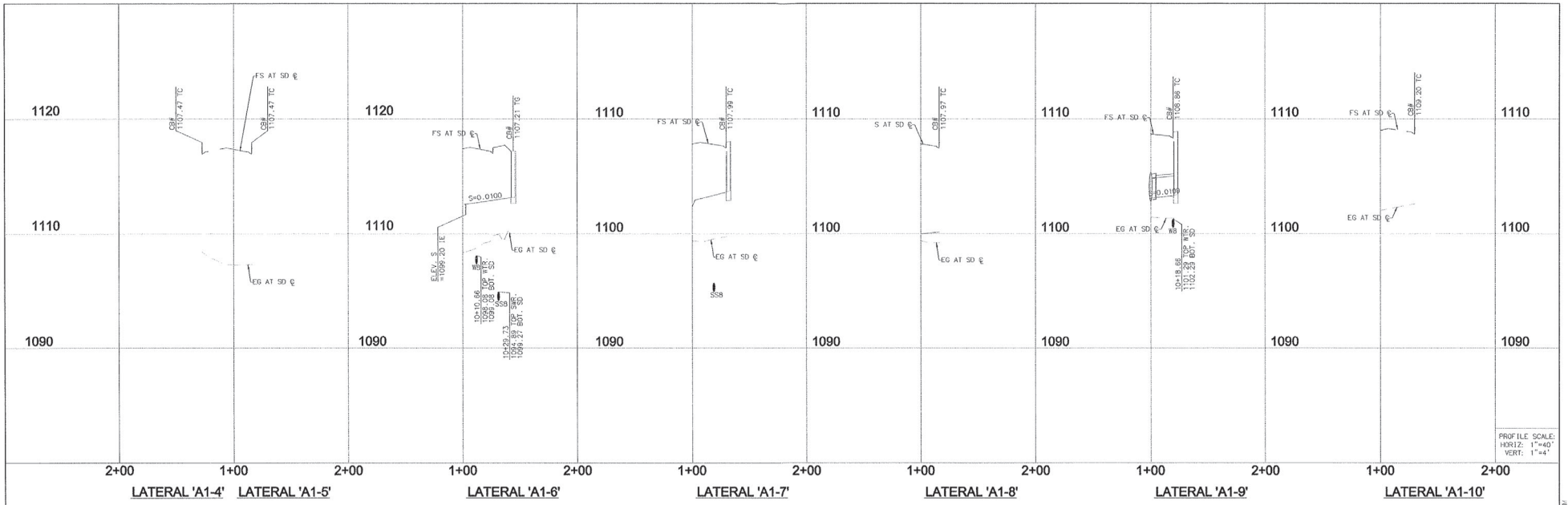

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR.
SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

PW17-XX

CONSTRUCTION RECORD	DATE	BY	REVISIONS	DATE	ACC'D
CONTRACTOR					
INSPECTOR					
DATE COMPLETED					

BENCH MARK
RIVERSIDE COUNTY B.M. 600-6-81
INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E., 300' W OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE.

SCALE
HORIZONTAL
AS NOTED
VERTICAL
N/A

REGISTERED PROFESSIONAL ENGINEER — JOHN D. TANNER III — No. 60132 — CIVIL — STATE OF CALIFORNIA

DESIGNED BY	DRAWN BY	CHECKED BY
T.BURNSIDE	T.BURNSIDE	K. HAGHIGHI

PLANS PREPARED UNDER THE SUPERVISION OF

_____ DATE: _____
JOHN D. TANNER III
R.C.E. 60132

RECOMMENDED BY: _____ DATE: _____

ACCEPTED BY: _____ DATE: _____
PATRICK A. THOMAS
DIRECTOR OF PUBLIC WORKS/CITY ENGINEER

CITY OF TEMECULA DEPARTMENT OF PUBLIC WORKS

PRIVATE STORM DRAIN IMPROVEMENT PLAN
VILLAGES AT PASEO DEL SOL
TRACT 36483, PA 4

SHEET NO. 7
OF 7 SHEETS

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ATTACHMENT 6

Copy of Project's Drainage Report

Use this checklist to ensure the required information has been included on the Drainage Report:

X The project is required to prepare and submit a CEQA Drainage Study in compliance with Riverside County Flood Control and Water Conservation District Hydrology Manual: http://rcflood.org/downloads/Planning/Hydrology%20Manual%20-%20Complete.pdf
In addition to the guideline, the study shall include the following but not limited to:

X The final CEQA Drainage report shall be signed, stamped and dated by the responsible Registered Civil Engineer.

X In the narrative of the report please provide a summary table of: pre- and post- development C, Tc, I, A, V100, Q100 without mitigation and Q100 with mitigation for each area (or point) where drainage discharges from the project. Peak runoff rates (cfs), velocities (fps) and identification of all erosive velocities (at all points of discharge) calculations for pre-development and post-development. The comparisons should be made about the same discharge points for each drainage basin affecting the site and adjacent properties.

X Summary/Conclusion: Please discuss whether the proposed project would substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site? Provide reasons and mitigations proposed.

X Discuss whether the proposed project would substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site? Provide reasons and mitigations proposed.

X Discuss whether the proposed project would create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems. Provide reasons and mitigations proposed.

X Discuss whether the proposed project would place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map, including County Floodplain Maps. Provide reasons and mitigations proposed.

X Discuss whether the proposed project would place structures within a 100-year flood hazard area, which would impede or redirect flood flows.

X Discuss whether the proposed project would expose people or structures to a significant risk of loss, injury or death involving flooding as a result of the failure of a levee or dam.

X Provide existing and proposed Hydrology Maps for each phase. The maps shall show existing and proposed culverts, discharge point with A & Q, flow path direction for each drainage basin. Show existing FEMA floodplain/floodway which flow through the property. A minimum map size is 11"x17".

X Provide Hydrologic Soil Group Map.
X Provide Rainfall Isopluvials for 100 Year Rainfall Event - 6 Hours and 24 Hours Maps.
X The report should have numbered pages and a corresponding Table of Contents.
☐ Improvements within City Public Right-of-Way have been designed in accordance with Appendix K: Guidance on Green Infrastructure.
BMP's have been designed to safely convey the 100-year flood

If hardcopy or CD is not attached, the following information should be provided:

Title:
Prepared By:
Date:

PRELIMINARY HYDROLOGY AND HYDRAULICS STUDY FOR THE VILLAGES AT PASEO DEL SOL

TTM 36483 – PLANNING AREA 4

CITY OF TEMECULA
CALIFORNIA

PREPARED FOR:

CAL-PASEO DEL SOL, LLC.
4790 EASTGATE MALL SUITE 150
SAN DIEGO, CA 92121
(858) 217-2706

PREPARED BY:

JLC Engineering & Consulting, Inc.
36263 CALLE DE LOBO
MURRIETA, CA 92562
(951) 304-9552 • FAX (951) 304-3568

DATE PREPARED:
DECEMBER 10, 2016
REVISED:
MAY 17, 2019
JUNE 6, 2019

This report has been prepared by or under the direction of the following registered civil engineer who attests to the technical information contained herein. The registered civil engineer has also judged the qualifications of any technical specialists providing engineering data upon which recommendations, conclusions, and decisions are based.

Joseph L. Castaneda RCE 59835 Registered Civil Engineer	05/17/2019 Date	Seal

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III. HYDROLOGY ANALYSIS 2
IV. HYDRAULIC ANALYSIS 3
V. CONCLUSIONS 5
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APPENDIX A.2: AREA B
APPENDIX A.3: AREA C
APPENDIX A.4: AREA D
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EXCERPT D: MAHLON VAIL ROAD/TEMECULA PARKWAY STORM DRAIN PLANS

EXHIBITS

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EXHIBIT B: DRAINAGE FACILITIES MAP
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EXHIBIT D: RAINFALL MAPS
EXHIBIT E: SLOPE OF INTENSITY DURATION CURVES

PRELIMINARY HYDROLOGY AND HYDRAULICS STUDY FOR THE VILLAGES AT PASEO DEL SOL TTM 36483 – PLANNING AREA 4 CITY OF TEMECULA, CALIFORNIA

I. INTRODUCTION

The Villages at Paseo Del Sol is a Specific Plan (Specific Plan No. 219, Amendment No. 8) which is located in the City of Temecula. This report is specifically for Planning Area 4A of the Specific Plan, also referred to as Tentative Tract Map 36483. Planning area 4A proposes to construct approximately 43 acres of medium-high density residential development. The scope of this report includes:

- Determine the peak 100-year peak flow rates for post-project conditions for onsite areas using the Riverside County Flood Control and Water Conservation District (RCFC & WCD) Rational Method.
- Determine the required storm drain improvements to flood protect the site.
- Preparation of a hydrology and hydraulic report, which consists of hydrological and analytical results and exhibits

II. PROJECT SITE AND DRAINAGE OVERVIEW

The Villages at Paseo Del Sol – TTM 36483 – Planning Area 4A, is a proposed medium-high density residential development located in the City of Temecula. The project site is roughly bounded by De Portola Road to the north, Butterfield Stage Road to the east, Temecula Parkway to the south, and residential development to the west.

The project site has been previously graded, and incorporates fill, earthen drainage ditches, and minor erosion control for the fill area. Currently, the project site discharges into the existing Line "S" Storm Drain system located within Temecula Parkway. The Line "S" Storm Drain is an 84" – 96" MS4 Facility maintained by Riverside County Flood Control and Water Conservation District. The Line "S" Storm Drain discharges directly into the Temecula Creek Channel (see Line "S" storm drain plans in Excerpt "A"). The offsite storm drain improvements have been analyzed as part of a separate report. This report supports the calculations and analyses for the onsite area only. The post-project onsite area will discharge into the proposed Line "A" Storm Drain system, which connects to the existing Line "A" Storm Drain (see Excerpt B) at De Portola Road and traverses the project site to the south, where it connects with the existing Line "S" Storm Drain.

The project site will construct medium-high density residential homes, a biofiltration basin, a subsurface basin and a modular wetlands for water quality treatment. The project site will also address hydromodifications as required by the Water Quality Management Plan. The water quality treatment has been discussed in the Water Quality Management Plan, and the hydromodification analyses has been included in a separate study.

The project did not require a pre-project condition analyses since the project is draining to existing MDP facilities, and have been designed for the ultimate build out of the tributary area. Any minor increase in flow rates will not adversely impact the design of the MDP system. The project is not within a 100-year flood hazard.

III. HYDROLOGY ANALYSIS

The RCFC & WCD Hydrology Manual (Reference 1) was used to develop the hydrological parameters for the rational method. The calculations were performed using the computer program developed by Civil Cadd/Civil Design.

The existing soil types are Soils A and D, and is shown in Exhibit C. Exhibit C is a Hydrologic Soils Map which was obtained from the United States Department of Agriculture, Natural Resources Conservation Service (NRCS) WebSoil Survey.

The following rainfall depths (in inches) were utilized in the hydrology analyses, which were obtained from the RCFC & WCD Hydrology Manual's Isohyetal Maps:

Storm Event	1-Hour Duration
2-Year	0.55
100-Year	1.30

The slope value used for the rational method value is 0.55. The rainfall maps have been included Exhibit D, and the slope of intensity duration curves have been included as Exhibit E.

The onsite watershed areas have been designated as areas A and B. Area A is tributary to the Line A1 and A2 systems, and Area B is the area tributary to the Line A2 systems. The onsite area was analyzed as condominium development, since this project site is medium-high density residential. The average lot size ranges from 5,200 sq. ft. to 7,000 sq. ft., which is smaller than the smallest lots for single family residential (1/4 acre residential). Therefore, the next higher impervious cover is associated with condominiums, per the RCFC&WCD Hydrology Manual.

Area A was broken into two separate areas with Area A1 being the area tributary to the splitter structure and Area A2 being the remainder of Area A. This was done in order to obtain a flow rate for the splitter structure, and then being able to add the flow rate through the splitter structure directly to the flows in the storm drain system downstream of the structure. Both hydrology models have been included in Appendix A.

Areas C through E are the offsite street areas. Butterfield Stage Road and De Portola

Road are tributary to existing catch basins, and Temecula Parkway flows continue to the south west to a catch basin approximately 280 feet downstream of the project site. The existing catch basins have all been sized for the ultimate tributary flow rate.

The rational method hydrology calculations have been included in Appendix A, and the rational method hydrology map has been included as Exhibit A.

IV. HYDRAULIC ANALYSIS

The proposed project will incorporate subsurface storm drain to convey the flows generated from the onsite area. The offsite storm drain systems are being designed and analyzed per a separate study. During the preliminary stages, the storm drain systems were sized using normal depth calculations and a minimum slope of 0.5%, with the exception of the Line A1 storm drain crossing the Line A extension. During final engineering, the storm drain systems will be analyzed using the Water Surface Profile Gradient Program and downstream water surface elevations obtained from the Line A system and southerly channel system. The catch basins were sized using normal depth calculations, and detailed catch basin flow by analyses were calculated to determine the intercepted flows and corresponding pipe flow rates.

Street capacity calculations were performed in order to access the flooding within the streets, and ensure that the flows meet the following street design criteria:

- 10-year storm event flows shall be contained within the top of curb elevation
- 100-year storm event flows shall be contained within the right-of-way elevation

These parameters controlled the location in which catch basins were required. For locations other than low points, catch basins were provided when the abovementioned street criteria was exceeded. Due to the street section being a 60' width right-of-way to right-of-way, the centerline depth is 0.55 feet above the gutter flow line, and the top of curb is 0.50 feet above the gutter flow line, therefore the 10-year flows will be contained within one side of the street. Rating tables for the street capacity calculations for various slopes have been included in Appendix B.

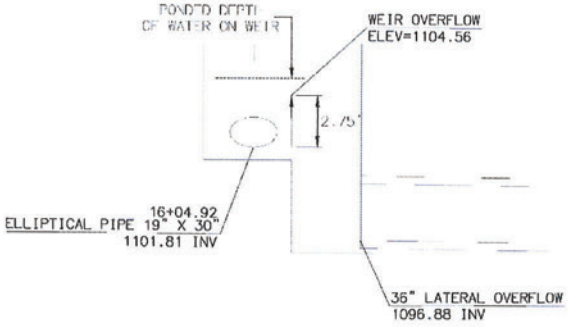
Once the location of the catch basins were determined, the catch basin sizing calculations were performed, and a spreadsheet summarizing the intercepted vs. by-pass flows was prepared. The following paragraphs document key factors in the hydraulic analyses.

The half street capacity at Catch Basin #1 is 10.51 ft^3/s, therefore an additional 1.36 ft^3/s will overtop the centerline to Catch Basin #2. A catch basin flow by summary table has been provided in Appendix B.

During the preliminary stages, soffit control spreadsheets were utilized to size the storm drain systems. The downstream water surface elevation within the basin was obtained from a weir equation that utilized a 16 foot weir with a flow line elevation of 1104.00 (which was obtained from the Technical Memorandum: SWMM Modeling for Hydromodification Compliance of: Villas at Paseo del Sol, Temecula, CA, prepared by REC Consultants, and has been included as an attachment to the Water Quality Management Plan). Using these parameters, the resulting 100-year water surface elevation over the weir is 1105.26, and is the starting water surface elevation for Lines A1 and A2.

Due to the elevations of the storm drain and the starting water surface elevation, Line A1 had to incorporate elliptical pipe and some double elliptical pipe due to cover issues and crossing the main Line A system. The flow rates within the systems were based upon the hydrology flow rates for the mainlines (systems with more than one reach) and the intercepted flow rates for the laterals (one reach systems).

The elevations of the site and the requirement for the crossing of Line A resulted in the design of a splitter structure that would allow for low flows to bypass to the biofiltration basin, and for flows in excess to pass to Lateral A1 and discharge directly into the Line A system. In order to determine the flows that are tributary to the low flow system and the bypass system, an iterative calculation had to be performed using a nomograph for the low flow and a weir equation for the overtopping flows. The baffle wall inside the splitter structure is 2.75 feet higher than the invert of the 24" equivalent pipe. Therefore, the depth of water at the upstream end of the 24" pipe would be 2.75 feet more than the depth of water on top of the weir, as shown in the figure below:



An iteration was performed until the depth of water at the 24" pipe was equal to the depth of water on the weir plus 2.75 feet. Based upon a nomograph (included in Appendix B), a flow rate of 23 ft^3/s would result in an approximate depth of 3.50 feet (elevation 1105.31). The remaining flow rate through the weir would be 33.76 ft^3/s

minus 23.00 ft^3/s, equaling 10.76 ft^3/s. Using an 8 foot weir length, the resulting ponded depth on the weir is 0.59 feet. The weir invert elevation is 1104.56, resulting in a water surface elevation of 1105.15. This is only 0.16 feet off from the nomograph water surface elevation of 1105.31, and therefore the flows are nearly balanced within the structure. The 23.00 ft^3/s was added to the flow rates within the pipe downstream of the structure directly. It should be noted that the flow rate of 23.00 ft^3/s is based upon a singular 24" pipe (or equivalent elliptical pipe), however, the required pipe to convey the flows downstream (due to upstream water surface elevations at Catch Basins #3 and #4). During final engineering, the exact design of this will be determined, and that the analyses and design are consistent.

The Lateral A bypass storm drain utilized a starting water surface elevation that was obtained from the Tentative Tract Map 36483 Storm Drain Plan for Line "A", and was interpolated to be approximately 1104.50. The upstream water surface elevation for Lateral A could not exceed 1104.56 (which is the flow line elevation of the baffle wall/weir located inside of the splitter structure), and based upon the calculations using a 42" storm drain, the upstream water surface elevation is 1104.53, therefore the splitter structure will function in the 100-year condition. The downstream water surface elevation for the Line B system was also obtained from the Line A improvement plans, and was interpolated to be approximately 1106.50. The Line C storm drain utilized the soffit elevation as the starting water surface elevation, since the water surface elevation in the channel is significantly lower than the storm drain. This would result in the most conservative storm drain size.

The lateral storm drain systems utilized a minimum slope of 0.5% for the preliminary analyses. During final engineering, detailed water surface profile gradient program calculations (and additional hydraulic calculations as needed) will be provided.

The street capacity calculations, catch basin sizing calculations, catch basin flow-by summary table, and storm drain sizing calculations have been included in Appendix B. The Drainage Facilities Map has been included as Exhibit B.

V. CONCLUSIONS

Preliminary hydrology and hydraulic analyses were performed for the Villages at Paseo Del Sol – TTM 36483 – Planning Area 4A to determine the required storm drain to flood protect the site and meet the street flooding criteria. The following can be concluded:

1. The limits of storm drain allow for the 10-year flows to be contained within the top-of-curb elevation and the 100-year flows to be contained within the right-of-way elevation.

2. The proposed storm drain systems will adequately convey the proposed 100-year flow rates.

VI. REFERENCES

1. Riverside County Flood Control and Water Conservation District Hydrology Manual, April 1978.
2. Los Angeles County Flood Control Design Manual, March 1982

FIGURES

FIGURE 1: VICINITY MAP

N

VILLAGES AT PASEO DEL SOL - PLANNING AREA 4
VICINITY MAP

JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

FIGURE 1

Drawing Name: O:\108.30.13\Engineering\Hydrology_Plan\Exhibits\Vicinity Map.dwg
Last Opened: Dec 13, 2018 - 11:58am by jcarver

APPENDICES

APPENDIX A: POST-PROJECT CONDITION ONSITE RATIONAL METHOD HYDROLOGY ANALYSIS

APPENDIX A.1: AREA A

100-YEAR

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
Rational Hydrology Study Date: 05/17/19 File:ARA1100.out

108.30.13
100-YEAR RATIONAL TABLING METHOD
POST PROJECT CONDITION FOR AREA A1
ARA1100.RRV

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6279

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation = 0.550(In.)
100 year, 1 hour precipitation = 1.300(In.)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.300(In/Hr)
Slope of intensity duration curve = 0.5500

++

Process from Point/Station 101.000 to Point/Station 102.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 728.000(Ft.)
Top (of initial area) elevation = 1125.000(Ft.)
Bottom (of initial area) elevation = 1113.300(Ft.)
Difference in elevation = 11.700(Ft.)
Slope = 0.01607 s(percent)= 1.61
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.799 min.
Rainfall intensity = 3.180(In/Hr) for a 100.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.861
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 75.00
Pervious area fraction = 0.350; Impervious fraction = 0.650
Initial subarea runoff = 5.615(CFS)
Total initial stream area = 2.050(Ac.)
Pervious area fraction = 0.350

++

Process from Point/Station 102.000 to Point/Station 103.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 1113.300(Ft.)
End of street segment elevation = 1109.500(Ft.)
Length of street segment = 413.000(Ft.)

```
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.083
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      8.839(CFS)
Depth of flow =   0.468(Ft.), Average velocity =   2.657(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  10.763(Ft.)
Flow velocity =   2.66(Ft/s)
Travel time =    2.59 min.     TC =   14.39  min.
 Adding area flow to street
CONDOMINIUM subarea type
Runoff Coefficient = 0.858
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Rainfall intensity =      2.851(In/Hr) for a   100.0 year storm
Subarea runoff =      6.259(CFS) for      2.560(Ac.)
Total runoff =     11.874(CFS)       Total area =       4.610(Ac.)
Street flow at end of street =     11.874(CFS)
Half street flow at end of street =      5.937(CFS)
Depth of flow =   0.510(Ft.), Average velocity =   2.752(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    0.48(Ft.)
Flow width (from curb towards crown)=  12.846(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      106.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1105.500(Ft.)
Downstream point/station elevation =  1105.000(Ft.)
Pipe length  =    31.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.874(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    11.874(CFS)
Normal flow depth in pipe =   13.22(In.)
Flow top width inside pipe =   15.90(In.)
Critical Depth =   15.71(In.)
Pipe flow velocity =      8.53(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    14.45 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      106.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      4.610(Ac.)
Runoff from this stream =     11.874(CFS)
Time of concentration =   14.45 min.
Rainfall intensity =     2.844(In/Hr)
Program is now starting with Main Stream No. 2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```

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Process from Point/Station      104.000 to Point/Station      105.000
**** INITIAL AREA EVALUATION ****
-------------------------------------------------------------------------
Initial area flow distance =   766.000(Ft.)
Top (of initial area) elevation =  1119.100(Ft.)
Bottom (of initial area) elevation =  1109.700(Ft.)
Difference in elevation =     9.400(Ft.)
Slope =    0.01227  s(percent)=       1.23
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.709 min.
Rainfall intensity =      3.053(In/Hr) for a   100.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.860
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      4.069(CFS)
Total initial stream area =        1.550(Ac.)
Pervious area fraction = 0.350


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
-------------------------------------------------------------------------
Upstream point/station elevation =  1105.700(Ft.)
Downstream point/station elevation =  1105.000(Ft.)
Pipe length  =   137.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.069(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     4.069(CFS)
Normal flow depth in pipe =   10.93(In.)
Flow top width inside pipe =   13.34(In.)
Critical Depth =    9.80(In.)
Pipe flow velocity =      4.25(Ft/s)
Travel time through pipe =    0.54 min.
Time of concentration (TC) =    13.25 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** CONFLUENCE OF MAIN STREAMS ****
-------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.550(Ac.)
Runoff from this stream =      4.069(CFS)
Time of concentration =   13.25 min.
Rainfall intensity =     2.984(In/Hr)
Summary of stream data:

Stream    Flow rate      TC            Rainfall Intensity
 No.        (CFS)       (min)                 (In/Hr)


1        11.874      14.45                2.844
2         4.069      13.25                2.984
Largest stream flow has longer time of concentration
Qp =     11.874 + sum of
          Qb          Ia/Ib
           4.069 *    0.953 =      3.879
Qp =     15.753

Total of 2 main streams to confluence:
Flow rates before confluence point:
      11.874       4.069
Area of streams before confluence:
        4.610        1.550
```

```
Results of confluence:
Total flow rate =      15.753(CFS)
Time of concentration =     14.450 min.
Effective stream area after confluence  =       6.160(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      108.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1105.000(Ft.)
Downstream point/station elevation =  1104.000(Ft.)
Pipe length  =     55.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     15.753(CFS)
Nearest computed pipe diameter  =      21.00(In.)
Calculated individual pipe flow  =     15.753(CFS)
Normal flow depth in pipe =    13.41(In.)
Flow top width inside pipe =    20.18(In.)
Critical Depth =    17.59(In.)
Pipe flow velocity =       9.71(Ft/s)
Travel time through pipe =     0.09 min.
Time of concentration (TC) =     14.54 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      108.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =       6.160(Ac.)
Runoff from this stream =      15.753(CFS)
Time of concentration =    14.54 min.
Rainfall intensity =      2.834(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.100 to Point/Station      107.200
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =    421.000(Ft.)
Top (of initial area) elevation =  1128.000(Ft.)
Bottom (of initial area) elevation =  1107.000(Ft.)
Difference in elevation =     21.000(Ft.)
Slope =     0.04988  s(percent)=        4.99
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =     7.557 min.
Rainfall intensity =       4.063(In/Hr) for a    100.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.869
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =       3.566(CFS)
Total initial stream area =        1.010(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station      107.200 to Point/Station      108.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1104.500(Ft.)
Downstream point/station elevation =  1104.000(Ft.)
Pipe length  =     21.00(Ft.)   Manning's N = 0.013
```

```
No. of pipes = 1  Required pipe flow  =     3.566(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.566(CFS)
Normal flow depth in pipe =     7.04(In.)
Flow top width inside pipe =    11.82(In.)
Critical Depth =     9.68(In.)
Pipe flow velocity =      7.45(Ft/s)
Travel time through pipe =     0.05 min.
Time of concentration (TC) =     7.60 min.


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Process from Point/Station      107.200 to Point/Station      108.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.010(Ac.)
Runoff from this stream =      3.566(CFS)
Time of concentration =     7.60 min.
Rainfall intensity =     4.049(In/Hr)
Summary of stream data:

Stream    Flow rate       TC             Rainfall Intensity
 No.        (CFS)        (min)                   (In/Hr)


1        15.753      14.54                2.834
2         3.566       7.60                4.049
Largest stream flow has longer time of concentration
Qp =      15.753 + sum of
           Qb          Ia/Ib
            3.566 *     0.700 =       2.496
Qp =      18.249

Total of 2 main streams to confluence:
Flow rates before confluence point:
      15.753       3.566
Area of streams before confluence:
        6.160        1.010


Results of confluence:
Total flow rate =      18.249(CFS)
Time of concentration =     14.544 min.
Effective stream area after confluence  =       7.170(Ac.)


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Process from Point/Station      108.000 to Point/Station      113.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1104.000(Ft.)
Downstream point/station elevation =  1103.500(Ft.)
Pipe length  =   239.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    18.249(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    18.249(CFS)
Normal flow depth in pipe =   23.86(In.)
Flow top width inside pipe =   24.21(In.)
Critical Depth =   17.37(In.)
Pipe flow velocity =      4.36(Ft/s)
Travel time through pipe =     0.91 min.
Time of concentration (TC) =    15.46 min.


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Process from Point/Station      108.000 to Point/Station      113.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
```

```
In Main Stream number: 1
Stream flow area =      7.170(Ac.)
Runoff from this stream =      18.249(CFS)
Time of concentration =   15.46 min.
Rainfall intensity =     2.741(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      110.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Initial area flow distance =   748.000(Ft.)
Top (of initial area) elevation =  1120.000(Ft.)
Bottom (of initial area) elevation =  1107.200(Ft.)
Difference in elevation =    12.800(Ft.)
Slope =    0.01711  s(percent)=       1.71
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.779 min.
Rainfall intensity =      3.183(In/Hr) for a   100.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.861
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      5.621(CFS)
Total initial stream area =        2.050(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station      110.000 to Point/Station      113.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1104.500(Ft.)
Downstream point/station elevation =  1103.500(Ft.)
Pipe length  =    31.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.621(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     5.621(CFS)
Normal flow depth in pipe =    8.72(In.)
Flow top width inside pipe =   10.70(In.)
Critical Depth =   11.32(In.)
Pipe flow velocity =      9.19(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    11.84 min.


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Process from Point/Station      110.000 to Point/Station      113.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.050(Ac.)
Runoff from this stream =      5.621(CFS)
Time of concentration =   11.84 min.
Rainfall intensity =     3.175(In/Hr)
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      112.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Initial area flow distance =   779.000(Ft.)
Top (of initial area) elevation =  1120.000(Ft.)
Bottom (of initial area) elevation =  1107.200(Ft.)
```

```
Difference in elevation =    12.800(Ft.)
Slope =    0.01643  s(percent)=       1.64
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.069 min.
Rainfall intensity =      3.141(In/Hr) for a   100.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.861
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      6.760(CFS)
Total initial stream area =        2.500(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station      112.000 to Point/Station      113.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1104.500(Ft.)
Downstream point/station elevation =  1103.500(Ft.)
Pipe length  =    17.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.760(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     6.760(CFS)
Normal flow depth in pipe =    7.99(In.)
Flow top width inside pipe =   11.32(In.)
Critical depth could not be calculated.
Pipe flow velocity =     12.17(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =    12.09 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      113.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      2.500(Ac.)
Runoff from this stream =      6.760(CFS)
Time of concentration =   12.09 min.
Rainfall intensity =     3.137(In/Hr)
Summary of stream data:

Stream    Flow rate      TC            Rainfall Intensity
 No.        (CFS)       (min)                 (In/Hr)


1       18.249     15.46               2.741
2        5.621     11.84               3.175
3        6.760     12.09               3.137
Largest stream flow has longer time of concentration
Qp =     18.249 + sum of
          Qb         Ia/Ib
           5.621 *    0.863 =      4.853
          Qb         Ia/Ib
           6.760 *    0.874 =      5.906
Qp =     29.007

Total of 3 main streams to confluence:
Flow rates before confluence point:
      18.249       5.621       6.760
Area of streams before confluence:
        7.170       2.050       2.500


Results of confluence:
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```
Total flow rate =      29.007(CFS)
Time of concentration =     15.459 min.
Effective stream area after confluence  =      11.720(Ac.)


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Process from Point/Station       113.000 to Point/Station       114.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1103.500(Ft.)
Downstream point/station elevation =  1103.000(Ft.)
Pipe length  =    98.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    29.007(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    29.007(CFS)
Normal flow depth in pipe =   24.33(In.)
Flow top width inside pipe =   23.49(In.)
Critical Depth =   22.03(In.)
Pipe flow velocity =      6.80(Ft/s)
Travel time through pipe =    0.24 min.
Time of concentration (TC) =    15.70 min.


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Process from Point/Station       114.000 to Point/Station       114.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
USER INPUT of soil data for subarea
Runoff Coefficient = 0.824
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.600; Impervious fraction =  0.400
Time of concentration =    15.70 min.
Rainfall intensity =      2.718(In/Hr) for a   100.0 year storm
Subarea runoff =      4.748(CFS) for      2.120(Ac.)
Total runoff =     33.755(CFS)        Total area =      13.840(Ac.)
End of computations, total study area =           13.84 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.388
Area averaged RI index number =  75.0
```

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
Rational Hydrology Study Date: 05/16/19 File:ARA2100.out

108.30.13
100-YEAR RATIONAL TABLING METHOD
POST PROJECT CONDITION FOR AREA A2
ARA2100.RRV

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6279

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation = 0.550(In.)
100 year, 1 hour precipitation = 1.300(In.)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.300(In/Hr)
Slope of intensity duration curve = 0.5500

++

Process from Point/Station 115.000 to Point/Station 116.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 707.000(Ft.)
Top (of initial area) elevation = 1119.500(Ft.)
Bottom (of initial area) elevation = 1106.000(Ft.)
Difference in elevation = 13.500(Ft.)
Slope = 0.01909 s(percent)= 1.91
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.266 min.
Rainfall intensity = 3.262(In/Hr) for a 100.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.862
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 75.00
Pervious area fraction = 0.350; Impervious fraction = 0.650
Initial subarea runoff = 5.512(CFS)
Total initial stream area = 1.960(Ac.)
Pervious area fraction = 0.350

++

Process from Point/Station 116.000 to Point/Station 119.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1103.500(Ft.)
Downstream point/station elevation = 1101.800(Ft.)
Pipe length = 61.00(Ft.) Manning's N = 0.013

```
No. of pipes = 1  Required pipe flow  =     5.512(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     5.512(CFS)
Normal flow depth in pipe =    9.13(In.)
Flow top width inside pipe =   10.24(In.)
Critical Depth =   11.28(In.)
Pipe flow velocity =      8.60(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =    11.38 min.


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Process from Point/Station      116.000 to Point/Station      119.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.960(Ac.)
Runoff from this stream =      5.512(CFS)
Time of concentration =   11.38 min.
Rainfall intensity =     3.243(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station      117.000 to Point/Station      118.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   433.000(Ft.)
Top (of initial area) elevation =  1110.000(Ft.)
Bottom (of initial area) elevation =  1106.000(Ft.)
Difference in elevation =     4.000(Ft.)
Slope =    0.00924  s(percent)=       0.92
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.707 min.
Rainfall intensity =      3.354(In/Hr) for a   100.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.863
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      3.764(CFS)
Total initial stream area =        1.300(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station      118.000 to Point/Station      119.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1103.500(Ft.)
Downstream point/station elevation =  1101.800(Ft.)
Pipe length  =   145.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.764(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.764(CFS)
Normal flow depth in pipe =    9.59(In.)
Flow top width inside pipe =    9.62(In.)
Critical Depth =    9.91(In.)
Pipe flow velocity =      5.60(Ft/s)
Travel time through pipe =    0.43 min.
Time of concentration (TC) =    11.14 min.


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Process from Point/Station      118.000 to Point/Station      119.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
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```
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.300(Ac.)
Runoff from this stream =      3.764(CFS)
Time of concentration =   11.14 min.
Rainfall intensity =     3.282(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        5.512      11.38               3.243
2        3.764      11.14               3.282
Largest stream flow has longer time of concentration
Qp =      5.512 + sum of
          Qb         Ia/Ib
           3.764 *    0.988 =      3.719
Qp =      9.231

Total of 2 main streams to confluence:
Flow rates before confluence point:
       5.512       3.764
Area of streams before confluence:
        1.960        1.300


Results of confluence:
Total flow rate =      9.231(CFS)
Time of concentration =    11.385 min.
Effective stream area after confluence  =      3.260(Ac.)


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Process from Point/Station      119.000 to Point/Station      122.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1101.800(Ft.)
Downstream point/station elevation =  1101.600(Ft.)
Pipe length  =   145.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.231(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =     9.231(CFS)
Normal flow depth in pipe =   18.30(In.)
Flow top width inside pipe =   25.23(In.)
Critical Depth =   12.55(In.)
Pipe flow velocity =      3.22(Ft/s)
Travel time through pipe =    0.75 min.
Time of concentration (TC) =    12.14 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      119.000 to Point/Station      122.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      3.260(Ac.)
Runoff from this stream =      9.231(CFS)
Time of concentration =   12.14 min.
Rainfall intensity =     3.131(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      121.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   565.000(Ft.)
Top (of initial area) elevation =  1123.700(Ft.)
Bottom (of initial area) elevation =  1110.200(Ft.)
```

```
Difference in elevation =    13.500(Ft.)
Slope =    0.02389  s(percent)=       2.39
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.848 min.
Rainfall intensity =      3.512(In/Hr) for a   100.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.865
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      5.223(CFS)
Total initial stream area =        1.720(Ac.)
Pervious area fraction = 0.350


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      121.000 to Point/Station      122.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1106.200(Ft.)
Downstream point/station elevation =  1101.600(Ft.)
Pipe length  =    61.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.223(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     5.223(CFS)
Normal flow depth in pipe =    6.24(In.)
Flow top width inside pipe =   11.99(In.)
Critical Depth =   11.13(In.)
Pipe flow velocity =     12.66(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =     9.93 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      121.000 to Point/Station      122.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.720(Ac.)
Runoff from this stream =      5.223(CFS)
Time of concentration =    9.93 min.
Rainfall intensity =     3.497(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        9.231     12.14               3.131
2        5.223      9.93               3.497
Largest stream flow has longer time of concentration
Qp =      9.231 + sum of
          Qb         Ia/Ib
           5.223 *    0.895 =      4.677
Qp =     13.908

Total of 2 main streams to confluence:
Flow rates before confluence point:
       9.231       5.223
Area of streams before confluence:
        3.260        1.720


Results of confluence:
Total flow rate =     13.908(CFS)
Time of concentration =    12.136 min.
Effective stream area after confluence  =      4.980(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      128.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1101.600(Ft.)
Downstream point/station elevation =  1100.800(Ft.)
Pipe length  =   244.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.908(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    13.908(CFS)
Normal flow depth in pipe =   18.00(In.)
Flow top width inside pipe =   25.46(In.)
Critical Depth =   15.55(In.)
Pipe flow velocity =      4.94(Ft/s)
Travel time through pipe =    0.82 min.
Time of concentration (TC) =    12.96 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      128.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      4.980(Ac.)
Runoff from this stream =     13.908(CFS)
Time of concentration =   12.96 min.
Rainfall intensity =     3.020(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      123.000 to Point/Station      124.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   750.000(Ft.)
Top (of initial area) elevation =  1125.500(Ft.)
Bottom (of initial area) elevation =  1109.000(Ft.)
Difference in elevation =    16.500(Ft.)
Slope =    0.02200  s(percent)=       2.20
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.214 min.
Rainfall intensity =      3.270(In/Hr) for a   100.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.862
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      7.219(CFS)
Total initial stream area =        2.560(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station      124.000 to Point/Station      127.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1105.000(Ft.)
Downstream point/station elevation =  1102.000(Ft.)
Pipe length  =    35.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.219(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     7.219(CFS)
Normal flow depth in pipe =    7.34(In.)
Flow top width inside pipe =   11.70(In.)
Critical depth could not be calculated.
```

```
Pipe flow velocity =      14.33(Ft/s)
Travel time through pipe =     0.04 min.
Time of concentration (TC) =     11.25 min.


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Process from Point/Station       124.000 to Point/Station       127.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =       2.560(Ac.)
Runoff from this stream =       7.219(CFS)
Time of concentration =    11.25 min.
Rainfall intensity =      3.264(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       125.000 to Point/Station       126.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------------
Initial area flow distance =    608.000(Ft.)
Top (of initial area) elevation =   1123.700(Ft.)
Bottom (of initial area) elevation =   1109.000(Ft.)
Difference in elevation =     14.700(Ft.)
Slope =     0.02418   s(percent)=        2.42
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    10.118 min.
Rainfall intensity =       3.460(In/Hr) for a    100.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.864
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)   =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =       4.964(CFS)
Total initial stream area =         1.660(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station       126.000 to Point/Station       127.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =   1105.000(Ft.)
Downstream point/station elevation =   1102.000(Ft.)
Pipe length  =     36.00(Ft.)    Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      4.964(CFS)
Nearest computed pipe diameter  =      12.00(In.)
Calculated individual pipe flow  =      4.964(CFS)
Normal flow depth in pipe =     5.88(In.)
Flow top width inside pipe =    12.00(In.)
Critical Depth =    10.98(In.)
Pipe flow velocity =      12.98(Ft/s)
Travel time through pipe =     0.05 min.
Time of concentration (TC) =     10.16 min.


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Process from Point/Station       126.000 to Point/Station       127.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =       1.660(Ac.)
Runoff from this stream =       4.964(CFS)
Time of concentration =    10.16 min.
Rainfall intensity =      3.452(In/Hr)
Summary of stream data:

Stream    Flow rate       TC            Rainfall Intensity
```

```
 No.       (CFS)        (min)                  (In/Hr)


1        7.219      11.25                  3.264
2        4.964      10.16                  3.452
Largest stream flow has longer time of concentration
Qp =      7.219 + sum of
          Qb          Ia/Ib
           4.964 *     0.945 =      4.693
Qp =     11.912

Total of 2 streams to confluence:
Flow rates before confluence point:
       7.219       4.964
Area of streams before confluence:
        2.560        1.660
Results of confluence:
Total flow rate =      11.912(CFS)
Time of concentration =     11.254 min.
Effective stream area after confluence =       4.220(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      127.000 to Point/Station      128.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1102.000(Ft.)
Downstream point/station elevation =  1100.800(Ft.)
Pipe length  =    40.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.912(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    11.912(CFS)
Normal flow depth in pipe =   10.62(In.)
Flow top width inside pipe =   17.71(In.)
Critical Depth =   15.74(In.)
Pipe flow velocity =     10.98(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    11.31 min.


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Process from Point/Station      127.000 to Point/Station      128.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      4.220(Ac.)
Runoff from this stream =     11.912(CFS)
Time of concentration =   11.31 min.
Rainfall intensity =     3.254(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                  (In/Hr)


1       13.908     12.96                3.020
2       11.912     11.31                3.254
Largest stream flow has longer time of concentration
Qp =     13.908 + sum of
          Qb          Ia/Ib
           11.912 *     0.928 =     11.055
Qp =     24.963

Total of 2 main streams to confluence:
Flow rates before confluence point:
      13.908      11.912
Area of streams before confluence:
        4.980        4.220
```

```
Results of confluence:
Total flow rate =      24.963(CFS)
Time of concentration =     12.960 min.
Effective stream area after confluence  =       9.200(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      128.000 to Point/Station      131.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1100.800(Ft.)
Downstream point/station elevation =  1100.300(Ft.)
Pipe length  =   160.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    24.963(CFS)
Nearest computed pipe diameter  =      33.00(In.)
Calculated individual pipe flow  =    24.963(CFS)
Normal flow depth in pipe =   23.25(In.)
Flow top width inside pipe =   30.11(In.)
Critical Depth =   19.88(In.)
Pipe flow velocity =       5.58(Ft/s)
Travel time through pipe =     0.48 min.
Time of concentration (TC) =     13.44 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      128.000 to Point/Station      131.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =       9.200(Ac.)
Runoff from this stream =      24.963(CFS)
Time of concentration =    13.44 min.
Rainfall intensity =     2.960(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      129.000 to Point/Station      130.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   242.000(Ft.)
Top (of initial area) elevation =  1110.000(Ft.)
Bottom (of initial area) elevation =  1107.000(Ft.)
Difference in elevation =      3.000(Ft.)
Slope =    0.01240  s(percent)=       1.24
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =     8.000 min.
Rainfall intensity =      3.938(In/Hr) for a   100.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.868
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      2.393(CFS)
Total initial stream area =        0.700(Ac.)
Pervious area fraction = 0.350


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      130.000 to Point/Station      131.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1103.000(Ft.)
Downstream point/station elevation =  1100.300(Ft.)
Pipe length  =    14.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.393(CFS)
Nearest computed pipe diameter  =      6.00(In.)
```

```
Calculated individual pipe flow  =     2.393(CFS)
Normal flow depth in pipe =    4.77(In.)
Flow top width inside pipe =    4.85(In.)
Critical depth could not be calculated.
Pipe flow velocity =     14.30(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =     8.02 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      130.000 to Point/Station      131.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.700(Ac.)
Runoff from this stream =      2.393(CFS)
Time of concentration =    8.02 min.
Rainfall intensity =     3.933(In/Hr)
Summary of stream data:

Stream    Flow rate      TC            Rainfall Intensity
 No.        (CFS)       (min)                  (In/Hr)


1        24.963      13.44                2.960
2         2.393       8.02                3.933
Largest stream flow has longer time of concentration
Qp =     24.963 + sum of
          Qb          Ia/Ib
           2.393 *    0.753 =      1.801
Qp =     26.764

Total of 2 main streams to confluence:
Flow rates before confluence point:
      24.963       2.393
Area of streams before confluence:
        9.200        0.700


Results of confluence:
Total flow rate =     26.764(CFS)
Time of concentration =    13.438 min.
Effective stream area after confluence  =      9.900(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      131.000 to Point/Station      137.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1100.300(Ft.)
Downstream point/station elevation =  1100.200(Ft.)
Pipe length  =    17.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    26.764(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    26.764(CFS)
Normal flow depth in pipe =   21.26(In.)
Flow top width inside pipe =   27.26(In.)
Critical Depth =   21.16(In.)
Pipe flow velocity =      7.19(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =    13.48 min.


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Process from Point/Station      131.000 to Point/Station      137.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      9.900(Ac.)
```

```
Runoff from this stream =      26.764(CFS)
Time of concentration =    13.48 min.
Rainfall intensity =      2.956(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       132.000 to Point/Station       133.000
**** INITIAL AREA EVALUATION ****

------------------------------------------------------------------------------
Initial area flow distance =    826.000(Ft.)
Top (of initial area) elevation =  1146.300(Ft.)
Bottom (of initial area) elevation =  1106.300(Ft.)
Difference in elevation =     40.000(Ft.)
Slope =     0.04843  s(percent)=        4.84
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =     9.954 min.
Rainfall intensity =       3.492(In/Hr) for a    100.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.829
Decimal fraction soil group A = 0.420
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.580
RI index for soil(AMC 2)   =  56.94
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      13.756(CFS)
Total initial stream area =         4.750(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station       133.000 to Point/Station       136.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

------------------------------------------------------------------------------
Upstream point/station elevation =  1102.300(Ft.)
Downstream point/station elevation =  1101.000(Ft.)
Pipe length  =    67.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.756(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    13.756(CFS)
Normal flow depth in pipe =   13.88(In.)
Flow top width inside pipe =   15.13(In.)
Critical Depth =   16.50(In.)
Pipe flow velocity =       9.41(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =    10.07 min.


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Process from Point/Station       133.000 to Point/Station       136.000
**** CONFLUENCE OF MINOR STREAMS ****

------------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =       4.750(Ac.)
Runoff from this stream =      13.756(CFS)
Time of concentration =   10.07 min.
Rainfall intensity =     3.469(In/Hr)


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Process from Point/Station       134.000 to Point/Station       135.000
**** INITIAL AREA EVALUATION ****

------------------------------------------------------------------------------
Initial area flow distance =    258.000(Ft.)
Top (of initial area) elevation =  1110.700(Ft.)
Bottom (of initial area) elevation =  1107.200(Ft.)
Difference in elevation =      3.500(Ft.)
Slope =     0.01357  s(percent)=        1.36
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =     8.060 min.
```

```
Rainfall intensity =      3.921(In/Hr) for a   100.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.868
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      3.165(CFS)
Total initial stream area =        0.930(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station      135.000 to Point/Station      136.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1103.200(Ft.)
Downstream point/station elevation =  1101.000(Ft.)
Pipe length  =    12.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.165(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     3.165(CFS)
Normal flow depth in pipe =    4.22(In.)
Flow top width inside pipe =    8.98(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.58(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     8.07 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      135.000 to Point/Station      136.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.930(Ac.)
Runoff from this stream =      3.165(CFS)
Time of concentration =    8.07 min.
Rainfall intensity =     3.918(In/Hr)
Summary of stream data:

Stream    Flow rate       TC            Rainfall Intensity
 No.        (CFS)        (min)                  (In/Hr)


1        13.756      10.07                  3.469
2         3.165       8.07                  3.918
Largest stream flow has longer time of concentration
Qp =      13.756 + sum of
           Qb          Ia/Ib
            3.165 *     0.885 =      2.803
Qp =      16.559

Total of 2 streams to confluence:
Flow rates before confluence point:
      13.756       3.165
Area of streams before confluence:
        4.750        0.930
Results of confluence:
Total flow rate =      16.559(CFS)
Time of concentration =    10.072 min.
Effective stream area after confluence =      5.680(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      136.000 to Point/Station      137.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1101.000(Ft.)
```

```
Downstream point/station elevation =  1100.200(Ft.)
Pipe length  =   115.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    16.559(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    16.559(CFS)
Normal flow depth in pipe =   17.44(In.)
Flow top width inside pipe =   21.39(In.)
Critical Depth =   17.61(In.)
Pipe flow velocity =      6.77(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =    10.36 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      136.000 to Point/Station      137.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      5.680(Ac.)
Runoff from this stream =     16.559(CFS)
Time of concentration =   10.36 min.
Rainfall intensity =     3.417(In/Hr)
Summary of stream data:

Stream    Flow rate      TC            Rainfall Intensity
 No.        (CFS)       (min)                 (In/Hr)


1       26.764      13.48                2.956
2       16.559      10.36                3.417
Largest stream flow has longer time of concentration
Qp =     26.764 + sum of
          Qb          Ia/Ib
          16.559 *    0.865 =     14.325
Qp =     41.089

Total of 2 main streams to confluence:
Flow rates before confluence point:
      26.764      16.559
Area of streams before confluence:
        9.900        5.680


Results of confluence:
Total flow rate =     41.089(CFS)
Time of concentration =    13.477 min.
Effective stream area after confluence  =     15.580(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      137.000 to Point/Station      137.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
USER INPUT of soil data for subarea
Runoff Coefficient = 0.794
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.900; Impervious fraction =  0.100
Time of concentration =    13.48 min.
Rainfall intensity =      2.956(In/Hr) for a   100.0 year storm
Subarea runoff =      2.159(CFS) for      0.920(Ac.)
Total runoff =     43.249(CFS)        Total area =      16.500(Ac.)
End of computations, total study area =           16.50 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.381
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Area averaged RI index number = 69.8

10-YEAR

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                Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
       Rational Hydrology Study        Date: 05/17/19  File:ARA110.out
------------------------------------------------------------------------
108.30.13
10-YEAR RATIONAL TABLING METHOD
POST PROJECT CONDITION FOR AREA A
ARA110.RRV
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 *********   Hydrology Study Control Information **********

 English (in-lb) Units used in input data file

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Program License Serial Number 6279

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Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) =   10.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation =  0.550(In.)
100 year, 1 hour precipitation =  1.300(In.)

Storm event year =  10.0
Calculated rainfall intensity data:
1 hour intensity =  0.859(In/Hr)
Slope of intensity duration curve = 0.5500




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Process from Point/Station      101.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Initial area flow distance =   728.000(Ft.)
Top (of initial area) elevation =  1125.000(Ft.)
Bottom (of initial area) elevation =  1113.300(Ft.)
Difference in elevation =    11.700(Ft.)
Slope =    0.01607  s(percent)=       1.61
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.799 min.
Rainfall intensity =      2.100(In/Hr) for a    10.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.845
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      3.638(CFS)
Total initial stream area =        2.050(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station      102.000 to Point/Station      103.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =  1113.300(Ft.)
End of street segment elevation =  1109.500(Ft.)
Length of street segment  =   413.000(Ft.)
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Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =    0.083
Slope from grade break to crown (v/hz)  =    0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =    0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      5.715(CFS)
Depth of flow =   0.412(Ft.), Average velocity =   2.510(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   7.961(Ft.)
Flow velocity =   2.51(Ft/s)
Travel time =    2.74 min.     TC =   14.54  min.
 Adding area flow to street
CONDOMINIUM subarea type
Runoff Coefficient = 0.840
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Rainfall intensity =      1.872(In/Hr) for a    10.0 year storm
Subarea runoff =      4.024(CFS) for      2.560(Ac.)
Total runoff =      7.661(CFS)        Total area =       4.610(Ac.)
Street flow at end of street =      7.661(CFS)
Half street flow at end of street =      3.831(CFS)
Depth of flow =   0.450(Ft.), Average velocity =   2.598(Ft/s)
Flow width (from curb towards crown)=   9.847(Ft.)


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Process from Point/Station      103.000 to Point/Station      106.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1105.500(Ft.)
Downstream point/station elevation =  1105.000(Ft.)
Pipe length  =    31.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.661(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     7.661(CFS)
Normal flow depth in pipe =   11.48(In.)
Flow top width inside pipe =   12.71(In.)
Critical Depth =   13.18(In.)
Pipe flow velocity =      7.60(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =    14.61 min.


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Process from Point/Station      103.000 to Point/Station      106.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      4.610(Ac.)
Runoff from this stream =      7.661(CFS)
Time of concentration =   14.61 min.
Rainfall intensity =     1.867(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station      104.000 to Point/Station      105.000
**** INITIAL AREA EVALUATION ****
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Initial area flow distance =   766.000(Ft.)
Top (of initial area) elevation =  1119.100(Ft.)
Bottom (of initial area) elevation =  1109.700(Ft.)
Difference in elevation =     9.400(Ft.)
Slope =    0.01227  s(percent)=       1.23
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.709 min.
Rainfall intensity =      2.016(In/Hr) for a    10.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.843
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      2.635(CFS)
Total initial stream area =        1.550(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station      105.000 to Point/Station      106.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1105.700(Ft.)
Downstream point/station elevation =  1105.000(Ft.)
Pipe length  =   137.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.635(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     2.635(CFS)
Normal flow depth in pipe =    8.12(In.)
Flow top width inside pipe =   14.95(In.)
Critical Depth =    7.82(In.)
Pipe flow velocity =      3.89(Ft/s)
Travel time through pipe =    0.59 min.
Time of concentration (TC) =    13.30 min.


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Process from Point/Station      105.000 to Point/Station      106.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.550(Ac.)
Runoff from this stream =      2.635(CFS)
Time of concentration =   13.30 min.
Rainfall intensity =     1.967(In/Hr)
Summary of stream data:

Stream    Flow rate      TC            Rainfall Intensity
 No.        (CFS)       (min)                  (In/Hr)


1         7.661     14.61                1.867
2         2.635     13.30                1.967
Largest stream flow has longer time of concentration
Qp =      7.661 + sum of
          Qb         Ia/Ib
           2.635 *    0.950 =      2.502
Qp =     10.163

Total of 2 main streams to confluence:
Flow rates before confluence point:
       7.661       2.635
Area of streams before confluence:
        4.610        1.550
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Results of confluence:
Total flow rate =      10.163(CFS)
Time of concentration =     14.610 min.
Effective stream area after confluence  =       6.160(Ac.)


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Process from Point/Station       106.000 to Point/Station       108.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1105.000(Ft.)
Downstream point/station elevation =  1104.000(Ft.)
Pipe length  =     55.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     10.163(CFS)
Nearest computed pipe diameter  =      18.00(In.)
Calculated individual pipe flow  =     10.163(CFS)
Normal flow depth in pipe =    11.29(In.)
Flow top width inside pipe =    17.41(In.)
Critical Depth =    14.72(In.)
Pipe flow velocity =       8.72(Ft/s)
Travel time through pipe =     0.11 min.
Time of concentration (TC) =     14.71 min.


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Process from Point/Station       106.000 to Point/Station       108.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =       6.160(Ac.)
Runoff from this stream =      10.163(CFS)
Time of concentration =    14.71 min.
Rainfall intensity =     1.860(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station       107.100 to Point/Station       107.200
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =    421.000(Ft.)
Top (of initial area) elevation =  1128.000(Ft.)
Bottom (of initial area) elevation =  1107.000(Ft.)
Difference in elevation =     21.000(Ft.)
Slope =     0.04988  s(percent)=        4.99
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =     7.557 min.
Rainfall intensity =       2.683(In/Hr) for a     10.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.855
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =       2.318(CFS)
Total initial stream area =         1.010(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station       107.200 to Point/Station       108.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1104.500(Ft.)
Downstream point/station elevation =  1104.000(Ft.)
Pipe length  =     21.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      2.318(CFS)
Nearest computed pipe diameter  =       9.00(In.)
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Calculated individual pipe flow  =     2.318(CFS)
Normal flow depth in pipe =    6.73(In.)
Flow top width inside pipe =    7.82(In.)
Critical Depth =    8.13(In.)
Pipe flow velocity =      6.55(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     7.61 min.


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Process from Point/Station      107.200 to Point/Station      108.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.010(Ac.)
Runoff from this stream =      2.318(CFS)
Time of concentration =    7.61 min.
Rainfall intensity =     2.673(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       10.163     14.71                1.860
2        2.318      7.61                2.673
Largest stream flow has longer time of concentration
Qp =     10.163 + sum of
          Qb          Ia/Ib
           2.318 *    0.696 =      1.613
Qp =     11.776

Total of 2 main streams to confluence:
Flow rates before confluence point:
      10.163       2.318
Area of streams before confluence:
       6.160        1.010


Results of confluence:
Total flow rate =     11.776(CFS)
Time of concentration =    14.715 min.
Effective stream area after confluence  =      7.170(Ac.)


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Process from Point/Station      108.000 to Point/Station      113.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1104.000(Ft.)
Downstream point/station elevation =  1103.500(Ft.)
Pipe length =   239.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.776(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    11.776(CFS)
Normal flow depth in pipe =   18.80(In.)
Flow top width inside pipe =   24.83(In.)
Critical Depth =   14.26(In.)
Pipe flow velocity =      3.98(Ft/s)
Travel time through pipe =    1.00 min.
Time of concentration (TC) =    15.71 min.


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Process from Point/Station      108.000 to Point/Station      113.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      7.170(Ac.)
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Runoff from this stream =      11.776(CFS)
Time of concentration =    15.71 min.
Rainfall intensity =      1.794(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station      109.000 to Point/Station      110.000
**** INITIAL AREA EVALUATION ****

------------------------------------------------------------------------------
Initial area flow distance =    748.000(Ft.)
Top (of initial area) elevation =  1120.000(Ft.)
Bottom (of initial area) elevation =  1107.200(Ft.)
Difference in elevation =     12.800(Ft.)
Slope =     0.01711  s(percent)=        1.71
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    11.779 min.
Rainfall intensity =       2.102(In/Hr) for a     10.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.845
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)   =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =       3.641(CFS)
Total initial stream area =         2.050(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station      110.000 to Point/Station      113.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

------------------------------------------------------------------------------
Upstream point/station elevation =  1104.500(Ft.)
Downstream point/station elevation =  1103.500(Ft.)
Pipe length  =    31.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.641(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.641(CFS)
Normal flow depth in pipe =    6.48(In.)
Flow top width inside pipe =   11.96(In.)
Critical Depth =    9.76(In.)
Pipe flow velocity =      8.41(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    11.84 min.


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Process from Point/Station      110.000 to Point/Station      113.000
**** CONFLUENCE OF MAIN STREAMS ****

------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.050(Ac.)
Runoff from this stream =       3.641(CFS)
Time of concentration =   11.84 min.
Rainfall intensity =     2.096(In/Hr)
Program is now starting with Main Stream No. 3


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Process from Point/Station      111.000 to Point/Station      112.000
**** INITIAL AREA EVALUATION ****

------------------------------------------------------------------------------
Initial area flow distance =    779.000(Ft.)
Top (of initial area) elevation =  1120.000(Ft.)
Bottom (of initial area) elevation =  1107.200(Ft.)
Difference in elevation =    12.800(Ft.)
Slope =     0.01643  s(percent)=        1.64
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TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.069 min.
Rainfall intensity =      2.074(In/Hr) for a    10.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.844
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      4.378(CFS)
Total initial stream area =        2.500(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station      112.000 to Point/Station      113.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1104.500(Ft.)
Downstream point/station elevation =  1103.500(Ft.)
Pipe length  =    17.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.378(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     4.378(CFS)
Normal flow depth in pipe =    6.05(In.)
Flow top width inside pipe =   12.00(In.)
Critical Depth =   10.53(In.)
Pipe flow velocity =     11.04(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =    12.09 min.


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Process from Point/Station      112.000 to Point/Station      113.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      2.500(Ac.)
Runoff from this stream =      4.378(CFS)
Time of concentration =   12.09 min.
Rainfall intensity =     2.072(In/Hr)
Summary of stream data:

Stream    Flow rate      TC            Rainfall Intensity
 No.        (CFS)       (min)                  (In/Hr)


1       11.776      15.71                1.794
2        3.641      11.84                2.096
3        4.378      12.09                2.072
Largest stream flow has longer time of concentration
Qp =     11.776 + sum of
          Qb          Ia/Ib
           3.641 *     0.856 =      3.116
          Qb          Ia/Ib
           4.378 *     0.866 =      3.791
Qp =     18.683

Total of 3 main streams to confluence:
Flow rates before confluence point:
      11.776       3.641       4.378
Area of streams before confluence:
        7.170       2.050       2.500


Results of confluence:
Total flow rate =     18.683(CFS)
Time of concentration =    15.714 min.
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Effective stream area after confluence  =      11.720(Ac.)


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Process from Point/Station       113.000 to Point/Station       114.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1103.500(Ft.)
Downstream point/station elevation =  1103.000(Ft.)
Pipe length  =    98.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    18.683(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    18.683(CFS)
Normal flow depth in pipe =   19.03(In.)
Flow top width inside pipe =   24.63(In.)
Critical Depth =   18.14(In.)
Pipe flow velocity =      6.24(Ft/s)
Travel time through pipe =    0.26 min.
Time of concentration (TC) =    15.98 min.


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Process from Point/Station       114.000 to Point/Station       114.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
USER INPUT of soil data for subarea
Runoff Coefficient = 0.792
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.600; Impervious fraction =  0.400
Time of concentration =    15.98 min.
Rainfall intensity =      1.778(In/Hr) for a    10.0 year storm
Subarea runoff =      2.985(CFS) for      2.120(Ac.)
Total runoff =     21.668(CFS)        Total area =      13.840(Ac.)
End of computations, total study area =           13.84 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.388
Area averaged RI index number =  75.0
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Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
Rational Hydrology Study Date: 05/16/19 File:ARA210.out

108.30.13
10-YEAR RATIONAL TABLING METHOD
POST PROJECT CONDITION FOR AREA A
ARA210.RRV

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6279

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation = 0.550(In.)
100 year, 1 hour precipitation = 1.300(In.)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.859(In/Hr)
Slope of intensity duration curve = 0.5500

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Process from Point/Station 115.000 to Point/Station 116.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 707.000(Ft.)
Top (of initial area) elevation = 1119.500(Ft.)
Bottom (of initial area) elevation = 1106.000(Ft.)
Difference in elevation = 13.500(Ft.)
Slope = 0.01909 s(percent)= 1.91
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.266 min.
Rainfall intensity = 2.154(In/Hr) for a 10.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.846
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 75.00
Pervious area fraction = 0.350; Impervious fraction = 0.650
Initial subarea runoff = 3.572(CFS)
Total initial stream area = 1.960(Ac.)
Pervious area fraction = 0.350

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Process from Point/Station 116.000 to Point/Station 119.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1103.500(Ft.)
Downstream point/station elevation = 1101.800(Ft.)
Pipe length = 61.00(Ft.) Manning's N = 0.013

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No. of pipes = 1  Required pipe flow  =     3.572(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.572(CFS)
Normal flow depth in pipe =    6.70(In.)
Flow top width inside pipe =   11.92(In.)
Critical Depth =    9.68(In.)
Pipe flow velocity =      7.92(Ft/s)
Travel time through pipe =    0.13 min.
Time of concentration (TC) =    11.39 min.


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Process from Point/Station      116.000 to Point/Station      119.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.960(Ac.)
Runoff from this stream =      3.572(CFS)
Time of concentration =   11.39 min.
Rainfall intensity =     2.141(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station      117.000 to Point/Station      118.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   433.000(Ft.)
Top (of initial area) elevation =  1110.000(Ft.)
Bottom (of initial area) elevation =  1106.000(Ft.)
Difference in elevation =     4.000(Ft.)
Slope =    0.00924  s(percent)=       0.92
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.707 min.
Rainfall intensity =      2.215(In/Hr) for a    10.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.847
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      2.440(CFS)
Total initial stream area =        1.300(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station      118.000 to Point/Station      119.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1103.500(Ft.)
Downstream point/station elevation =  1101.800(Ft.)
Pipe length  =   145.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.440(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.440(CFS)
Normal flow depth in pipe =    6.93(In.)
Flow top width inside pipe =   11.86(In.)
Critical Depth =    8.03(In.)
Pipe flow velocity =      5.20(Ft/s)
Travel time through pipe =    0.47 min.
Time of concentration (TC) =    11.17 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      118.000 to Point/Station      119.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
```

```
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.300(Ac.)
Runoff from this stream =      2.440(CFS)
Time of concentration =   11.17 min.
Rainfall intensity =     2.164(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        3.572     11.39               2.141
2        2.440     11.17               2.164
Largest stream flow has longer time of concentration
Qp =      3.572 + sum of
          Qb          Ia/Ib
           2.440 *     0.989 =      2.414
Qp =      5.986

Total of 2 main streams to confluence:
Flow rates before confluence point:
       3.572       2.440
Area of streams before confluence:
        1.960        1.300


Results of confluence:
Total flow rate =      5.986(CFS)
Time of concentration =    11.395 min.
Effective stream area after confluence  =      3.260(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      119.000 to Point/Station      122.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1101.800(Ft.)
Downstream point/station elevation =  1101.600(Ft.)
Pipe length  =   145.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.986(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     5.986(CFS)
Normal flow depth in pipe =   17.58(In.)
Flow top width inside pipe =   15.51(In.)
Critical Depth =   10.81(In.)
Pipe flow velocity =      2.79(Ft/s)
Travel time through pipe =    0.87 min.
Time of concentration (TC) =    12.26 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      119.000 to Point/Station      122.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      3.260(Ac.)
Runoff from this stream =      5.986(CFS)
Time of concentration =   12.26 min.
Rainfall intensity =     2.056(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      121.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   565.000(Ft.)
Top (of initial area) elevation =  1123.700(Ft.)
Bottom (of initial area) elevation =  1110.200(Ft.)
```

```
Difference in elevation =    13.500(Ft.)
Slope =    0.02389  s(percent)=       2.39
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.848 min.
Rainfall intensity =      2.320(In/Hr) for a    10.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.849
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      3.389(CFS)
Total initial stream area =        1.720(Ac.)
Pervious area fraction = 0.350


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      121.000 to Point/Station      122.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1106.200(Ft.)
Downstream point/station elevation =  1101.600(Ft.)
Pipe length  =    61.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.389(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     3.389(CFS)
Normal flow depth in pipe =    5.79(In.)
Flow top width inside pipe =    8.62(In.)
Critical depth could not be calculated.
Pipe flow velocity =     11.27(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =     9.94 min.


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Process from Point/Station      121.000 to Point/Station      122.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.720(Ac.)
Runoff from this stream =      3.389(CFS)
Time of concentration =    9.94 min.
Rainfall intensity =     2.308(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        5.986     12.26               2.056
2        3.389      9.94               2.308
Largest stream flow has longer time of concentration
Qp =      5.986 + sum of
          Qb         Ia/Ib
           3.389 *    0.891 =      3.019
Qp =      9.005

Total of 2 main streams to confluence:
Flow rates before confluence point:
       5.986       3.389
Area of streams before confluence:
        3.260        1.720


Results of confluence:
Total flow rate =      9.005(CFS)
Time of concentration =    12.262 min.
Effective stream area after confluence  =      4.980(Ac.)
```

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Process from Point/Station      122.000 to Point/Station      128.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1101.600(Ft.)
Downstream point/station elevation =  1100.800(Ft.)
Pipe length  =   244.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.005(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     9.005(CFS)
Normal flow depth in pipe =   17.06(In.)
Flow top width inside pipe =   16.39(In.)
Critical Depth =   13.39(In.)
Pipe flow velocity =      4.30(Ft/s)
Travel time through pipe =    0.95 min.
Time of concentration (TC) =    13.21 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      128.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      4.980(Ac.)
Runoff from this stream =      9.005(CFS)
Time of concentration =   13.21 min.
Rainfall intensity =     1.974(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      123.000 to Point/Station      124.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   750.000(Ft.)
Top (of initial area) elevation =  1125.500(Ft.)
Bottom (of initial area) elevation =  1109.000(Ft.)
Difference in elevation =    16.500(Ft.)
Slope =    0.02200  s(percent)=       2.20
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.214 min.
Rainfall intensity =      2.160(In/Hr) for a    10.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.846
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      4.679(CFS)
Total initial stream area =       2.560(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station      124.000 to Point/Station      127.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1105.000(Ft.)
Downstream point/station elevation =  1102.000(Ft.)
Pipe length  =    35.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.679(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     4.679(CFS)
Normal flow depth in pipe =    7.11(In.)
Flow top width inside pipe =    7.33(In.)
Critical depth could not be calculated.
```

```
Pipe flow velocity =      12.49(Ft/s)
Travel time through pipe =     0.05 min.
Time of concentration (TC) =     11.26 min.


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Process from Point/Station       124.000 to Point/Station       127.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =       2.560(Ac.)
Runoff from this stream =       4.679(CFS)
Time of concentration =    11.26 min.
Rainfall intensity =      2.155(In/Hr)


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Process from Point/Station       125.000 to Point/Station       126.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------------
Initial area flow distance =    608.000(Ft.)
Top (of initial area) elevation =  1123.700(Ft.)
Bottom (of initial area) elevation =  1109.000(Ft.)
Difference in elevation =     14.700(Ft.)
Slope =     0.02418  s(percent)=        2.42
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    10.118 min.
Rainfall intensity =       2.285(In/Hr) for a     10.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.849
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)   =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =       3.220(CFS)
Total initial stream area =         1.660(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station       126.000 to Point/Station       127.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =  1105.000(Ft.)
Downstream point/station elevation =  1102.000(Ft.)
Pipe length  =     36.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      3.220(CFS)
Nearest computed pipe diameter  =       9.00(In.)
Calculated individual pipe flow  =      3.220(CFS)
Normal flow depth in pipe =     5.41(In.)
Flow top width inside pipe =     8.81(In.)
Critical depth could not be calculated.
Pipe flow velocity =      11.60(Ft/s)
Travel time through pipe =     0.05 min.
Time of concentration (TC) =     10.17 min.


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Process from Point/Station       126.000 to Point/Station       127.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =       1.660(Ac.)
Runoff from this stream =       3.220(CFS)
Time of concentration =    10.17 min.
Rainfall intensity =      2.279(In/Hr)
Summary of stream data:

Stream    Flow rate       TC            Rainfall Intensity
```

```
 No.       (CFS)        (min)                 (In/Hr)


1        4.679      11.26                  2.155
2        3.220      10.17                  2.279
Largest stream flow has longer time of concentration
Qp =      4.679 + sum of
          Qb          Ia/Ib
           3.220 *     0.945 =       3.044
Qp =      7.723

Total of 2 streams to confluence:
Flow rates before confluence point:
       4.679       3.220
Area of streams before confluence:
        2.560       1.660
Results of confluence:
Total flow rate =       7.723(CFS)
Time of concentration =     11.260 min.
Effective stream area after confluence =       4.220(Ac.)


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Process from Point/Station      127.000 to Point/Station      128.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1102.000(Ft.)
Downstream point/station elevation =  1100.800(Ft.)
Pipe length  =    40.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.723(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     7.723(CFS)
Normal flow depth in pipe =    9.16(In.)
Flow top width inside pipe =   14.63(In.)
Critical Depth =   13.21(In.)
Pipe flow velocity =      9.84(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =    11.33 min.


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Process from Point/Station      127.000 to Point/Station      128.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      4.220(Ac.)
Runoff from this stream =      7.723(CFS)
Time of concentration =   11.33 min.
Rainfall intensity =     2.148(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        9.005      13.21                  1.974
2        7.723      11.33                  2.148
Largest stream flow has longer time of concentration
Qp =      9.005 + sum of
          Qb          Ia/Ib
           7.723 *     0.919 =       7.098
Qp =     16.103

Total of 2 main streams to confluence:
Flow rates before confluence point:
       9.005       7.723
Area of streams before confluence:
        4.980       4.220
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Results of confluence:
Total flow rate =      16.103(CFS)
Time of concentration =     13.208 min.
Effective stream area after confluence  =       9.200(Ac.)


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Process from Point/Station      128.000 to Point/Station      131.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1100.800(Ft.)
Downstream point/station elevation =  1100.300(Ft.)
Pipe length  =   160.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    16.103(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    16.103(CFS)
Normal flow depth in pipe =   20.60(In.)
Flow top width inside pipe =   22.96(In.)
Critical Depth =   16.81(In.)
Pipe flow velocity =      4.95(Ft/s)
Travel time through pipe =    0.54 min.
Time of concentration (TC) =    13.75 min.


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Process from Point/Station      128.000 to Point/Station      131.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      9.200(Ac.)
Runoff from this stream =     16.103(CFS)
Time of concentration =   13.75 min.
Rainfall intensity =     1.931(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      129.000 to Point/Station      130.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   242.000(Ft.)
Top (of initial area) elevation =  1110.000(Ft.)
Bottom (of initial area) elevation =  1107.000(Ft.)
Difference in elevation =     3.000(Ft.)
Slope =    0.01240  s(percent)=       1.24
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.000 min.
Rainfall intensity =      2.601(In/Hr) for a    10.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.854
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      1.555(CFS)
Total initial stream area =        0.700(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station      130.000 to Point/Station      131.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1103.000(Ft.)
Downstream point/station elevation =  1100.300(Ft.)
Pipe length  =    14.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.555(CFS)
Nearest computed pipe diameter  =      6.00(In.)
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Calculated individual pipe flow  =     1.555(CFS)
Normal flow depth in pipe =     3.46(In.)
Flow top width inside pipe =     5.93(In.)
Critical depth could not be calculated.
Pipe flow velocity =     13.27(Ft/s)
Travel time through pipe =     0.02 min.
Time of concentration (TC) =     8.02 min.


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Process from Point/Station      130.000 to Point/Station      131.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.700(Ac.)
Runoff from this stream =      1.555(CFS)
Time of concentration =     8.02 min.
Rainfall intensity =     2.597(In/Hr)
Summary of stream data:

Stream    Flow rate      TC            Rainfall Intensity
 No.        (CFS)       (min)                 (In/Hr)


1        16.103      13.75                1.931
2         1.555       8.02                2.597
Largest stream flow has longer time of concentration
Qp =      16.103 + sum of
           Qb          Ia/Ib
            1.555 *     0.743 =       1.156
Qp =      17.258

Total of 2 main streams to confluence:
Flow rates before confluence point:
      16.103       1.555
Area of streams before confluence:
        9.200        0.700


Results of confluence:
Total flow rate =      17.258(CFS)
Time of concentration =     13.747 min.
Effective stream area after confluence  =       9.900(Ac.)


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Process from Point/Station      131.000 to Point/Station      137.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1100.300(Ft.)
Downstream point/station elevation =  1100.200(Ft.)
Pipe length  =    17.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    17.258(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    17.258(CFS)
Normal flow depth in pipe =   19.55(In.)
Flow top width inside pipe =   18.66(In.)
Critical Depth =   17.96(In.)
Pipe flow velocity =      6.30(Ft/s)
Travel time through pipe =     0.05 min.
Time of concentration (TC) =     13.79 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      131.000 to Point/Station      137.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      9.900(Ac.)
```

```
Runoff from this stream =      17.258(CFS)
Time of concentration =    13.79 min.
Rainfall intensity =      1.927(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station      132.000 to Point/Station      133.000
**** INITIAL AREA EVALUATION ****

------------------------------------------------------------------------------
Initial area flow distance =    826.000(Ft.)
Top (of initial area) elevation =  1146.300(Ft.)
Bottom (of initial area) elevation =  1106.300(Ft.)
Difference in elevation =     40.000(Ft.)
Slope =     0.04843  s(percent)=        4.84
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =     9.954 min.
Rainfall intensity =       2.306(In/Hr) for a     10.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.804
Decimal fraction soil group A = 0.420
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.580
RI index for soil(AMC 2)   =  56.94
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =       8.809(CFS)
Total initial stream area =         4.750(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station      133.000 to Point/Station      136.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

------------------------------------------------------------------------------
Upstream point/station elevation =  1102.300(Ft.)
Downstream point/station elevation =  1101.000(Ft.)
Pipe length  =    67.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.809(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     8.809(CFS)
Normal flow depth in pipe =   12.02(In.)
Flow top width inside pipe =   11.96(In.)
Critical Depth =   13.79(In.)
Pipe flow velocity =      8.36(Ft/s)
Travel time through pipe =    0.13 min.
Time of concentration (TC) =    10.09 min.


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Process from Point/Station      133.000 to Point/Station      136.000
**** CONFLUENCE OF MINOR STREAMS ****

------------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      4.750(Ac.)
Runoff from this stream =      8.809(CFS)
Time of concentration =   10.09 min.
Rainfall intensity =     2.289(In/Hr)


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Process from Point/Station      134.000 to Point/Station      135.000
**** INITIAL AREA EVALUATION ****

------------------------------------------------------------------------------
Initial area flow distance =    258.000(Ft.)
Top (of initial area) elevation =  1110.700(Ft.)
Bottom (of initial area) elevation =  1107.200(Ft.)
Difference in elevation =     3.500(Ft.)
Slope =     0.01357  s(percent)=        1.36
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =     8.060 min.
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```
Rainfall intensity =      2.590(In/Hr) for a    10.0 year storm
CONDOMINIUM subarea type
Runoff Coefficient = 0.854
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      2.056(CFS)
Total initial stream area =        0.930(Ac.)
Pervious area fraction = 0.350


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Process from Point/Station      135.000 to Point/Station      136.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1103.200(Ft.)
Downstream point/station elevation =  1101.000(Ft.)
Pipe length  =    12.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.056(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     2.056(CFS)
Normal flow depth in pipe =    4.27(In.)
Flow top width inside pipe =    5.43(In.)
Critical depth could not be calculated.
Pipe flow velocity =     13.75(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     8.08 min.


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Process from Point/Station      135.000 to Point/Station      136.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.930(Ac.)
Runoff from this stream =      2.056(CFS)
Time of concentration =    8.08 min.
Rainfall intensity =     2.587(In/Hr)
Summary of stream data:

Stream    Flow rate      TC            Rainfall Intensity
 No.        (CFS)       (min)                 (In/Hr)


1         8.809     10.09                2.289
2         2.056      8.08                2.587
Largest stream flow has longer time of concentration
Qp =      8.809 + sum of
          Qb         Ia/Ib
           2.056 *    0.885 =      1.820
Qp =     10.628

Total of 2 streams to confluence:
Flow rates before confluence point:
       8.809       2.056
Area of streams before confluence:
        4.750        0.930
Results of confluence:
Total flow rate =     10.628(CFS)
Time of concentration =    10.087 min.
Effective stream area after confluence =      5.680(Ac.)


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Process from Point/Station      136.000 to Point/Station      137.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1101.000(Ft.)
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Downstream point/station elevation =  1100.200(Ft.)
Pipe length  =   115.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    10.628(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    10.628(CFS)
Normal flow depth in pipe =   14.27(In.)
Flow top width inside pipe =   19.60(In.)
Critical Depth =   14.59(In.)
Pipe flow velocity =      6.11(Ft/s)
Travel time through pipe =    0.31 min.
Time of concentration (TC) =    10.40 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      136.000 to Point/Station      137.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      5.680(Ac.)
Runoff from this stream =     10.628(CFS)
Time of concentration =   10.40 min.
Rainfall intensity =     2.251(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                  (In/Hr)


1       17.258     13.79                1.927
2       10.628     10.40                2.251
Largest stream flow has longer time of concentration
Qp =     17.258 + sum of
          Qb          Ia/Ib
          10.628 *    0.856 =      9.100
Qp =     26.359

Total of 2 main streams to confluence:
Flow rates before confluence point:
      17.258      10.628
Area of streams before confluence:
        9.900        5.680


Results of confluence:
Total flow rate =     26.359(CFS)
Time of concentration =    13.792 min.
Effective stream area after confluence  =     15.580(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      137.000 to Point/Station      137.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
USER INPUT of soil data for subarea
Runoff Coefficient = 0.748
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.900; Impervious fraction =  0.100
Time of concentration =    13.79 min.
Rainfall intensity =      1.927(In/Hr) for a    10.0 year storm
Subarea runoff =      1.327(CFS) for      0.920(Ac.)
Total runoff =     27.685(CFS)       Total area =      16.500(Ac.)
End of computations, total study area =           16.50 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.381
```

Area averaged RI index number = 69.8

APPENDIX A.2: AREA B

100-YEAR

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
Rational Hydrology Study Date: 05/15/19 File:ARB100.out

108.30.13
100-YEAR RATIONAL TABLING METHOD
POST PROJECT CONDITION FOR AREA B
ARB100.RRV

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6279

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation = 0.550(In.)
100 year, 1 hour precipitation = 1.300(In.)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.300(In/Hr)
Slope of intensity duration curve = 0.5500

++

Process from Point/Station 201.000 to Point/Station 202.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 497.000(Ft.)
Top (of initial area) elevation = 1125.500(Ft.)
Bottom (of initial area) elevation = 1117.100(Ft.)
Difference in elevation = 8.400(Ft.)
Slope = 0.01690 s(percent)= 1.69
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.027 min.
Rainfall intensity = 3.478(In/Hr) for a 100.0 year storm
USER INPUT of soil data for subarea
Runoff Coefficient = 0.864
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 75.00
Pervious area fraction = 0.350; Impervious fraction = 0.650
Initial subarea runoff = 7.845(CFS)
Total initial stream area = 2.610(Ac.)
Pervious area fraction = 0.350

++

Process from Point/Station 202.000 to Point/Station 205.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1113.100(Ft.)
Downstream point/station elevation = 1112.100(Ft.)
Pipe length = 33.00(Ft.) Manning's N = 0.013

```
No. of pipes = 1  Required pipe flow  =     7.845(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     7.845(CFS)
Normal flow depth in pipe =    9.22(In.)
Flow top width inside pipe =   14.60(In.)
Critical Depth =   13.29(In.)
Pipe flow velocity =      9.91(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    10.08 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      205.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      2.610(Ac.)
Runoff from this stream =      7.845(CFS)
Time of concentration =   10.08 min.
Rainfall intensity =     3.467(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      204.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   407.000(Ft.)
Top (of initial area) elevation =  1130.000(Ft.)
Bottom (of initial area) elevation =  1117.100(Ft.)
Difference in elevation =    12.900(Ft.)
Slope =    0.03170  s(percent)=       3.17
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.163 min.
Rainfall intensity =      3.894(In/Hr) for a   100.0 year storm
USER INPUT of soil data for subarea
Runoff Coefficient = 0.868
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      4.427(CFS)
Total initial stream area =        1.310(Ac.)
Pervious area fraction = 0.350


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      205.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1113.100(Ft.)
Downstream point/station elevation =  1112.100(Ft.)
Pipe length  =    24.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.427(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     4.427(CFS)
Normal flow depth in pipe =    6.76(In.)
Flow top width inside pipe =   11.90(In.)
Critical Depth =   10.58(In.)
Pipe flow velocity =      9.71(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     8.20 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      205.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
```

```
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.310(Ac.)
Runoff from this stream =      4.427(CFS)
Time of concentration =    8.20 min.
Rainfall intensity =     3.883(In/Hr)
Summary of stream data:

Stream    Flow rate      TC            Rainfall Intensity
 No.        (CFS)       (min)                 (In/Hr)


1         7.845     10.08                3.467
2         4.427      8.20                3.883
Largest stream flow has longer time of concentration
Qp =       7.845 + sum of
          Qb          Ia/Ib
           4.427 *     0.893 =      3.952
Qp =      11.797

Total of 2 main streams to confluence:
Flow rates before confluence point:
       7.845       4.427
Area of streams before confluence:
        2.610       1.310


Results of confluence:
Total flow rate =     11.797(CFS)
Time of concentration =    10.082 min.
Effective stream area after confluence  =      3.920(Ac.)
End of computations, total study area =            3.92 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.350
Area averaged RI index number =  75.0
```

10-YEAR

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
Rational Hydrology Study Date: 05/15/19 File:ARB10.out

108.30.13
10-YEAR RATIONAL TABLING METHOD
POST PROJECT CONDITION FOR AREA B
ARB10.RRV

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6279

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation = 0.550(In.)
100 year, 1 hour precipitation = 1.300(In.)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.859(In/Hr)
Slope of intensity duration curve = 0.5500

++

Process from Point/Station 201.000 to Point/Station 202.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 497.000(Ft.)
Top (of initial area) elevation = 1125.500(Ft.)
Bottom (of initial area) elevation = 1117.100(Ft.)
Difference in elevation = 8.400(Ft.)
Slope = 0.01690 s(percent)= 1.69
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.027 min.
Rainfall intensity = 2.297(In/Hr) for a 10.0 year storm
USER INPUT of soil data for subarea
Runoff Coefficient = 0.849
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 75.00
Pervious area fraction = 0.350; Impervious fraction = 0.650
Initial subarea runoff = 5.089(CFS)
Total initial stream area = 2.610(Ac.)
Pervious area fraction = 0.350

++

Process from Point/Station 202.000 to Point/Station 205.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1113.100(Ft.)
Downstream point/station elevation = 1112.100(Ft.)
Pipe length = 33.00(Ft.) Manning's N = 0.013

```
No. of pipes = 1  Required pipe flow  =     5.089(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     5.089(CFS)
Normal flow depth in pipe =    8.27(In.)
Flow top width inside pipe =   11.11(In.)
Critical Depth =   11.05(In.)
Pipe flow velocity =      8.81(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    10.09 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      205.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      2.610(Ac.)
Runoff from this stream =      5.089(CFS)
Time of concentration =   10.09 min.
Rainfall intensity =     2.289(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      204.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   407.000(Ft.)
Top (of initial area) elevation =  1130.000(Ft.)
Bottom (of initial area) elevation =  1117.100(Ft.)
Difference in elevation =    12.900(Ft.)
Slope =    0.03170  s(percent)=       3.17
TC = k(0.370)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.163 min.
Rainfall intensity =      2.572(In/Hr) for a    10.0 year storm
USER INPUT of soil data for subarea
Runoff Coefficient = 0.854
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.350; Impervious fraction =  0.650
Initial subarea runoff =      2.898(CFS)
Total initial stream area =        1.320(Ac.)
Pervious area fraction = 0.350


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      205.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1113.100(Ft.)
Downstream point/station elevation =  1112.100(Ft.)
Pipe length =    24.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.898(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     2.898(CFS)
Normal flow depth in pipe =    6.42(In.)
Flow top width inside pipe =    8.14(In.)
Critical depth could not be calculated.
Pipe flow velocity =      8.59(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     8.21 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      205.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
```

```
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.320(Ac.)
Runoff from this stream =      2.898(CFS)
Time of concentration =    8.21 min.
Rainfall intensity =     2.564(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        5.089     10.09               2.289
2        2.898      8.21               2.564
Largest stream flow has longer time of concentration
Qp =      5.089 + sum of
          Qb         Ia/Ib
           2.898 *    0.893 =      2.587
Qp =      7.676

Total of 2 main streams to confluence:
Flow rates before confluence point:
       5.089       2.898
Area of streams before confluence:
        2.610        1.320


Results of confluence:
Total flow rate =      7.676(CFS)
Time of concentration =    10.089 min.
Effective stream area after confluence  =      3.930(Ac.)
End of computations, total study area =            3.93 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.350
Area averaged RI index number =  75.0
```

APPENDIX A.4: AREA D

100-YEAR

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2001 Version 6.4
Rational Hydrology Study Date: 05/16/19 File:ARD100.out

108.30.13
100-YEAR RATIONAL TABLING METHOD
POST PROJECT CONDITION FOR AREA D
ARD100.RRV

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

TRI-8 Builders - S/N 615

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation = 0.550(In.)
100 year, 1 hour precipitation = 1.300(In.)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.300(In/Hr)
Slope of intensity duration curve = 0.5500

++

Process from Point/Station 401.000 to Point/Station 402.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 431.000(Ft.)
Top (of initial area) elevation = 1119.400(Ft.)
Bottom (of initial area) elevation = 1117.000(Ft.)
Difference in elevation = 2.400(Ft.)
Slope = 0.00557 s(percent)= 0.56
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.589 min.
Rainfall intensity = 3.564(In/Hr) for a 100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.890
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 75.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 2.347(CFS)
Total initial stream area = 0.740(Ac.)
Pervious area fraction = 0.100
End of computations, total study area = 0.74 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number = 75.0

10-YEAR

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2001 Version 6.4
Rational Hydrology Study Date: 05/16/19 File:ARD10.out

108.30.13
10-YEAR RATIONAL TABLING METHOD
POST PROJECT CONDITION FOR AREA D
ARD10.RRV

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

TRI-8 Builders - S/N 615

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation = 0.550(In.)
100 year, 1 hour precipitation = 1.300(In.)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.859(In/Hr)
Slope of intensity duration curve = 0.5500

++

Process from Point/Station 401.000 to Point/Station 402.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 431.000(Ft.)
Top (of initial area) elevation = 1119.400(Ft.)
Bottom (of initial area) elevation = 1117.000(Ft.)
Difference in elevation = 2.400(Ft.)
Slope = 0.00557 s(percent)= 0.56
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.589 min.
Rainfall intensity = 2.354(In/Hr) for a 10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.886
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 75.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 1.543(CFS)
Total initial stream area = 0.740(Ac.)
Pervious area fraction = 0.100
End of computations, total study area = 0.74 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number = 75.0

APPENDIX A.5: AREA E

100-YEAR

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2001 Version 6.4
Rational Hydrology Study Date: 05/16/19 File:ARE100.out

108.30.13
100-YEAR RATIONAL TABLING METHOD
POST PROJECT CONDITION FOR AREA E
ARE100.RRV

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

TRI-8 Builders - S/N 615

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation = 0.550(In.)
100 year, 1 hour precipitation = 1.300(In.)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.300(In/Hr)
Slope of intensity duration curve = 0.5500

++

Process from Point/Station 501.000 to Point/Station 502.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 699.000(Ft.)
Top (of initial area) elevation = 1119.400(Ft.)
Bottom (of initial area) elevation = 1115.300(Ft.)
Difference in elevation = 4.100(Ft.)
Slope = 0.00587 s(percent)= 0.59
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.515 min.
Rainfall intensity = 3.223(In/Hr) for a 100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.889
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 75.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 3.467(CFS)
Total initial stream area = 1.210(Ac.)
Pervious area fraction = 0.100

++

Process from Point/Station 502.000 to Point/Station 503.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 1115.300(Ft.)
End of street segment elevation = 1112.500(Ft.)
Length of street segment = 564.000(Ft.)
Height of curb above gutter flowline = 8.0(In.)
Width of half street (curb to crown) = 75.000(Ft.)
Distance from crown to crossfall grade break = 41.000(Ft.)

```
Slope from gutter to grade break (v/hz) =    0.083
Slope from grade break to crown (v/hz)  =    0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  32.000(Ft.)
Slope from curb to property line (v/hz) =    0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      4.871(CFS)
Depth of flow =   0.542(Ft.), Average velocity =   2.763(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   6.517(Ft.)
Flow velocity =   2.76(Ft/s)
Travel time =    3.40 min.     TC =   14.92  min.
 Adding area flow to street
COMMERCIAL subarea type
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      2.795(In/Hr) for a   100.0 year storm
Subarea runoff =      2.431(CFS) for      0.980(Ac.)
Total runoff =      5.899(CFS)       Total area =       2.190(Ac.)
Street flow at end of street =      5.899(CFS)
Half street flow at end of street =      5.899(CFS)
Depth of flow =   0.582(Ft.), Average velocity =   2.898(Ft/s)
Flow width (from curb towards crown)=   7.002(Ft.)
End of computations, total study area =            2.19 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  75.0
```

10-YEAR

```
                Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2001 Version 6.4
        Rational Hydrology Study        Date: 05/16/19  File:ARE10.out
------------------------------------------------------------------------
108.30.13
10-YEAR RATIONAL TABLING METHOD
POST PROJECT CONDITION FOR AREA E
ARE10.RRV
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

 English (in-lb) Units used in input data file

------------------------------------------------------------------------
TRI-8 Builders - S/N   615
------------------------------------------------------------------------
Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) =   10.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation =  0.550(In.)
100 year, 1 hour precipitation =  1.300(In.)

Storm event year =  10.0
Calculated rainfall intensity data:
1 hour intensity =  0.859(In/Hr)
Slope of intensity duration curve = 0.5500



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      501.000 to Point/Station      502.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Initial area flow distance =   699.000(Ft.)
Top (of initial area) elevation =  1119.400(Ft.)
Bottom (of initial area) elevation =  1115.300(Ft.)
Difference in elevation =     4.100(Ft.)
Slope =    0.00587  s(percent)=       0.59
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.515 min.
Rainfall intensity =      2.128(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.884
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      2.278(CFS)
Total initial stream area =        1.210(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      502.000 to Point/Station      503.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =  1115.300(Ft.)
End of street segment elevation =  1112.500(Ft.)
Length of street segment  =   564.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  75.000(Ft.)
Distance from crown to crossfall grade break  =  41.000(Ft.)
```

```
Slope from gutter to grade break (v/hz) =    0.083
Slope from grade break to crown (v/hz)  =    0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  32.000(Ft.)
Slope from curb to property line (v/hz) =    0.020
Gutter width =    2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =       3.200(CFS)
Depth of flow =   0.463(Ft.), Average velocity =   2.487(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   5.567(Ft.)
Flow velocity =   2.49(Ft/s)
Travel time =    3.78 min.     TC =   15.29  min.
 Adding area flow to street
COMMERCIAL subarea type
Runoff Coefficient = 0.882
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      1.821(In/Hr) for a    10.0 year storm
Subarea runoff =      1.574(CFS) for      0.980(Ac.)
Total runoff =      3.852(CFS)        Total area =       2.190(Ac.)
Street flow at end of street =      3.852(CFS)
Half street flow at end of street =      3.852(CFS)
Depth of flow =   0.496(Ft.), Average velocity =   2.605(Ft/s)
Flow width (from curb towards crown)=   5.968(Ft.)
End of computations, total study area =            2.19 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  75.0
```

APPENDIX A.6: AREA F

100-YEAR

```
                Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2001 Version 6.4
        Rational Hydrology Study        Date: 05/16/19  File:ARF100.out
------------------------------------------------------------------------
108.30.13
100-YEAR RATIONAL TABLING METHOD
POST PROJECT CONDITION FOR AREA F
ARF100.RRV
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

 English (in-lb) Units used in input data file

------------------------------------------------------------------------
TRI-8 Builders - S/N   615
------------------------------------------------------------------------
Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) =  100.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation =  0.550(In.)
100 year, 1 hour precipitation =  1.300(In.)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.300(In/Hr)
Slope of intensity duration curve = 0.5500



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      601.000 to Point/Station      602.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Initial area flow distance =   833.000(Ft.)
Top (of initial area) elevation =  1113.000(Ft.)
Bottom (of initial area) elevation =  1105.700(Ft.)
Difference in elevation =     7.300(Ft.)
Slope =    0.00876  s(percent)=       0.88
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.398 min.
Rainfall intensity =      3.241(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.889
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      4.870(CFS)
Total initial stream area =        1.690(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      602.000 to Point/Station      603.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =  1105.700(Ft.)
End of street segment elevation =  1100.000(Ft.)
Length of street segment  =   969.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  18.000(Ft.)
Distance from crown to crossfall grade break  =  16.000(Ft.)
```

```
Slope from gutter to grade break (v/hz) =    0.083
Slope from grade break to crown (v/hz)  =    0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =    0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      7.550(CFS)
Depth of flow =   0.475(Ft.), Average velocity =   2.390(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  17.411(Ft.)
Flow velocity =   2.39(Ft/s)
Travel time =    6.76 min.     TC =   18.15  min.
 Adding area flow to street
COMMERCIAL subarea type
Runoff Coefficient = 0.886
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      2.509(In/Hr) for a   100.0 year storm
Subarea runoff =      4.137(CFS) for      1.860(Ac.)
Total runoff =      9.007(CFS)        Total area =       3.550(Ac.)
Street flow at end of street =      9.007(CFS)
Half street flow at end of street =      9.007(CFS)
Depth of flow =   0.497(Ft.), Average velocity =   2.531(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  18.000(Ft.)
End of computations, total study area =            3.55 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  75.0
```

10-YEAR

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2001 Version 6.4
Rational Hydrology Study Date: 05/16/19 File:ARF10.out

108.30.13
10-YEAR RATIONAL TABLING METHOD
POST PROJECT CONDITION FOR AREA F
ARF10.RRV

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

TRI-8 Builders - S/N 615

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation = 0.550(In.)
100 year, 1 hour precipitation = 1.300(In.)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.859(In/Hr)
Slope of intensity duration curve = 0.5500

++

Process from Point/Station 601.000 to Point/Station 602.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 833.000(Ft.)
Top (of initial area) elevation = 1113.000(Ft.)
Bottom (of initial area) elevation = 1105.700(Ft.)
Difference in elevation = 7.300(Ft.)
Slope = 0.00876 s(percent)= 0.88
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.398 min.
Rainfall intensity = 2.140(In/Hr) for a 10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.885
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 75.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 3.200(CFS)
Total initial stream area = 1.690(Ac.)
Pervious area fraction = 0.100

++

Process from Point/Station 602.000 to Point/Station 603.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 1105.700(Ft.)
End of street segment elevation = 1100.000(Ft.)
Length of street segment = 969.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 18.000(Ft.)
Distance from crown to crossfall grade break = 16.000(Ft.)

```
Slope from gutter to grade break (v/hz) =    0.083
Slope from grade break to crown (v/hz)  =    0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =    0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      4.960(CFS)
Depth of flow =   0.421(Ft.), Average velocity =   2.159(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  14.733(Ft.)
Flow velocity =   2.16(Ft/s)
Travel time =    7.48 min.     TC =   18.88  min.
 Adding area flow to street
COMMERCIAL subarea type
Runoff Coefficient = 0.881
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      1.622(In/Hr) for a    10.0 year storm
Subarea runoff =      2.656(CFS) for      1.860(Ac.)
Total runoff =      5.856(CFS)        Total area =       3.550(Ac.)
Street flow at end of street =      5.856(CFS)
Half street flow at end of street =      5.856(CFS)
Depth of flow =   0.442(Ft.), Average velocity =   2.247(Ft/s)
Flow width (from curb towards crown)=  15.744(Ft.)
End of computations, total study area =            3.55 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  75.0
```

APPENDIX B: HYDRAULIC STORM DRAIN ANALYSIS

APPENDIX B.1: STREET CAPACITY CALCULATIONS

Rating Table for 60' Street-ROW

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.04350	ft/ft
Normal Depth	0.70	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00.000	0.70
0+10.000	0.50
0+10.125	0.00
0+12.125	0.17
0+12.125	0.20
0+30.000	0.56
0+47.875	0.20
0+47.875	0.17
0+50.000	0.00
0+50.000	0.50
0+60.000	0.70

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.000, 0.70)	(0+60.000, 0.70)	0.015

Channel Slope (ft/ft)	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00300	36.19	2.24	16.16	60.98	60.00
0.00400	41.79	2.59	16.16	60.98	60.00
0.00500	46.72	2.89	16.16	60.98	60.00

Rating Table for 60' Street-ROW

Input Data

Channel Slope (ft/ft)	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00600	51.18	3.17	16.16	60.98	60.00
0.00700	55.29	3.42	16.16	60.98	60.00
0.00800	59.10	3.66	16.16	60.98	60.00
0.00900	62.69	3.88	16.16	60.98	60.00
0.01000	66.08	4.09	16.16	60.98	60.00
0.01100	69.30	4.29	16.16	60.98	60.00
0.01200	72.39	4.48	16.16	60.98	60.00
0.01300	75.34	4.66	16.16	60.98	60.00
0.01400	78.19	4.84	16.16	60.98	60.00
0.01500	80.93	5.01	16.16	60.98	60.00
0.01600	83.58	5.17	16.16	60.98	60.00
0.01700	86.16	5.33	16.16	60.98	60.00
0.01800	88.65	5.48	16.16	60.98	60.00
0.01900	91.08	5.63	16.16	60.98	60.00
0.02000	93.45	5.78	16.16	60.98	60.00
0.02100	95.76	5.92	16.16	60.98	60.00
0.02200	98.01	6.06	16.16	60.98	60.00
0.02300	100.21	6.20	16.16	60.98	60.00
0.02400	102.37	6.33	16.16	60.98	60.00
0.02500	104.48	6.46	16.16	60.98	60.00
0.02600	106.55	6.59	16.16	60.98	60.00
0.02700	108.58	6.72	16.16	60.98	60.00
0.02800	110.57	6.84	16.16	60.98	60.00
0.02900	112.53	6.96	16.16	60.98	60.00
0.03000	114.45	7.08	16.16	60.98	60.00
0.03100	116.34	7.20	16.16	60.98	60.00
0.03200	118.20	7.31	16.16	60.98	60.00
0.03300	120.04	7.43	16.16	60.98	60.00
0.03400	121.84	7.54	16.16	60.98	60.00
0.03500	123.62	7.65	16.16	60.98	60.00
0.03600	125.38	7.76	16.16	60.98	60.00
0.03700	127.10	7.86	16.16	60.98	60.00
0.03800	128.81	7.97	16.16	60.98	60.00
0.03900	130.49	8.07	16.16	60.98	60.00
0.04000	132.16	8.18	16.16	60.98	60.00
0.04100	133.80	8.28	16.16	60.98	60.00
0.04200	135.42	8.38	16.16	60.98	60.00

Rating Table for 60' Street-ROW

Input Data

Channel Slope (ft/ft)	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.04300	137.02	8.48	16.16	60.98	60.00
0.04400	138.61	8.57	16.16	60.98	60.00
0.04500	140.17	8.67	16.16	60.98	60.00
0.04600	141.72	8.77	16.16	60.98	60.00
0.04700	143.25	8.86	16.16	60.98	60.00
0.04800	144.77	8.96	16.16	60.98	60.00
0.04900	146.27	9.05	16.16	60.98	60.00
0.05000	147.76	9.14	16.16	60.98	60.00

Rating Table for 60' Street-Half Street

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.56	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00.000	0.70
0+10.000	0.50
0+10.125	0.00
0+12.125	0.17
0+12.125	0.20
0+30.000	0.56

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.000, 0.70)	(0+30.000, 0.56)	0.015

Channel Slope (ft/ft)	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00300	7.43	1.75	4.25	23.18	22.75
0.00400	8.58	2.02	4.25	23.18	22.75
0.00500	9.60	2.26	4.25	23.18	22.75
0.00600	10.51	2.48	4.25	23.18	22.75
0.00700	11.36	2.67	4.25	23.18	22.75
0.00800	12.14	2.86	4.25	23.18	22.75
0.00900	12.88	3.03	4.25	23.18	22.75
0.01000	13.57	3.20	4.25	23.18	22.75

Rating Table for 60' Street-Half Street

Input Data

Channel Slope (ft/ft)	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.01100	14.24	3.35	4.25	23.18	22.75
0.01200	14.87	3.50	4.25	23.18	22.75
0.01300	15.48	3.64	4.25	23.18	22.75
0.01400	16.06	3.78	4.25	23.18	22.75
0.01500	16.62	3.91	4.25	23.18	22.75
0.01600	17.17	4.04	4.25	23.18	22.75
0.01700	17.70	4.17	4.25	23.18	22.75
0.01800	18.21	4.29	4.25	23.18	22.75
0.01900	18.71	4.40	4.25	23.18	22.75
0.02000	19.20	4.52	4.25	23.18	22.75
0.02100	19.67	4.63	4.25	23.18	22.75
0.02200	20.13	4.74	4.25	23.18	22.75
0.02300	20.58	4.85	4.25	23.18	22.75
0.02400	21.03	4.95	4.25	23.18	22.75
0.02500	21.46	5.05	4.25	23.18	22.75
0.02600	21.89	5.15	4.25	23.18	22.75
0.02700	22.30	5.25	4.25	23.18	22.75
0.02800	22.71	5.35	4.25	23.18	22.75
0.02900	23.11	5.44	4.25	23.18	22.75
0.03000	23.51	5.53	4.25	23.18	22.75
0.03100	23.90	5.63	4.25	23.18	22.75
0.03200	24.28	5.72	4.25	23.18	22.75
0.03300	24.66	5.81	4.25	23.18	22.75
0.03400	25.03	5.89	4.25	23.18	22.75
0.03500	25.39	5.98	4.25	23.18	22.75
0.03600	25.75	6.06	4.25	23.18	22.75
0.03700	26.11	6.15	4.25	23.18	22.75
0.03800	26.46	6.23	4.25	23.18	22.75
0.03900	26.80	6.31	4.25	23.18	22.75
0.04000	27.15	6.39	4.25	23.18	22.75
0.04100	27.48	6.47	4.25	23.18	22.75
0.04200	27.82	6.55	4.25	23.18	22.75
0.04300	28.15	6.63	4.25	23.18	22.75
0.04400	28.47	6.70	4.25	23.18	22.75
0.04500	28.79	6.78	4.25	23.18	22.75
0.04600	29.11	6.85	4.25	23.18	22.75
0.04700	29.43	6.93	4.25	23.18	22.75

Rating Table for 60' Street-Half Street

Input Data

Channel Slope (ft/ft)	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.04800	29.74	7.00	4.25	23.18	22.75
0.04900	30.05	7.07	4.25	23.18	22.75
0.05000	30.35	7.15	4.25	23.18	22.75

Rating Table for 60' Street-TC (one side)

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.04350	ft/ft
Normal Depth	0.50	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00.000	0.70
0+10.000	0.50
0+10.125	0.00
0+12.125	0.17
0+12.125	0.20
0+30.000	0.56

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.000, 0.70)	(0+30.000, 0.56)	0.015

Channel Slope (ft/ft)	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00300	5.41	1.72	3.15	17.68	17.25
0.00400	6.24	1.98	3.15	17.68	17.25
0.00500	6.98	2.22	3.15	17.68	17.25
0.00600	7.64	2.43	3.15	17.68	17.25
0.00700	8.26	2.62	3.15	17.68	17.25
0.00800	8.83	2.80	3.15	17.68	17.25
0.00900	9.36	2.97	3.15	17.68	17.25
0.01000	9.87	3.14	3.15	17.68	17.25

Rating Table for 60' Street-TC (one side)

Input Data

Channel Slope (ft/ft)	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.01100	10.35	3.29	3.15	17.68	17.25
0.01200	10.81	3.43	3.15	17.68	17.25
0.01300	11.25	3.57	3.15	17.68	17.25
0.01400	11.68	3.71	3.15	17.68	17.25
0.01500	12.09	3.84	3.15	17.68	17.25
0.01600	12.48	3.97	3.15	17.68	17.25
0.01700	12.87	4.09	3.15	17.68	17.25
0.01800	13.24	4.21	3.15	17.68	17.25
0.01900	13.60	4.32	3.15	17.68	17.25
0.02000	13.96	4.43	3.15	17.68	17.25
0.02100	14.30	4.54	3.15	17.68	17.25
0.02200	14.64	4.65	3.15	17.68	17.25
0.02300	14.97	4.75	3.15	17.68	17.25
0.02400	15.29	4.86	3.15	17.68	17.25
0.02500	15.60	4.96	3.15	17.68	17.25
0.02600	15.91	5.06	3.15	17.68	17.25
0.02700	16.22	5.15	3.15	17.68	17.25
0.02800	16.51	5.25	3.15	17.68	17.25
0.02900	16.81	5.34	3.15	17.68	17.25
0.03000	17.09	5.43	3.15	17.68	17.25
0.03100	17.37	5.52	3.15	17.68	17.25
0.03200	17.65	5.61	3.15	17.68	17.25
0.03300	17.93	5.70	3.15	17.68	17.25
0.03400	18.20	5.78	3.15	17.68	17.25
0.03500	18.46	5.87	3.15	17.68	17.25
0.03600	18.72	5.95	3.15	17.68	17.25
0.03700	18.98	6.03	3.15	17.68	17.25
0.03800	19.24	6.11	3.15	17.68	17.25
0.03900	19.49	6.19	3.15	17.68	17.25
0.04000	19.74	6.27	3.15	17.68	17.25
0.04100	19.98	6.35	3.15	17.68	17.25
0.04200	20.22	6.43	3.15	17.68	17.25
0.04300	20.46	6.50	3.15	17.68	17.25
0.04400	20.70	6.58	3.15	17.68	17.25
0.04500	20.93	6.65	3.15	17.68	17.25
0.04600	21.17	6.72	3.15	17.68	17.25
0.04700	21.39	6.80	3.15	17.68	17.25

Rating Table for 60' Street-TC (one side)

Input Data

Channel Slope (ft/ft)	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.04800	21.62	6.87	3.15	17.68	17.25
0.04900	21.84	6.94	3.15	17.68	17.25
0.05000	22.07	7.01	3.15	17.68	17.25

APPENDIX B.2: CATCH BASIN FLOW-BY SUMMARY TABLE

CATCH BASIN FLOW-BY SUMMARY TABLE

		CB			STREET	CAPACITY		US Q10	US Q100	US	FOR INTERCEPTION[2]		INTERCEPTED[3]		BY PASS[4]		CB	DS
CB	NODE	TYPE	Q10[1]	Q100[1]	SLOPE	10 YR	100 YR	BYPASS	BYPASS	CB	Q10	Q100	Q10	Q100	Q10	Q100	WIDTH	CB
15	**105**	**ON GRADE**	**2.64**	**4.07**	**0.0149**	**12.05**	**80.66**	**0.00**	**0.00**	**N/A**	**2.64**	**4.07**	**2.64**	**3.93**	**0**	**0.14**	**14'**	**1**
1[6]	103	ON GRADE	7.66	11.87	0.006	7.64	51.18	0.00	0.14	15	7.66	10.51	7.66	10.27	0	0.24	21'	3
2[6]	**107.2**	**ON GRADE**	**2.32**	**3.57**	**0.006**	**7.64**	**51.18**	**0.00**	**0.00**	**N/A**	**2.32**	**4.93**	**2.32**	**4.87**	**0**	**0.06**	**14'**	**3**
3	110	ON GRADE	3.64	5.62	0.005	6.98	46.72	0	0.3	1, 2	3.64	5.92	3.64	5.73	0	0.19	14'	5
4	**112**	**ON GRADE**	**4.38**	**6.76**	**0.005**	**6.98**	**46.72**	**0.00**	**0.00**	**N/A**	**4.38**	**6.76**	**4.38**	**6.35**	**0.00**	**0.41**	**14'**	**6**
5	116	SUMP[5]	3.57	5.51	0.0031	5.67	37.96	0.11	0.96	3, 7	3.68	6.47	3.65	6.42	0.03	0.05	7'	N/A
6	**118**	**SUMP[5]**	**2.44**	**3.76**	**0.0031**	**5.67**	**37.96**	**0.00**	**0.00**	**N/A**	**2.44**	**3.76**	**2.44**	**3.76**	**0.00**	**0.00**	**4'**	**N/A**
7	121	ON GRADE	3.39	5.22	0.0246	15.48	103.64	0.00	0.00	N/A	3.39	5.22	3.28	4.45	0.11	0.77	14'	5
8	**126**	**ON GRADE**	**3.22**	**4.96**	**0.0096**	**9.67**	**64.74**	**0.00**	**0.00**	**N/A**	**3.22**	**4.96**	**2.98**	**3.96**	**0.24**	**1.00**	**10'**	**10**
9	124	ON GRADE	4.68	7.22	0.0096	9.67	64.74	0.00	0.00	N/A	4.68	7.22	4.53	6.18	0.15	1.04	14'	10
10	**130**	**SUMP[5]**	**1.56**	**2.39**	**0.008**	**8.83**	**59.1**	**0.39**	**2.04**	**8, 9**	**1.95**	**4.43**	**1.95**	**4.43**	**0.00**	**0.00**	**4'**	**N/A**
11	133	ON GRADE	8.81	13.76	0.0435	20.58	137.82	0.00	0.00	N/A	8.81	13.76	8.52	11.69	0.29	2.07	28'	Offsite
12	**135**	**ON GRADE**	**2.06**	**3.16**	**0.0273**	**16.31**	**109.18**	**0.00**	**0.00**	**N/A**	**2.06**	**3.16**	**2.06**	**3.07**	**0.00**	**0.09**	**14'**	**Offsite**
13	202	SUMP[5]	5.09	7.85	0.0052	7.12	47.65	0.00	0.00	N/A	5.09	7.85	5.09	7.85	0.00	0.00	4'	N/A
14	**204**	**SUMP[5]**	**2.90**	**4.43**	**0.0052**	**7.12**	**47.65**	**0.00**	**0.00**	**N/A**	**2.90**	**4.43**	**2.90**	**4.43**	**0.00**	**0.00**	**4'**	**N/A**

1. Appendix A Q10 and Q100 Values
2. Q100 + "Upstream Q100 Bypass" = For Interception (same for Q10)
3. Intercepted from Catch Basin Sizing Calculations
4. "By pass" = "For Interception" - "Intercepted"
5. Street slope and capacities for sump conditions untilize the smallest adjacent street slope.
6. Half Street Capacity is 10.51 cft, therefore 4.16 cfs will overtop to CB 2 for the 100-year.

APPENDIX B.3: CATCH BASIN SIZING CALCULATIONS

Worksheet for Catch Basin #1-10yr

Project Description

Solve For	Efficiency

Input Data

Discharge	7.66	ft³/s
Slope	0.00600	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	21.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	100.00	%
Intercepted Flow	7.66	ft³/s
Bypass Flow	0.00	ft³/s
Spread	15.96	ft
Depth	0.45	ft
Flow Area	2.67	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	2.86	ft/s
Equivalent Cross Slope	0.06284	ft/ft
Length Factor	1.06	
Total Interception Length	19.88	ft

Worksheet for Catch Basin #1-100yr

Project Description

Solve For	Efficiency

Input Data

Discharge	10.51	ft³/s
Slope	0.00600	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	21.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	97.75	%
Intercepted Flow	10.27	ft³/s
Bypass Flow	0.24	ft³/s
Spread	18.14	ft
Depth	0.49	ft
Flow Area	3.42	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	3.08	ft/s
Equivalent Cross Slope	0.05765	ft/ft
Length Factor	0.88	
Total Interception Length	23.91	ft

Worksheet for Catch Basin #2-10yr

Project Description

Solve For	Efficiency

Input Data

Discharge	2.32	ft³/s
Slope	0.00600	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	14.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	100.00	%
Intercepted Flow	2.32	ft³/s
Bypass Flow	0.00	ft³/s
Spread	9.54	ft
Depth	0.32	ft
Flow Area	1.04	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	2.24	ft/s
Equivalent Cross Slope	0.08898	ft/ft
Length Factor	1.43	
Total Interception Length	9.77	ft

Worksheet for Catch Basin #2-100yr

Project Description

Solve For	Efficiency

Input Data

Discharge	4.93	ft³/s
Slope	0.00600	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	14.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	98.78	%
Intercepted Flow	4.87	ft³/s
Bypass Flow	0.06	ft³/s
Spread	13.30	ft
Depth	0.39	ft
Flow Area	1.90	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	2.60	ft/s
Equivalent Cross Slope	0.07123	ft/ft
Length Factor	0.91	
Total Interception Length	15.32	ft

Worksheet for Catch Basin #3-10yr

Project Description

Solve For	Efficiency

Input Data

Discharge	3.64	ft³/s
Slope	0.00500	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	14.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	100.00	%
Intercepted Flow	3.64	ft³/s
Bypass Flow	0.00	ft³/s
Spread	12.15	ft
Depth	0.37	ft
Flow Area	1.60	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	2.27	ft/s
Equivalent Cross Slope	0.07578	ft/ft
Length Factor	1.14	
Total Interception Length	12.31	ft

Worksheet for Catch Basin #3-100yr

Project Description

Solve For	Efficiency

Input Data

Discharge	5.92	ft³/s
Slope	0.00500	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	14.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	96.81	%
Intercepted Flow	5.73	ft³/s
Bypass Flow	0.19	ft³/s
Spread	14.91	ft
Depth	0.42	ft
Flow Area	2.35	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	2.52	ft/s
Equivalent Cross Slope	0.06584	ft/ft
Length Factor	0.85	
Total Interception Length	16.42	ft

Worksheet for Catch Basin #4-10yr

Project Description

Solve For	Efficiency

Input Data

Discharge	4.38	ft³/s
Slope	0.00500	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	14.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	100.00	%
Intercepted Flow	4.38	ft³/s
Bypass Flow	0.00	ft³/s
Spread	13.15	ft
Depth	0.39	ft
Flow Area	1.86	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	2.36	ft/s
Equivalent Cross Slope	0.07179	ft/ft
Length Factor	1.02	
Total Interception Length	13.74	ft

Worksheet for Catch Basin #4-100yr

Project Description

Solve For	Efficiency

Input Data

Discharge	6.76	ft³/s
Slope	0.00500	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	14.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	93.89	%
Intercepted Flow	6.35	ft³/s
Bypass Flow	0.41	ft³/s
Spread	15.75	ft
Depth	0.44	ft
Flow Area	2.61	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	2.59	ft/s
Equivalent Cross Slope	0.06343	ft/ft
Length Factor	0.79	
Total Interception Length	17.76	ft

Worksheet for Catch Basin #5-10yr

Project Description

Solve For	Spread

Input Data

Discharge		3.65	ft³/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.08	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		7.00	ft
Opening Height		0.83	ft
Curb Throat Type	Horizontal		
Local Depression		4.00	in
Local Depression Width		4.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	11.60	ft
Depth	0.36	ft
Gutter Depression	0.13	ft
Total Depression	0.46	ft

Worksheet for Catch Basin #5-100yr

Project Description

Solve For	Spread

Input Data

Discharge		6.42	ft³/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.08	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		7.00	ft
Opening Height		0.83	ft
Curb Throat Type	Horizontal		
Local Depression		4.00	in
Local Depression Width		4.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	16.90	ft
Depth	0.46	ft
Gutter Depression	0.13	ft
Total Depression	0.46	ft

Worksheet for Catch Basin #6-10yr

Project Description

Solve For	Spread

Input Data

Discharge		2.44	ft^3/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.08	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		4.00	ft
Opening Height		0.83	ft
Curb Throat Type	Horizontal		
Local Depression		4.00	in
Local Depression Width		4.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	10.39	ft
Depth	0.33	ft
Gutter Depression	0.13	ft
Total Depression	0.46	ft

Worksheet for Catch Basin #6-100yr

Project Description

Solve For	Spread

Input Data

Discharge		3.76	ft³/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.08	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		4.00	ft
Opening Height		0.83	ft
Curb Throat Type	Horizontal		
Local Depression		4.00	in
Local Depression Width		4.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	13.86	ft
Depth	0.40	ft
Gutter Depression	0.13	ft
Total Depression	0.46	ft

Worksheet for Catch Basin #7-10yr

Project Description

Solve For	Efficiency

Input Data

Discharge	3.39	ft³/s
Slope	0.02460	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	14.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	96.62	%
Intercepted Flow	3.28	ft³/s
Bypass Flow	0.11	ft³/s
Spread	8.15	ft
Depth	0.29	ft
Flow Area	0.79	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	4.29	ft/s
Equivalent Cross Slope	0.09792	ft/ft
Length Factor	0.85	
Total Interception Length	16.52	ft

Worksheet for Catch Basin #7-100yr

Project Description

Solve For	Efficiency

Input Data

Discharge	5.22	ft³/s
Slope	0.02460	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	14.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	85.29	%
Intercepted Flow	4.45	ft³/s
Bypass Flow	0.77	ft³/s
Spread	10.01	ft
Depth	0.33	ft
Flow Area	1.13	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	4.62	ft/s
Equivalent Cross Slope	0.08624	ft/ft
Length Factor	0.66	
Total Interception Length	21.37	ft

Worksheet for Catch Basin #8-10yr

Project Description

Solve For	Efficiency

Input Data

Discharge	3.22	ft³/s
Slope	0.00960	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	10.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	92.45	%
Intercepted Flow	2.98	ft³/s
Bypass Flow	0.24	ft³/s
Spread	9.96	ft
Depth	0.33	ft
Flow Area	1.12	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	2.88	ft/s
Equivalent Cross Slope	0.08656	ft/ft
Length Factor	0.76	
Total Interception Length	13.12	ft

Worksheet for Catch Basin #8-100yr

Project Description

Solve For	Efficiency

Input Data

Discharge	4.96	ft³/s
Slope	0.00960	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	10.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	79.78	%
Intercepted Flow	3.96	ft³/s
Bypass Flow	1.00	ft³/s
Spread	12.06	ft
Depth	0.37	ft
Flow Area	1.58	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	3.14	ft/s
Equivalent Cross Slope	0.07616	ft/ft
Length Factor	0.59	
Total Interception Length	16.99	ft

Worksheet for Catch Basin #9-10yr

Project Description

Solve For	Efficiency

Input Data

Discharge	4.68	ft³/s
Slope	0.00960	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	14.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	96.83	%
Intercepted Flow	4.53	ft³/s
Bypass Flow	0.15	ft³/s
Spread	11.76	ft
Depth	0.36	ft
Flow Area	1.51	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	3.10	ft/s
Equivalent Cross Slope	0.07748	ft/ft
Length Factor	0.85	
Total Interception Length	16.41	ft

Worksheet for Catch Basin #9-100yr

Project Description

Solve For	Efficiency

Input Data

Discharge	7.22	ft³/s
Slope	0.00960	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	14.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	85.59	%
Intercepted Flow	6.18	ft³/s
Bypass Flow	1.04	ft³/s
Spread	14.14	ft
Depth	0.41	ft
Flow Area	2.13	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	3.40	ft/s
Equivalent Cross Slope	0.06828	ft/ft
Length Factor	0.66	
Total Interception Length	21.24	ft

Worksheet for Catch Basin #10-10yr

Project Description

Solve For	Spread

Input Data

Discharge		1.95	ft³/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.08	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		4.00	ft
Opening Height		0.83	ft
Curb Throat Type	Horizontal		
Local Depression		4.00	in
Local Depression Width		4.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	3.83	ft
Depth	0.31	ft
Gutter Depression	0.13	ft
Total Depression	0.46	ft

Worksheet for Catch Basin #10-100yr

Project Description

Solve For	Spread

Input Data

Discharge		4.43	ft³/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.08	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		4.00	ft
Opening Height		0.83	ft
Curb Throat Type	Horizontal		
Local Depression		4.00	in
Local Depression Width		4.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	15.46	ft
Depth	0.44	ft
Gutter Depression	0.13	ft
Total Depression	0.46	ft

Worksheet for Catch Basin #11-10yr

Project Description

Solve For	Efficiency

Input Data

Discharge	8.81	ft³/s
Slope	0.04350	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	28.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	96.69	%
Intercepted Flow	8.52	ft³/s
Bypass Flow	0.29	ft³/s
Spread	11.15	ft
Depth	0.35	ft
Flow Area	1.37	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	6.44	ft/s
Equivalent Cross Slope	0.08034	ft/ft
Length Factor	0.85	
Total Interception Length	32.96	ft

Worksheet for Catch Basin #11-100yr

Project Description

Solve For	Efficiency

Input Data

Discharge	13.76	ft³/s
Slope	0.04350	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	28.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	84.99	%
Intercepted Flow	11.69	ft³/s
Bypass Flow	2.07	ft³/s
Spread	13.50	ft
Depth	0.40	ft
Flow Area	1.95	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	7.06	ft/s
Equivalent Cross Slope	0.07049	ft/ft
Length Factor	0.65	
Total Interception Length	42.99	ft

Worksheet for Catch Basin #12-10yr

Project Description

Solve For	Efficiency

Input Data

Discharge	2.06	ft³/s
Slope	0.02730	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	14.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	100.00	%
Intercepted Flow	2.06	ft³/s
Bypass Flow	0.00	ft³/s
Spread	6.05	ft
Depth	0.25	ft
Flow Area	0.49	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	4.19	ft/s
Equivalent Cross Slope	0.11387	ft/ft
Length Factor	1.11	
Total Interception Length	12.63	ft

Worksheet for Catch Basin #12-100yr

Project Description

Solve For	Efficiency

Input Data

Discharge	3.16	ft³/s
Slope	0.02730	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	14.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	97.25	%
Intercepted Flow	3.07	ft³/s
Bypass Flow	0.09	ft³/s
Spread	7.66	ft
Depth	0.28	ft
Flow Area	0.71	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	4.43	ft/s
Equivalent Cross Slope	0.10141	ft/ft
Length Factor	0.86	
Total Interception Length	16.20	ft

Worksheet for Catch Basin #13-10yr

Project Description

Solve For	Spread

Input Data

Discharge		5.09	ft³/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.08	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		4.00	ft
Opening Height		0.83	ft
Curb Throat Type	Horizontal		
Local Depression		4.00	in
Local Depression Width		4.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	16.96	ft
Depth	0.47	ft
Gutter Depression	0.13	ft
Total Depression	0.46	ft

Worksheet for Catch Basin #14-10yr

Project Description

Solve For	Spread

Input Data

Discharge		2.90	ft³/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.08	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		4.00	ft
Opening Height		0.83	ft
Curb Throat Type	Horizontal		
Local Depression		4.00	in
Local Depression Width		4.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	11.66	ft
Depth	0.36	ft
Gutter Depression	0.13	ft
Total Depression	0.46	ft

Worksheet for Catch Basin #15-10yr

Project Description

Solve For	Efficiency

Input Data

Discharge	2.64	ft³/s
Slope	0.01490	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	14.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	100.00	%
Intercepted Flow	2.64	ft³/s
Bypass Flow	0.00	ft³/s
Spread	8.15	ft
Depth	0.29	ft
Flow Area	0.79	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	3.34	ft/s
Equivalent Cross Slope	0.09790	ft/ft
Length Factor	1.09	
Total Interception Length	12.80	ft

Worksheet for Catch Basin #15-100yr

Project Description

Solve For	Efficiency

Input Data

Discharge	4.07	ft³/s
Slope	0.01490	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.015	
Curb Opening Length	14.00	ft
Local Depression	4.00	in
Local Depression Width	4.00	ft

Results

Efficiency	96.52	%
Intercepted Flow	3.93	ft³/s
Bypass Flow	0.14	ft³/s
Spread	10.02	ft
Depth	0.33	ft
Flow Area	1.13	ft²
Gutter Depression	0.13	ft
Total Depression	0.46	ft
Velocity	3.60	ft/s
Equivalent Cross Slope	0.08619	ft/ft
Length Factor	0.85	
Total Interception Length	16.57	ft

APPENDIX B.4: DROP INLET CALCULATIONS

WEIR EQUATION: $Q = CLH^{(3/2)}$

SOLVING FOR L: $L = \frac{Q}{CH^{(3/2)}}$

$C = 2.8$

Atrium Diameter = 6"

Atrium Weir Lengths = π d

Equivalent Atrium Weir = 1.57 ft

Inlet	Line/Lateral	Q100	H	Min. L	Total Opening Length	Inlet Type
16	Lateral A1-6	4.75	0.75	2.61	3	Modified CB 110

APPENDIX B.5: STORM DRAIN SIZING FRICTION SLOPE CALCULATIONS

LINE A1

PIPE SIZING (SOFFIT CONTROL)

DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1105.24	LINE A1	54	7.69	49.76	1966.48	0.0030	1100.25	1100.27	0.0006	3.1328	0.1521	1.5000	0.2282	1105.47
1105.47	LINE A1	54	157.84	47.96	1966.48	0.0030	1100.27	1100.75	0.0006	3.0195	0.1413	1.5000	0.2120	1105.78
1105.78	LINE A1	48	268.14	36.91	1436.42	0.0030	1100.75	1101.55	0.0007	2.9410	0.1341	1.5000	0.2011	1106.16
1106.16	LINE A1	48	119.43	32.23	1436.42	0.0030	1101.55	1101.91	0.0005	2.5681	0.1022	1.5000	0.1533	1106.37
1106.37	LINE A1	24	51.80	11.50	226.22	0.0030	1101.91	1102.06	0.0026	3.6654	0.2082	1.5000	0.3124	1106.82
1106.82	LINE A1	36	93.29	14.51	666.97	0.0030	1102.06	1102.34	0.0005	2.0547	0.0654	1.5000	0.0982	1106.96
1106.96	LINE A1	36	231.79	18.25	666.97	0.0050	1102.34	1103.50	0.0007	2.5852	0.1036	1.5000	0.1554	1107.29
1107.29	LINE A1	30	61.64	15.75	410.16	0.0150	1103.50	1104.43	0.0015	3.2128	0.1600	1.5000	0.2400	1107.62
1107.62	LINE A1	18	140.03	4.07	105.04	0.0150	1104.43	1106.53	0.0015	2.3062	0.0824	1.5000	0.1237	1107.95

LOSS		
TRANSITION STRUCTURE	0.25	0.25
WALL ENTRANCE	0.25	0.25
JUNCTION STRUCTURE	0.50	1.00
		2.50

LAT A1-1

PIPE SIZING (SOFFIT CONTROL)

DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1105.47	A1-1	18	13.28	4.45	105.04	0.0050	1100.27	1100.34	0.0018	2.5215	0.0985	1.5000	0.1478	1105.64

LAT A1-2

PIPE SIZING (SOFFIT CONTROL)

DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1105.78	LAT A1-2	18	36.07	11.91	105.04	0.0050	1100.75	1100.93	0.0129	6.7485	0.7059	1.5000	1.0589	1107.30
1107.30	LAT A1-2	18	38.64	7.22	105.04	0.0050	1100.93	1101.12	0.0047	4.0910	0.2594	1.5000	0.3891	1107.87

CP A1-2

PIPE SIZING (SOFFIT CONTROL)

DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1107.30	LAT A1-3	18	38.05	3.96	105.04	0.0050	1100.93	1101.12	0.0014	2.2438	0.0780	1.5000	0.1171	1107.47

LAT A1-3

PIPE SIZING (SOFFIT CONTROL)

DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1106.16	LAT A1-3	18	69.53	4.45	105.04	0.0050	1101.55	1101.90	0.0018	2.5215	0.0985	1.5000	0.1478	1106.43

LAT A1-4

PIPE SIZING (SOFFIT CONTROL)

DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1106.37	LAT A1-4	18	27.80	6.42	105.04	0.0050	1101.91	1102.05	0.0037	3.6377	0.2051	1.5000	0.3077	1106.78

LAT A1-5

PIPE SIZING (SOFFIT CONTROL)

DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1106.37	LAT A1-5	18	16.53	3.76	105.04	0.0050	1101.91	1101.99	0.0013	2.1305	0.0704	1.5000	0.1055	1106.50

LAT A1-6

PIPE SIZING (SOFFIT CONTROL)														
DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1106.82	LAT A1-6	30	39.73	4.75	410.16	0.0050	1102.06	1102.26	0.0001	0.9689	0.0146	1.5000	0.0218	1106.84

LAT A1-7

PIPE SIZING (SOFFIT CONTROL)														
DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1106.96	LAT A1-7	30	30.26	5.73	410.16	0.0050	1102.34	1102.50	0.0002	1.1688	0.0212	1.5000	0.0318	1107.00

LAT A1-8

PIPE SIZING (SOFFIT CONTROL)														
DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1106.96	LAT A1-8	30	16.84	6.35	410.16	0.0050	1102.34	1102.43	0.0002	1.2953	0.0260	1.5000	0.0390	1107.00

LAT A1-9

PIPE SIZING (SOFFIT CONTROL)														
DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1107.29	LAT A1-9	24	33.66	4.87	226.22	0.0050	1103.50	1103.67	0.0005	1.5522	0.0373	1.5000	0.0560	1107.36

LAT A1-10

PIPE SIZING (SOFFIT CONTROL)														
DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1107.62	LAT A1-10	24	30.60	10.27	226.22	0.0050	1104.43	1104.58	0.0021	3.2733	0.1661	1.5000	0.2491	1107.93

LINE A2

PIPE SIZING (SOFFIT CONTROL)														
DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1105.24	LINE A2	42	114.70	16.56	1006.08	0.0050	1100.25	1100.82	0.0003	1.7235	0.0460	1.5000	0.0691	1105.34
1105.34	LINE A2	42	60.38	13.76	1006.08	0.0050	1100.82	1101.13	0.0002	1.4321	0.0318	1.5000	0.0477	1105.40

LOSS		
TRANSITION STRUCTURE	0.25	0.25
WALL ENTRANCE	0.25	0.25
JUNCTION STRUCTURE	0.50	1.00
		2.50

LAT A2-1

PIPE SIZING (SOFFIT CONTROL)														
DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1105.34	LAT A2-1	18	10.96	3.16	105.04	0.0050	1100.82	1100.88	0.0009	1.7905	0.0497	1.5000	0.0745	1105.42

LINE B

PIPE SIZING (SOFFIT CONTROL)

DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1106.50	LINE B	18	66.70	11.80	105.04	0.0100	1101.65	1102.32	0.0126	6.6862	0.6929	1.5000	1.0394	1108.38
1108.38	LINE B	18	32.15	7.85	105.04	0.0100	1102.32	1102.64	0.0056	4.4480	0.3067	1.5000	0.4600	1109.02

LOSS		
TRANSITION STRUCTURE	0.25	0.25
WALL ENTRANCE	0.25	0.25
JUNCTION STRUCTURE	0.50	1.00
		2.50

LAT B1

PIPE SIZING (SOFFIT CONTROL)

DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1108.38	LAT B1	18	4.22	4.43	105.04	0.0030	1102.32	1102.33	0.0018	2.5101	0.0977	1.5000	0.1465	1108.54

SPLIT FLOW PIPE - LATERAL A

PIPE SIZING (SOFFIT CONTROL)														
DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1104.50	LAT A	42	28.75	10.76	1006.08	0.0100	1098.50	1098.79	0.0001	1.1198	0.0194	1.5000	0.0292	1104.53

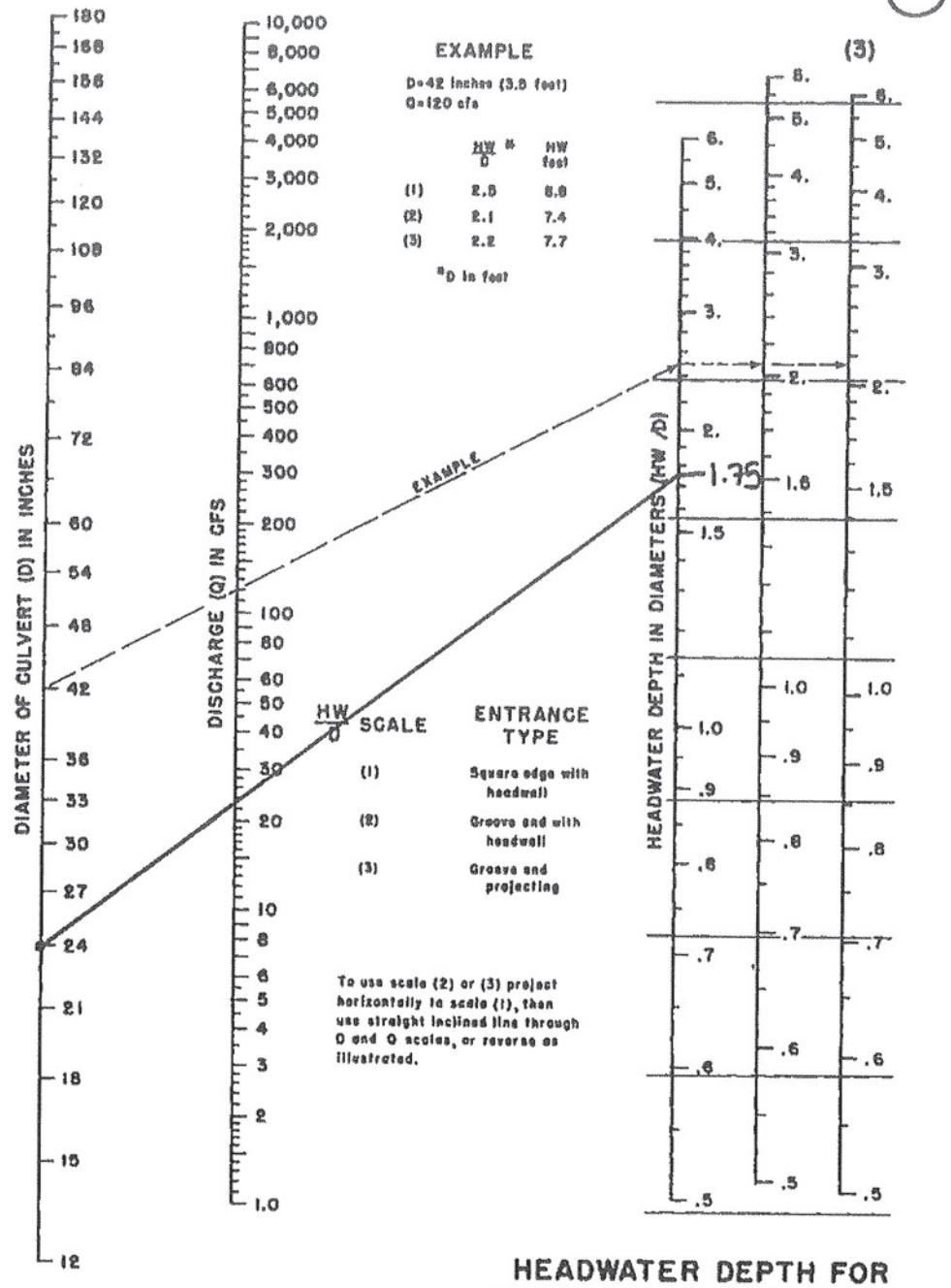
BASIN OUTLET PIPE - LINE C

PIPE SIZING (SOFFIT CONTROL)														
DS WSE	SYSTEM	PIPE DIA.	PIPE LENGTH	Q (cfs)	K	PIPE SLOPE	DS INVERT	US INVERT	FRICTION SLOPE	VELOCITY	VELOCITY HEAD	LOSS COEFFICIENT	LOSSES	US WSE
1100.02	LINE C	36	129.50	66.32	666.97	0.0063	1097.02	1097.84	0.0099	9.3946	1.3680	1.5000	2.0520	1103.35

APPENDIX B.6: SPLITTER STRUCTURE NOMOGRAPH

Splitter Structure Nomograph

CHART 1B



HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

$\frac{HW}{D} = 1.75' = \frac{HW}{2'} \Rightarrow HW = 3.50'$ (1101.81 + 3.5 = 1105.31)

Discharge = 23 cfs

APPENDIX B.7: SPLITTER STRUCTURE WEIR CALCULATION

DIVERSION STRUCTURE WEIR

100-YEAR WSE CALCULATION

WEIR EQUATION: $Q = CLH^{(3/2)}$

SOLVING FOR H: $H = \left(\frac{Q}{CL} \right)^{(2/3)}$

Q =	10.76	ft^3/s
L =	8	ft
C =	3	
H =	0.59	ft

Invert = 1104.56

100-YEAR WSE = 1105.15

APPENDIX B.8: BASIN OUTLET STRUCTURE CALCULATION

BASIN OUTLET STRUCTURE CALCULATIONS

100-YEAR WSE CALCULATION

WEIR EQUATION: $Q = CLH^{(3/2)}$

SOLVING FOR H: $H = \left(\frac{Q}{CL}\right)^{(2/3)}$

Q =	66.32	ft^3/s
L =	16	ft
C =	3	

H = 1.24 ft

Invert = 1104

100-YEAR WSE = 1105.24

EXCERPTS

EXCERPT A: PALOMA DEL SOL TEMECULA CREEK CHANNEL – ALCOBA DRIVE STORM DRAIN TRACT NO. 24185 STORM DRAIN PLANS

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

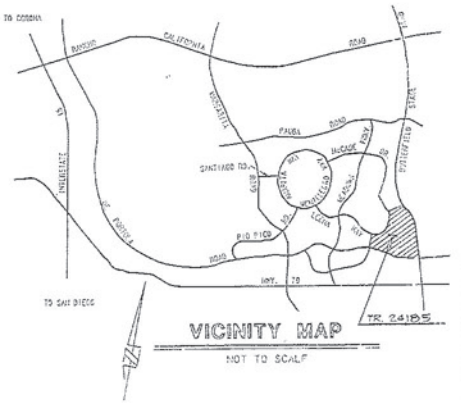
TRACT 24184

CAST-IN-PLACE PIPE RECOMMENDATION

1. CONCRETE MIXES SHALL NOT HAVE LESS THAN SIX (6) SACKS OF PORTLAND CEMENT/CU YD.
2. CONCRETE MIX DESIGNS SHALL BE SUBMITTED BY CONTRACTOR FOR APPROVAL PRIOR TO START OF CONSTRUCTION.
3. IF CAST-IN-PLACE PIPE IS USED FOR DESIGN VELOCITIES GREATER THAN 20 FPS AND LESS THAN 30 FPS, THE INVERT THICKNESS SHALL BE INCREASED 2" OVER THE LOWER 120 DEGREES OF THE PIPE. FOR VELOCITIES GREATER THAN 30 FPS, A 4" THICKENED INVERT SHALL BE CONSTRUCTED. THE CONCRETE DESIGN STRENGTH IN THESE REACHES SHALL BE PC GREATER THAN OR EQUAL TO 4,000 PSI.
4. MAXIMUM PERMISSIBLE CONCRETE SLUMP SHALL BE 2-1/2", 1-1/2" MIN. TO 2-1/2" MAX.
5. CONTRACTOR SHALL ALLOW INSPECTOR INTO PIPE WHILE UNDER CONSTRUCTION & "RCD" FOR WALL THICKNESS AT A MIN. OF 25 C.Y. OF THE POUR.
6. AT THE END OF ALL POURS AND AT THE END OF EACH WORKING DAY THE CONTRACTOR SHALL INSTALL #4 DOWELS 24" LONG 12" INTO THE LAST POUR AT 12" CENTERS AROUND THE CIRCUMFERENCE OF REINFORCED CONCRETE PIPE.
7. REFER TO ADDENDUM TO GEOTECHNICAL INVESTIGATION BY CONVERSE CONSULTANTS INLAND EMPIRE DATED MAY 16, 1996 REF. GEOTECHNICAL RECOMMENDATIONS FOR CAST-IN-PLACE CONCRETE PIPE.
8. JUNCTION STRUCTURES SHOWN ON THE PLANS ARE FOR REINFORCED CONCRETE PIPE. THE FOLLOWING SUBSTITUTIONS SHALL BE MADE FOR JUNCTIONS STRUCTURES FOR USE WITH CAST-IN-PLACE PIPE:
   A. A JUNCTION STRUCTURE NO. 4 (JS 225) SHALL BE REPLACED WITH EITHER A JUNCTION STRUCTURE NO. 2 (JS 227) OR A TRANSITION STRUCTURE NO 3 (TS 303).
   B. A JUNCTION STRUCTURE NO. 2 (JS 227) SHALL BE REPLACED WITH A TRANSITION STRUCTURE NO. 3 (TS 303).
9. STANDARD DRAWING NO. JS 227, JUNCTION STRUCTURE NO. 2 WHEN USED WITH CAST-IN-PLACE PIPE SHALL BE MODIFIED TO INCLUDE CONCRETE BACKFILL 1 FOOT OVER THE CAST-IN-PLACE PIPE.

CITY OF TEMECULA GENERAL NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CLEARING OF THE PROPOSED WORK AREA, AND RELOCATION COSTS OF ALL EXISTING UTILITIES. PERMITTEE MUST INFORM THE CITY OF CONSTRUCTION SCHEDULE AT LEAST 48 HOURS PRIOR TO BEGINNING OF CONSTRUCTION.
   PHONE: (909) 694-6411
2. ALL CITY INSPECTED WORK SHALL CONFORM TO THE REQUIREMENTS OF THE CITY OF TEMECULA PUBLIC WORKS DEPARTMENT IMPROVEMENT STANDARDS AND THE LATEST EDITION OF STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (GREEN BOOK).
3. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY THE ENGINEER TO INSTALL STREET CENTERLINE MONUMENTS AS REQUIRED BY THE CITY OF TEMECULA STANDARDS.
4. IT SHALL BE THE RESPONSIBILITY OF THE DEVELOPER OR CONTRACTOR TO APPLY TO THE CITY OF TEMECULA DEPARTMENT OF PUBLIC WORKS FOR AN ENCROACHMENT PERMIT FOR ALL WORK ON EXISTING CITY MAINTAINED ROADS, AND FOR UTILITY WORK WITHIN OFFERS OF DEDICATION FOR PUBLIC USE.
5. ALL UNDERGROUND FACILITIES, WITH LATERALS, SHALL BE IN PLACE PRIOR TO PAVING THE STREET SECTION INCLUDING, BUT NOT LIMITED TO, THE FOLLOWING: SEWER, WATER, ELECTRIC, GAS, DRAINAGE.
6. ASPHALTIC EMULSION (FOG SEAL) SHALL BE APPLIED NOT LESS THAN FOURTEEN (14) DAYS FOLLOWING PLACEMENT OF THE ASPHALT SURFACING AND SHALL BE APPLIED AT A RATE OF 0.05 GALLON PER SQUARE YARD. ASPHALTIC EMULSION SHALL CONFORM TO SECTION 37, 39 AND 94 OF THE STATE STANDARD SPECIFICATIONS.



VICINITY MAP

NOT TO SCALE

MAINTENANCE NOTE

THE FOLLOWING ITEMS ARE TO BE INSPECTED AND MAINTAINED BY RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT:

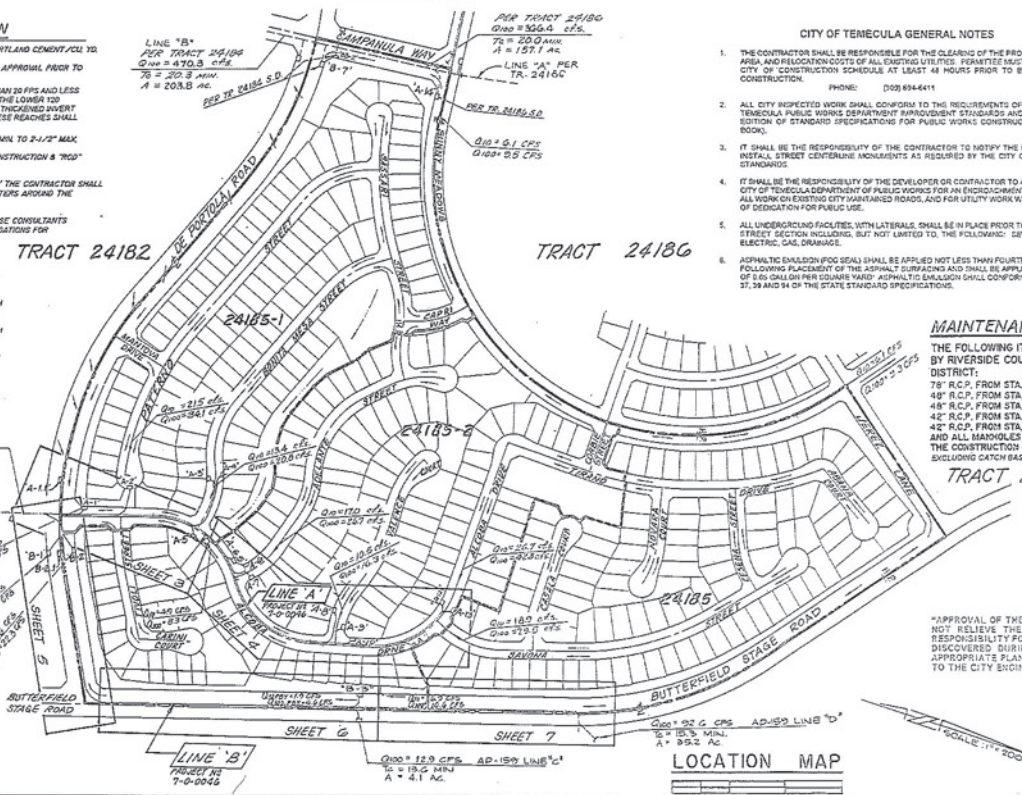
78" R.C.P. FROM STA. 24+90.00 TO STA. 25+00.00 SHOWN ON SHEET 3
48" R.C.P. FROM STA. 25+14.16 TO STA. 27+85.00 SHOWN ON SHEET 3
48" R.C.P. FROM STA. 10+14.58 TO STA. 17+97.67 SHOWN ON SHEETS 5 & 6
42" R.C.P. FROM STA. 27+94.16 TO STA.30+15.74 SHOWN ON SHEET 3
42" R.C.P. FROM STA. 18+02.33 TO STA. 23+99.42 SHOWN ON SHEET 6
AND ALL MANHOLES AND OTHER STRUCTURES REQUIRED TO COMPLETE THE CONSTRUCTION OF THE ABOVE MENTIONED MAINLINE PIPE;
EXCLUDING CATCH BASINS AND CONNECTOR PIPES

SHEET INDEX

	SHEET NO.
TITLE SHEET	1
GENERAL NOTES, CONSTRUCTION NOTES, L.R. 07.5, AND ESTIMATED QUANTITIES	2
LINE 'A' - PLAN AND PROFILE STA. 24+90.00 TO STA. 31+50.00	3
LINE 'A' - PLAN AND PROFILE STA. 31+50.00 TO STA. 41+76.64	4
LINE 'B' - PLAN AND PROFILE STA. 10+00.00 TO STA. 17+50.00	5
LINE 'E' - PLAN AND PROFILE STA. 17+50.00 TO STA. 27+00.00	6
LINE 'B' - PLAN AND PROFILE STA. 27+00.00 TO STA. 34+37.42	7
LATERALS AND DETAILS	8, 9, 10

R.C.F.C.D. STANDARD DRAWINGS

- CB 100 CATCH BASIN NO. 1
- JS 227 JUNCTION STRUCTURE NO. 2
- JS 223 JUNCTION STRUCTURE NO. 4
- MH 251 MANHOLE NO. 1
- MH 252 MANHOLE NO. 2
- MH 254 MANHOLE NO. 4
- TS 303 TRANSITION STRUCTURE NO. 3
- M 803 CONCRETE COLLAR



LOCATION MAP

"APPROVAL OF THESE PLANS BY THE CITY OR ITS AGENTS DOES NOT RELIEVE THE APPLICANT AND HIS ENGINEER FROM THE RESPONSIBILITY FOR THE CORRECTION OF ERRORS OR OMISSIONS DISCOVERED DURING CONSTRUCTION. UPON REQUEST, THE APPROPRIATE PLAN REVISIONS SHALL BE PROMPTLY SUBMITTED TO THE CITY ENGINEER FOR REVIEW AND APPROVAL."

AS BUILT

APPROVED BY:

DATE: 9/20/96

CATCH BASIN INLET TABLE

IDENTIFICATION NUMBER		DESIGN Q(cfs)	FLOW Q(cfs)
LINE 'A' :	A-1	19.8	7.7
	A-2	54.1	21.5
	A-3	10.4	6.7
	A-4	10.4	6.7
	A-5	8.3	4.8
	A-6	13.4	8.5
	A-6.5	8.4	2.7
	A-7	8.2	6.6
	A-8	8.2	5.3
	A-9	8.2	5.3
	A-10	13.4	10.5
	A-11	13.4	10.5
	A-12	21.2	13.4
	A-13	21.2	13.4
	A-14	1.2	0.5
LINE 'B' :	B-1	1.8	1.8
	B-2	22.3	13.6
	B-3	4.0	8.0
	B-23	1.8	0.9

LD 96-055 CO

Underground Service Alert

Call: TOLL FREE 1-800 422-4133

TWO WORKING DAYS BEFORE YOU DIG

UNDERGROUND STRUCTURES

ALL UNDERGROUND UTILITIES OR STRUCTURES REPORTED BY THE OWNER OR OTHERS AND THOSE SHOWN ON THE RECORDS EXAMINED ARE INDICATED WITH THEIR APPROXIMATE LOCATION AND EXTENT. THE OWNER BY ACCEPTING THESE PLANS OR PROCEEDING WITH IMPROVEMENTS PURSUANT THERETO AGREES TO ASSUME LIABILITY AND TO HOLD UNDERSIGNED HARMLESS FOR ANY DAMAGE RESULTING FROM THE EXISTENCE OF UNDERGROUND UTILITIES OR STRUCTURES NOT REPORTED TO THE UNDERSIGNED, NOT INDICATED ON THE PUBLIC RECORDS EXAMINED, LOCATED AT VARIANCE WITH THAT REPORTED OR SHOWN ON RECORDS EXAMINED. THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTIONARY MEASURES TO PROTECT THE UTILITIES OR STRUCTURES SHOWN AND ANY OTHER UTILITIES OR STRUCTURES FOUND AT THE SITE. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE OWNERS OF THE UTILITIES OR STRUCTURES CONCERNED BEFORE STARTING WORK.

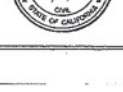
THE PRIVATE ENGINEER SIGNING THESE PLANS IS RESPONSIBLE FOR ASSURING THE ACCURACY OF DESIGN AND ACCEPTABILITY OF THE WORK HEREON. IN THE EVENT OF DISCREPANCIES ARISING AFTER CITY APPROVAL OR DURING CONSTRUCTION, THE PRIVATE ENGINEER SHALL BE RESPONSIBLE FOR DETERMINING AN ACCEPTABLE SOLUTION AND REVISING THE PLANS FOR APPROVAL BY THE CITY, AND BY THE RIVERSIDE COUNTY FLOOD CONTROL DISTRICT.

BASIS OF BEARINGS

THE BEARINGS SHOWN HEREON ARE BASED ON A PORTION OF THE CENTERLINE OF BUTTERFIELD STAGE ROAD AS SHOWN ON PARCEL MAP NO. 23432 FILED IN BOOK 159, PAGES 38 THROUGH 61 OF PARCEL MAPS IN THE OFFICE OF THE COUNTY RECORDER OF RIVERSIDE COUNTY, CALIFORNIA BEING N 22°59'25"W

BENCH MARK

COUNTY OF RIVERSIDE B.M. NO. T-29-81
1 1/2" BRASS DISC IN CONC. CYLINDER LOCATED FROM THE INTERSECTION OF FRONT ST. AND RANCHO CALIFORNIA ROAD, 1.8 MILES N.E. ON RANCHO CALIFORNIA ROAD TO THE INTERSECTION OF RANCHO CALIFORNIA ROAD AND MURRIETA ROAD, IN THE W.W. CORNER OF THE INTERSECTION 1' E. OF A 7' CHAINLINK FENCE, 21' + 10' AROUND SO. CALIF. GAS VALVES, 10' N. OF P.P. (ELEV. 961' M. OF THE CENTERLINE OF RANCHO CALIFORNIA ROAD. FIBERGLASS WITNESS POST SET 2' W. OF MONUMENT.
ADJ. DATE: 9-13-82 ELEV. 1125.410



KEITH INTERNATIONAL, INC.
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Land Surveying • Public Works • Water Resources
Inland Empire Division
3839 Conroy Rd., Ste. 200, Orange, Ca. 92868 (714) 637-0259
Fax (714) 637-0429

Date 4-22-96

DAVID LI-WEN SHEN RCE NO. 44374 EXP. 6/30/97

REVISIONS				
REF.	DESCRIPTION	ENGR. DATE	RCFCD DATE	

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

RECOMMENDED FOR APPROVAL BY: [signature] PLANNING ENGINEER DATE: 8/29/97

APPROVED BY: [signature] CHIEF ENGINEER DATE: 9/3/97

CITY OF TEMECULA

RECOMMENDED BY: [signature] DATE: 8/20/97

ACCEPTED BY: [signature] DATE: 8/19/97
PRINCIPAL ENGINEER, FOR CITY ENGINEER
RONALD A. PARKS
R.C.E. NO. 19744 EXP. DATE: 9/30/01

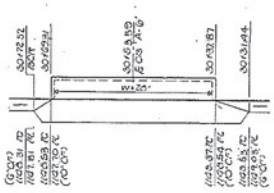
PALOMA DEL SOL
TEMECULA CREEK CHANNEL - ALCOBA DRIVE STORM DRAIN
TRACT NO. 24185
STORM DRAIN PLANS

PROJECT NO.	7-0-0046
DRAWING NO.	7-263
SHEET NO.	1 OF 10

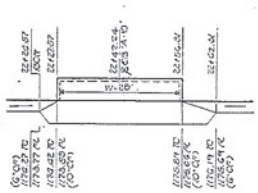
TRACT 24185 STORM DRAIN PLANS

GENERAL NOTES

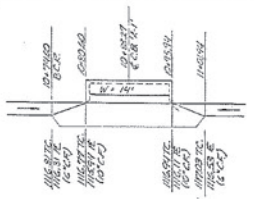
1. THE CONTRACTOR SHALL CONSTRUCT THE FLOOD CONTROL IMPROVEMENTS SHOWN ON THE DRAWINGS IN CONFORMANCE WITH THE REQUIREMENTS OF THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT'S SPECIFICATIONS DATED SEPTEMBER 1984, AND DESIGN MANUAL STANDARD DRAWINGS, RECENT EDITION.
2. JUNCTION STRUCTURES SHOWN ARE FOR RCP ALTERNATIVE. REFER TO ADDITIONAL INFORMATION IN PLAN VIEW FOR CIPP OPTION STRUCTURES.
3. CONSTRUCTION INSPECTION WILL BE PERFORMED BY RIVERSIDE COUNTY FLOOD CONTROL. THE CONTRACTOR SHALL NOTIFY THE DISTRICT IN WRITING A MINIMUM OF TWO WEEKS BEFORE BEGINNING CONSTRUCTION, AND SHALL NOT BEGIN CONSTRUCTION BEFORE OBTAINING AUTHORIZATION TO PROCEED.
4. ALL STATIONING REFERS TO CENTERLINE OF CONSTRUCTION UNLESS OTHERWISE NOTED.
5. STATIONING FOR LATERALS AND CONNECTOR PIPE REFER TO THE CENTERLINE-CENTERLINE INTERSECTION STATION.
6. FORTY-EIGHT HOURS BEFORE EXCAVATION, CALL UNDERGROUND SERVICE ALERT 1-800-422-4133.
7. ALL ELEVATIONS SHOWN ARE IN FEET AND DECIMALS THEREOF BASED ON U.S.C. & G.S. DATUM.
8. ALL CROSS SECTIONS ARE TAKEN LOOKING DOWNSTREAM.
9. ELEVATIONS OF UTILITIES ARE APPROXIMATE UNLESS OTHERWISE NOTED.
10. OPENINGS RESULTING FROM THE CUTTING OR PARTIAL REMOVAL OF EXISTING CULVERTS, PIPES OF SIMILAR STRUCTURES TO BE ABANDONED SHALL BE SEALED WITH 5" OF CLASS "B" CONCRETE.
11. PIPE CONNECTED TO THE MAINLINE PIPE SHALL CONFORM TO JUNCTION STRUCTURE NO. 4 (JS 229) UNLESS OTHERWISE NOTED.
12. BEDDING PIPE WITH LESS THAN TWO FEET OF COVER SHALL CONFORM TO LOS ANGELES COUNTY FLOOD CONTROL DISTRICT STANDARD DRAWINGS 2-D2113 AND 2-D177 FOR CONCRETE BACKFILL IN TRENCHES. ALL OTHER PIPE SHALL CONFORM TO RCFC&WCD STD. DRAWING M615.
13. "V" IS THE DEPTH OF INLET OF CATCH BASINS MEASURED FROM THE TOP OF CURB TO INVERT OF CONNECTOR PIPE.
14. CATCH BASINS SHALL BE LOCATED SO THAT LOCAL DEPRESSION SHALL BEGIN AT EXISTING CURB RETURN JOINT, UNLESS OTHERWISE SPECIFIED.
15. ALL CURBS, GUTTERS, SIDEWALKS, DRIVEWAYS AND OTHER EXISTING IMPROVEMENTS TO BE RECONSTRUCTED IN KIND AND AT THE SAME ELEVATION AND LOCATION AS THE EXISTING IMPROVEMENTS UNLESS OTHERWISE NOTED.
16. A SOILS INVESTIGATION DATED APRIL 26, 1996, PREPARED BY ~~CONVERSE CONSULTANTS~~ SHALL BE INCLUDED AS A PART OF THESE PLANS. ALL WORK SHALL CONFORM TO RECOMMENDATIONS AS OUTLINED IN SAID REPORT.
17. THE CONCRETE COVER ON THE INSIDE OF ALL REINFORCED CONCRETE PIPE SHALL BE INCREASED TO PROVIDE A MINIMUM OF 1-1/2" OVER THE REINFORCING WHEN THE DESIGN VELOCITIES EXCEED 20 FEET PER SECOND. THE CONCRETE DESIGN STRENGTH IN THESE REACHES SHALL BE FC=5,000 PSI FOR VELOCITIES EXCEEDING 20 FEET PER SECOND AND FC=6,000 PSI FOR VELOCITIES EXCEEDING 30 FEET PER SECOND.
18. ALL CONSTRUCTION TO BE IN CONFORMANCE w/ THE REGULATION OF CAL-OSHA.
19. NOTICE TO CONTRACTOR: THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY PIPES OR STRUCTURES SHOWN ON THESE PLANS WERE OBTAINED BY A SEARCH OF THE AVAILABLE RECORDS. TO THE BEST OF OUR KNOWLEDGE, THERE ARE NO EXISTING UTILITIES EXCEPT FOR THOSE SHOWN ON THESE PLANS. THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTIONARY MEASURES TO PROTECT THE UTILITY LINES SHOWN AND ANY OTHER LINES NOT SHOWN ON THESE PLANS OR NOT RECORDED.



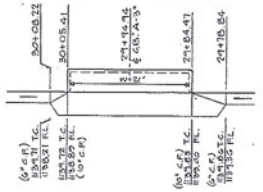
STA. 30+53.59
ADELANTE STREET
LOCAL DEPRESSION NO.A-6
FOR PLAN VIEW SEE SHT. 4



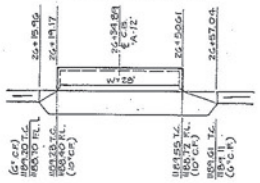
STA. 22+42.24
ALCOBA DRIVE
LOCAL DEPRESSION NO.A-10
FOR PLAN VIEW SEE SHT. 4



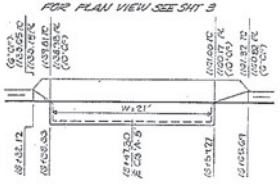
STA. 10+88.27
ALCOBA DRIVE
LOCAL DEPRESSION No. 'A-1'
FOR PLAN VIEW SEE SHT 3



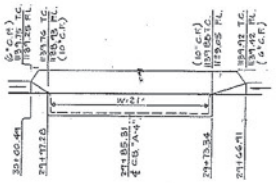
STA. 29+94.94
BONITA MESA STREET
LOCAL DEPRESSION NO.A-8
FOR PLAN VIEW SEE SHT 3



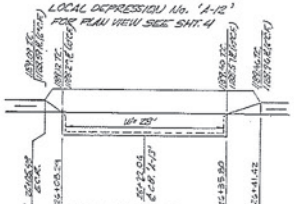
STA. 26+34.89
ALCOBA DRIVE
LOCAL DEPRESSION No. 'A-12'
FOR PLAN VIEW SEE SHT 4



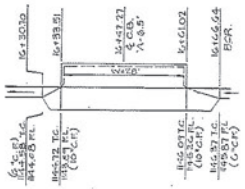
STA. 15+47.30
ALCOBA DRIVE
LOCAL DEPRESSION NO.A-9
FOR PLAN VIEW SEE SHT 3



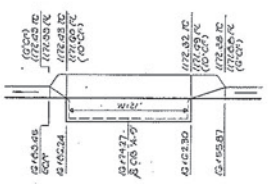
STA. 29+85.31
BONITA MESA STREET
LOCAL DEPRESSION NO.A-4
FOR PLAN VIEW SEE SHT 3



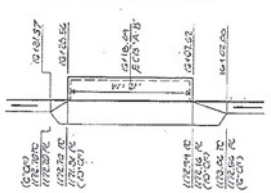
STA. 26+22.04
ALCOBA DRIVE
LOCAL DEPRESSION No. 'A-13'
FOR PLAN VIEW SEE SHT 4



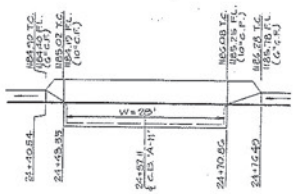
STA. 15+47.27
ALCOBA DRIVE
LOCAL DEPRESSION NO.A-9.5
FOR PLAN VIEW SEE SHT 4



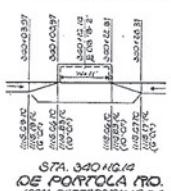
STA. 15+74.27
VALENCE COURT
LOCAL DEPRESSION NO.A-5
FOR PLAN VIEW SEE SHT 4



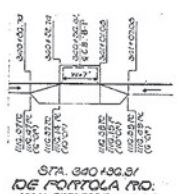
STA. 15+18.09
VALENCE COURT
LOCAL DEPRESSION NO.A-5
FOR PLAN VIEW SEE SHT 4



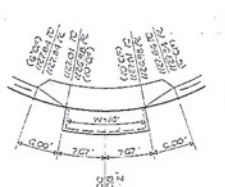
STA. 24+57.11
ALCOBA DRIVE
LOCAL DEPRESSION NO.A-11
FOR PLAN VIEW SEE SHT 4



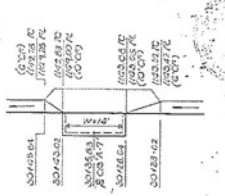
STA. 340+10.14
DE PORTOLA RD.
LOCAL DEPRESSION NO.A-2
FOR PLAN VIEW SEE SHT 3



STA. 340+80.81
DE PORTOLA RD.
LOCAL DEPRESSION NO.A-1
FOR PLAN VIEW SEE SHT 3



M.O.C.
PATERNO STREET
LOCAL DEPRESSION NO.A-2
FOR PLAN VIEW SEE SHT 4



STA. 30+35.83
ADELANTE STREET
LOCAL DEPRESSION NO.A-7
FOR PLAN VIEW SEE SHT 4

CONSTRUCTION NOTES & ESTIMATED QUANTITIES

NO.	ITEM DESCRIPTION	UNIT	QUANTITY
1	CONSTRUCT 78" R.C.P. OR C.I.P.P. (D-LOAD PER PROFILE)	L.F.	10.00.
2	CONSTRUCT 48" R.C.P. OR ALT. C.I.P.P. (D-LOAD PER PROFILE)	L.F.	1049.27
3	CONSTRUCT 42" R.C.P. OR ALT. C.I.P.P. (D-LOAD PER PROFILE)	L.F.	1014.01
4	CONSTRUCT 36" R.C.P. OR ALT. C.I.P.P. (D-LOAD PER PROFILE)	L.F.	1578.89
5	CONSTRUCT 30" R.C.P. OR ALT. C.I.P.P. (D-LOAD PER PROFILE)	L.F.	497.64
6	CONSTRUCT 24" R.C.P. (CLASS IV)	L.F.	466.52
7	CONSTRUCT 18" R.C.P. (CLASS IV)	L.F.	423.82
8	CONSTRUCT MANHOLE NO.1 PER R.C.F.C.D. STD. MH 251	EA.	2
9	CONSTRUCT MANHOLE NO.2 PER R.C.F.C.D. STD. MH 252	EA.	3
10	CONSTRUCT MANHOLE NO.4 PER R.C.F.C.D. STD. MH 254	EA.	7
11	CONSTRUCT JUNCTION STRUCTURE NO.2 PER R.C.F.C.D. STD. JS 227	EA.	5
12	CONSTRUCT JUNCTION STRUCTURE NO.4 PER R.C.F.C.D. STD. JS 229	EA.	3
13	CONSTRUCT TRANSITION STRUCTURE NO.3 PER R.C.F.C.D. STD. TS 303	EA.	5
14	CONSTRUCT CATCH BASIN NO.1 PER R.C.F.C.D. STD. CB 100	L.F.	341 (17 EACH)
15	CONSTRUCT LOCAL DEPRESSION NO.2 CASE "B" PER RIV. CO. STD. NO. 311	EA.	13
16	CONSTRUCT LOCAL DEPRESSION NO.2 CASE "C" PER RIV. CO. STD. NO. 311	EA.	5
17	CONSTRUCT CONCRETE COLLAR PER R.C.F.C.D. STD. M 803	EA.	9
18	~~CONSTRUCT SANITARY SEWER PROTECTION PER R.C.F.C.D. STD. M 601~~	~~L.F.~~	~~60~~
19	REMOVE EXIST. 36" R.C.P., HEADWALL & RIP. RAP AND ABANDON OFFSITE	L.F.	195
20	REMOVE EXIST. 66" R.C.P. CULVERT AND ABANDON OFFSITE	L.F.	280
21	SAWCUT, REMOVE & REPLACE EXIST PAVEMENT PER CITY STD.NO 600 (DE PORTOLA: 0.58'AC W/SEAL COAT- 209 TON/0.65'AB CLASS 2 - 178 C.Y.) (BUTTERFIELD: 0.6'AC W/SEAL COAT ~ 83 TON/0.65'AB CLASS 2 ~ 75 C.Y.)	S.F.	8493

DAVID LI-WEN SHEN
NO. 44574
EXP. 6-30-97
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA
CIVIL

AS BUILT
APPROVED BY:
DATE 9/26/97

LD 96-055 CO

Underground Service Alert
Call: TOLL FREE
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TWO WORKING DAYS BEFORE YOU DIG

KEITH INTERNATIONAL, INC.
Planning • Civil Engineering • Environmental Services
Land Surveying • Public Works • Project Management
Inland Empire Division
3200 Inland Empire Blvd., Ste. 160, Ontario, CA 91764 (909) 483-2400
PREPARED UNDER THE SUPERVISION OF
DAVID LI-WEN SHEN RCE NO. 44574 EXP. 6/30/97 DATE 4-22-96

BENCH MARK
SEE SHEET NO.1

REVISIONS				
REF.	DESCRIPTION	BY	DATE	RECD DATE

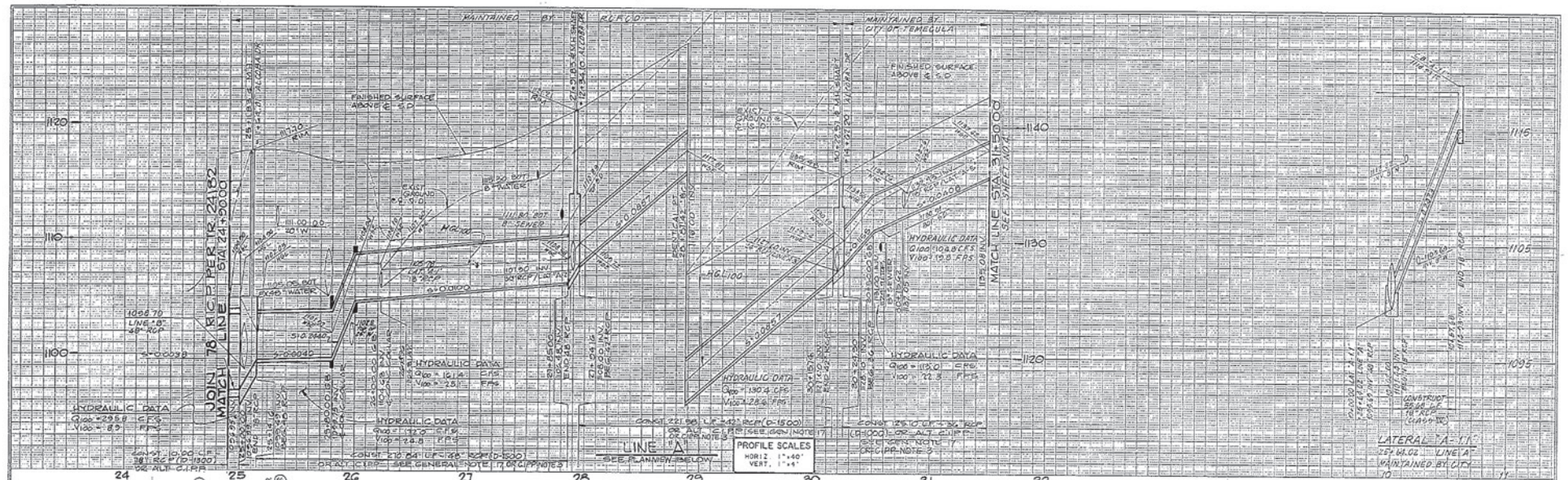
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER DATE: 8/29/97
APPROVED BY: CHIEF ENGINEER DATE: 9/3/97

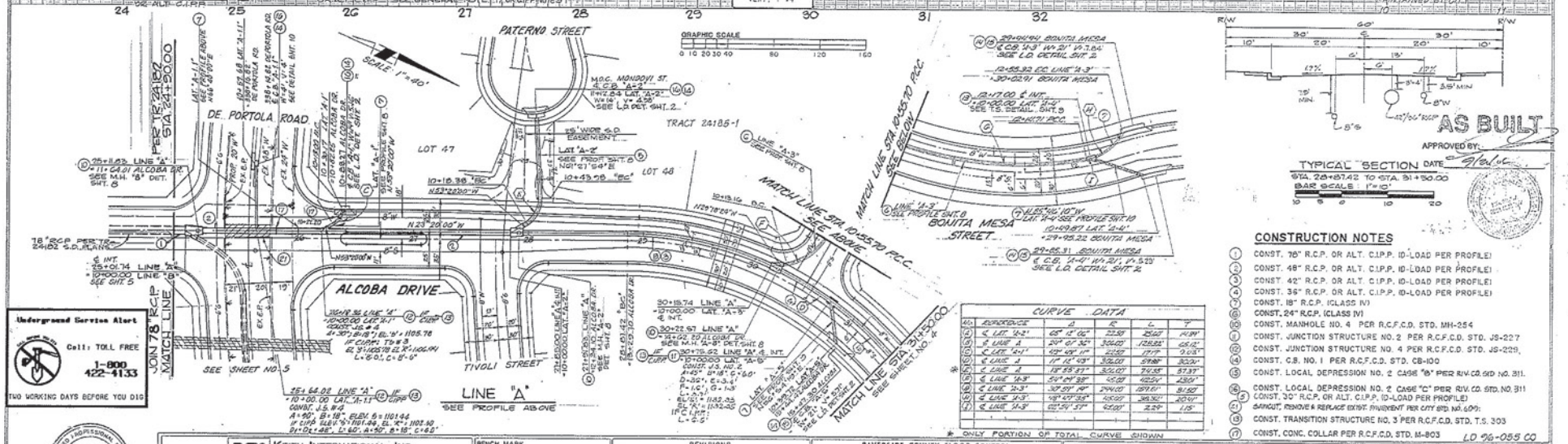
CITY OF TEMECULA
RECOMMENDED BY: DATE: 8/26/97
ACCEPTED BY: PRINCIPAL ENGINEER, FOR CITY ENGINEER DATE: 8/26/97
DONALD G. PARKS
R.C.E. NO. 13744 EXP. DATE: 9/30/98

PALOMA DEL SOL
GENERAL NOTES, CONSTRUCTION NOTES AND ESTIMATED QUANTITIES
TRACT NO.24185

PROJECT NO. 7-0-0046
DRAWING NO. 7-263
SHEET NO. 2 OF 10

JOB NO.





CONSTRUCTION NOTES

1. CONST. 78" R.C.P. OR ALT. C.I.P.P. (D-LOAD PER PROFILE)
2. CONST. 48" R.C.P. OR ALT. C.I.P.P. (D-LOAD PER PROFILE)
3. CONST. 42" R.C.P. OR ALT. C.I.P.P. (D-LOAD PER PROFILE)
4. CONST. 36" R.C.P. OR ALT. C.I.P.P. (D-LOAD PER PROFILE)
7. CONST. 18" R.C.P. (CLASS IV)
8. CONST. 24" R.C.P. (CLASS IV)
10. CONST. MANHOLE NO. 4 PER R.C.F.C.D. STD. MH-254
11. CONST. JUNCTION STRUCTURE NO. 2 PER R.C.F.C.D. STD. JS-227
12. CONST. JUNCTION STRUCTURE NO. 4 PER R.C.F.C.D. STD. JS-229.
14. CONST. C.B. NO. 1 PER R.C.F.C.D. STD. CB-100
15. CONST. LOCAL DEPRESSION NO. 2 CASE "B" PER RIV. CO. STD NO. 311.
16. CONST. LOCAL DEPRESSION NO. 2 CASE "C" PER RIV. CO. STD. NO. 311
5. CONST. 30" R.C.P. OR ALT. C.I.P.P. (D-LOAD PER PROFILE)
21. SAWCUT, REMOVE & REPLACE EXIST. PAVEMENT PER CITY STD. NO. 609:
13. CONST. TRANSITION STRUCTURE NO. 3 PER R.C.F.C.D. STD. T.S. 303
17. CONST. CONC. COLLAR PER R.C.F.C.D. STD. M-803

LD 96-055 CO

CURVE DATA					
NO.	REFERENCE	Δ	R	L	T
(A)	℄ LAT. 'A-2'	65° 13' 06"	225.00'	256.00'	143.99'
(B)	℄ LINE 'A'	24° 07' 32"	300.00'	126.33'	64.12'
(C)	℄ LAT. 'A-1'	47° 49' 11"	225.00'	187.79'	100.03'
(D)	℄ LINE 'A'	11° 16' 09"	300.00'	59.00'	30.00'
(E)	℄ LINE 'A'	18° 59' 37"	300.00'	74.25'	37.37'
(F)	℄ LINE 'A-3'	54° 17' 39"	45.00'	42.64'	23.01'
(G)	℄ LINE 'A-3'	30° 59' 19"	244.00'	131.61'	67.50'
(H)	℄ LINE 'A-3'	98° 47' 38"	45.00'	38.32'	20.41'
(I)	℄ LINE 'A-3'	60° 52' 57"	45.00'	2.29'	1.15'

* ONLY PORTION OF TOTAL CURVE SHOWN

Underground Service Alert
Call: TOLL FREE
1-800 422-4133
TWO WORKING DAYS BEFORE YOU DIG

PREPARED UNDER THE SUPERVISION OF
DAVID LI-WEN SHEN, RCE NO. 44374 EXP. 6/30/97
DATE 4-22-96

KEITH INTERNATIONAL, INC.
Planning • Civil Engineering • Environmental Services
Land Surveying • Public Parks • Park Programs
Inland Empire Division

BENCH MARK
SEE SHEET NO. 1

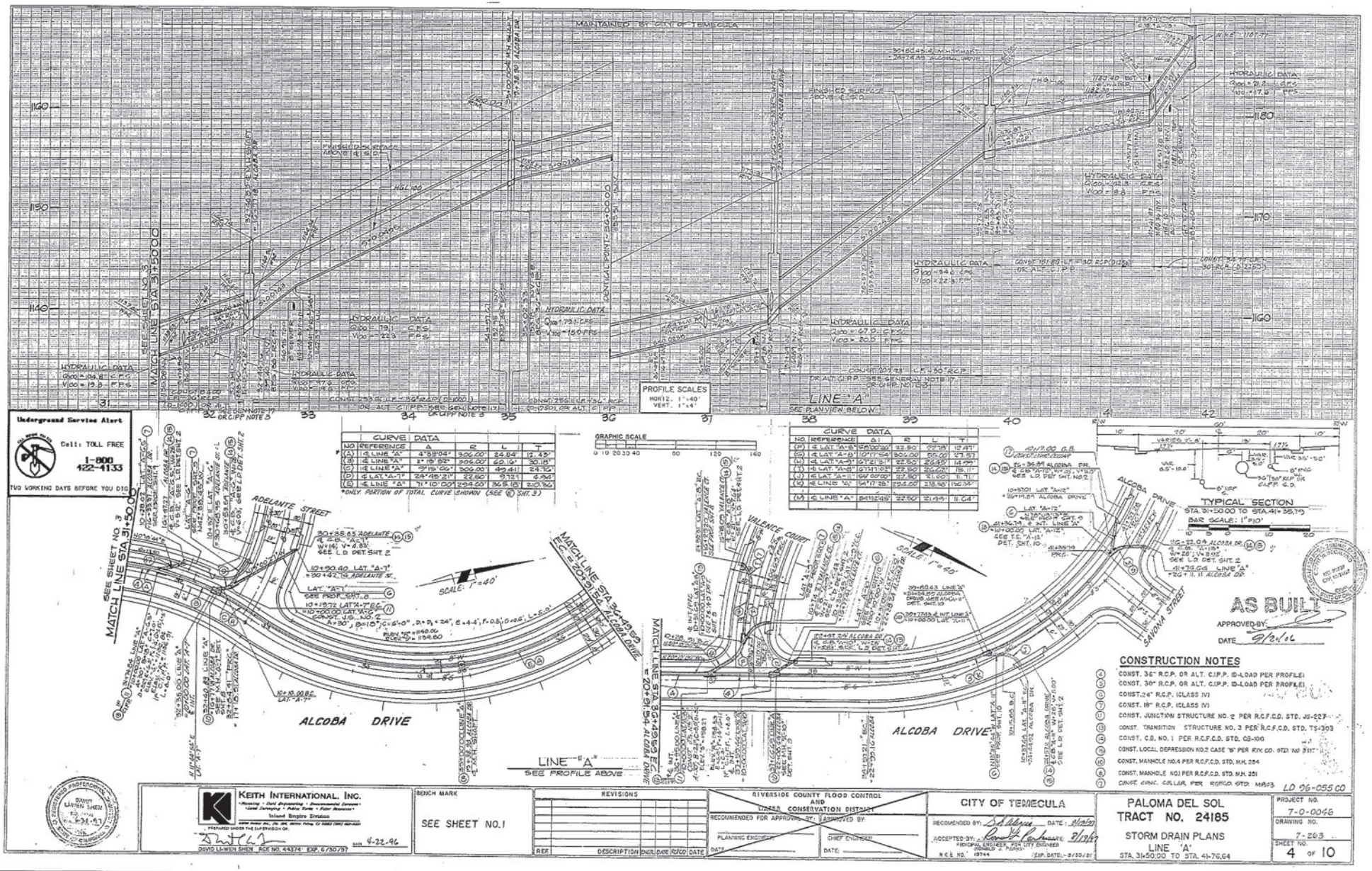
REVISIONS				
RER	DESCRIPTION	ENGR	DATE	RC'D/DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER — DATE: 9/20/97
APPROVED BY: CHIEF ENGINEER — DATE: 9/3/97

CITY OF TEMECULA
RECOMMENDED BY: DATE: 8/26/97
ACCEPTED BY: PRINCIPAL ENGINEER, FOR CITY ENGINEER RONALD J. PARKS R.C.E. NO. 13744 — DATE: 8/19/97
EXP. DATE: 3/30/01

PALOMA DEL SOL
TRACT NO. 24185
STORM DRAIN PLANS
LINE 'A'
STA. 24+90.00 TO STA. 31+50.00

PROJECT NO. 7-0-0046
DRAWING NO. 7-263
SHEET NO. 3 OF 10



CURVE DATA				
NO	REFERENCE	Δ	R	L	T
(A)	℄ LINE "A"	4°59'04"	306.00'	26.64'	13.45'
(B)	℄ LINE "A"	11°19'52"	306.00'	60.16'	30.18'
(C)	℄ LINE "A"	9°19'00"	306.00'	49.61'	24.86'
(D)	℄ LAT. "A-1"	28°48'21"	22.60'	9.72'	4.96'
(E)	℄ LINE "A"	71°10'00"	249.60'	345.18'	210.86'

*ONLY PORTION OF TOTAL CURVE SHOWN (SEE (E) SHT. 3)

CURVE DATA				
NO	REFERENCE	Δ	R	L	T
(F)	℄ LAT "A-8"	5°00'00"	22.60'	27.78'	12.47'
(G)	℄ LAT "A-8"	10°17'54"	304.00'	55.00'	27.57'
(H)	℄ LAT "A-9"	107°41'31"	22.60'	29.93'	14.29'
(I)	℄ LAT. "A-8"	61°41'02"	22.60'	24.60'	13.77'
(J)	℄ LAT "A-11"	66°00'00"	22.60'	21.60'	11.71'
(K)	℄ LINE "A"	54°17'26"	234.00'	218.60'	150.34'
(L)	℄ LINE "A"	54°17'26"	234.00'	221.80'	152.54'
(M)	℄ LINE "A"	54°17'26"	22.60'	21.43'	11.64'

GRAPHIC SCALE
0 10 20 30 40 80 120 160

CONSTRUCTION NOTES

A. CONST. 36" R.C.P. OR ALT. C.I.P.P. (D-LOAD PER PROFILE)
B. CONST. 30" R.C.P. OR ALT. C.I.P.P. (D-LOAD PER PROFILE)
C. CONST. 24" R.C.P. (CLASS IV)
D. CONST. 18" R.C.P. (CLASS IV)
E. CONST. JUNCTION STRUCTURE NO. 2 PER R.C.F.C.D. STD. JS-227
F. CONST. TRANSITION STRUCTURE NO. 3 PER R.C.F.C.D. STD. TS-303
G. CONST. C.B. NO. 1 PER R.C.F.C.D. STD. CB-100
H. CONST. LOCAL DEPRESSION NO.2 CASE "B" PER RIV. CO. STD. NO 311
I. CONST. MANHOLE NO.4 PER R.C.F.C.D. STD. M.H. 254
J. CONST. MANHOLE NO.1 PER R.C.F.C.D. STD. M.H. 251
K. CONST. CONC. COLLAR PER R.C.F.C.D. STD. M803

LD 96-055 CO

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Inland Empire Division
PREPARED UNDER THE SUPERVISION OF:
DAVID LI-WEN SHEN
DAVID LI-WEN SHEN RCE NO. 44374 EXP. 6/30/97
DATE 4-22-96

BENCH MARK
SEE SHEET NO. 1

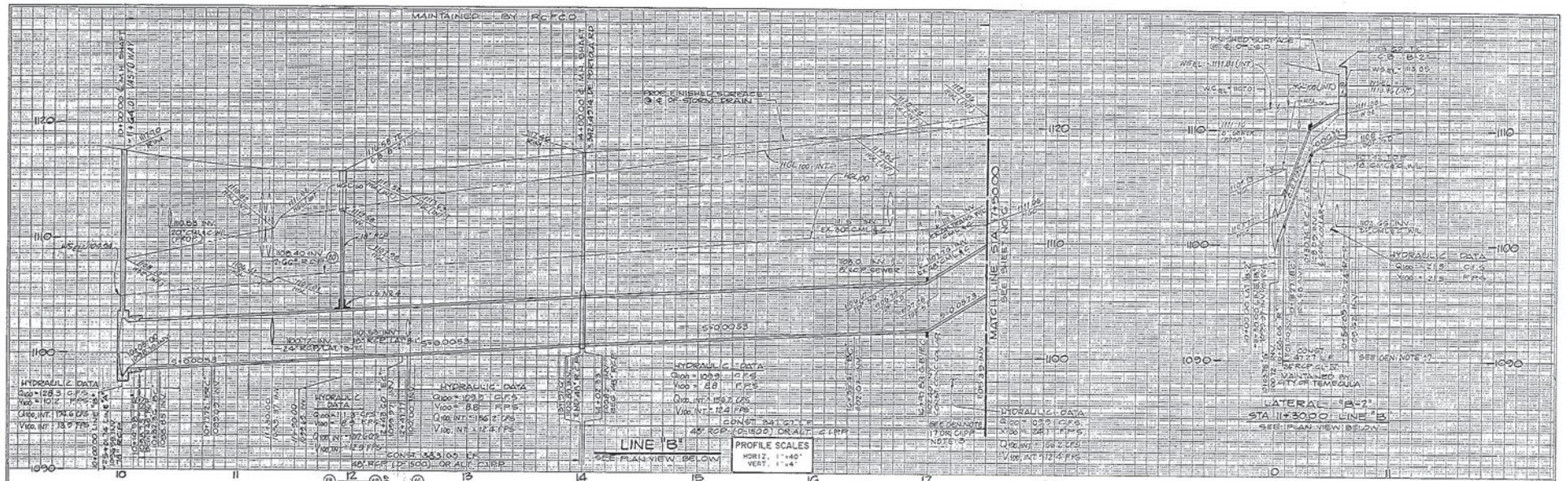
REVISIONS				
REF.	DESCRIPTION	ENGR.	DATE	R/R'CD DATE

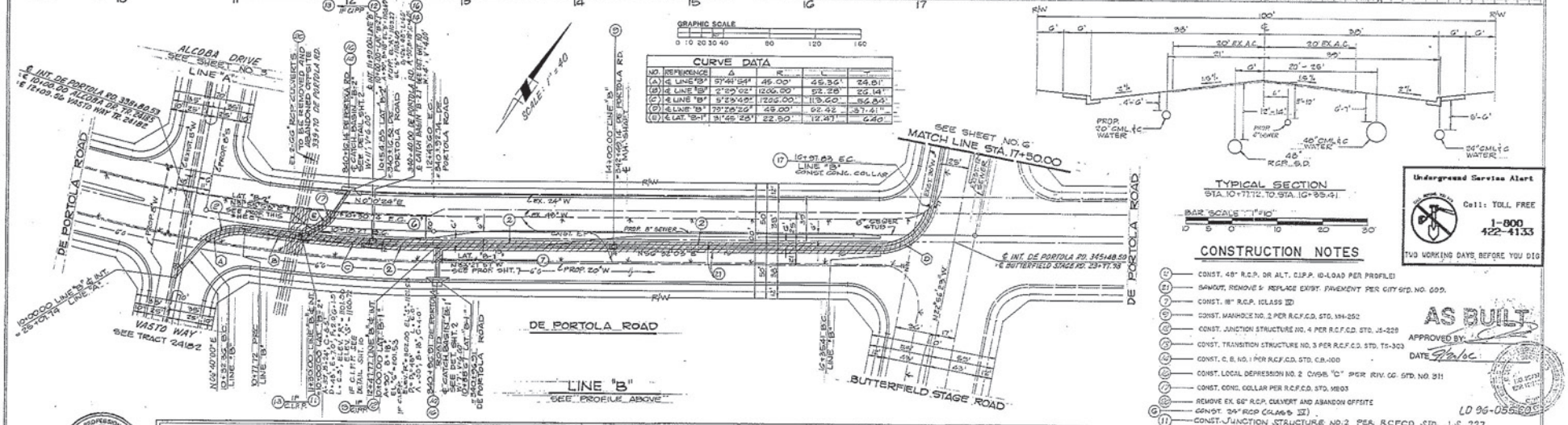
RIVERSIDE COUNTY FLOOD CONTROL AND CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY:
PLANNING ENGINEER DATE
APPROVED BY:
CHIEF ENGINEER DATE

CITY OF TEMECULA
RECOMMENDED BY: DATE: 8/28/97
ACCEPTED BY: DATE: 8/29/97
PRINCIPAL ENGINEER, PSW CITY ENGINEER
DONALD J. PARKS
R.C.E. NO. 19744 EXP. DATE: 3/30/98

PALOMA DEL SOL
TRACT NO. 24185
STORM DRAIN PLANS
LINE 'A'
STA. 31+50.00 TO STA. 41+70.64

PROJECT NO. 7-0-0046
DRAWING NO. 7-263
SHEET NO. 4 OF 10





NO.	REFERENCE	Δ	R	L	T
(A)	℄ LINE "B"	51°41'54"	46.00'	45.36'	24.61'
(B)	℄ LINE "B"	2°29'02"	1206.00'	52.28'	26.14'
(C)	℄ LINE "B"	5°23'45"	1205.00'	113.60'	56.84'
(D)	℄ LINE "B"	73°58'29"	46.00'	92.42'	53.41'
(E)	℄ LAT. "B-1"	31°46'28"	22.50'	12.47'	6.40'

TYPICAL SECTION
STA. 10+77.12 TO STA. 16+85.41

CONSTRUCTION NOTES

- (C) CONST. 48" R.C.P., DR ALT., C.I.P.P. (0-1,500 PER PROFILE)
- (E1) SAWCUT, REMOVE & REPLACE EXIST. PAVEMENT PER CITY STD. NO. 609.
- (7) CONST. 18" R.C.P. (CLASS III)
- (9) CONST. MANHOLE NO. 2 PER R.C.F.C.D. STD. M4-202
- (12) CONST. JUNCTION STRUCTURE NO. 4 PER R.C.F.C.D. STD. J5-229
- (13) CONST. TRANSITION STRUCTURE NO. 3 PER R.C.F.C.D. STD. T5-303
- (14) CONST. C. B. NO. 1 PER R.C.F.C.D. STD. C.B.-100
- (15) CONST. LOCAL DEPRESSION NO. 2 CWSB "C" PER RIV. CO. STD. NO. 311
- (17) CONST. CONC. COLLAR PER R.C.F.C.D. STD. M803
- (A) REMOVE EX. 66" R.C.P. CULVERT AND ABANDON OFFSITE
- (G) CONST. 24" RCP CLASS III
- (11) CONST. JUNCTION STRUCTURE NO. 2 PER R.C.F.C.D. STD. J-5 227

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DAVID LI-WEN GHEN
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Exp. 6-30-97
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REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA

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Land Surveying • Public Works • Water Resources
Inland Empire Division
PREPARED UNDER THE SUPERVISION OF:
DAVID LI-WEN GHEN RCE NO. 44374 EXP. 6/30/97
DATE 4-22-96

BENCH MARK
SEE SHEET NO. 1

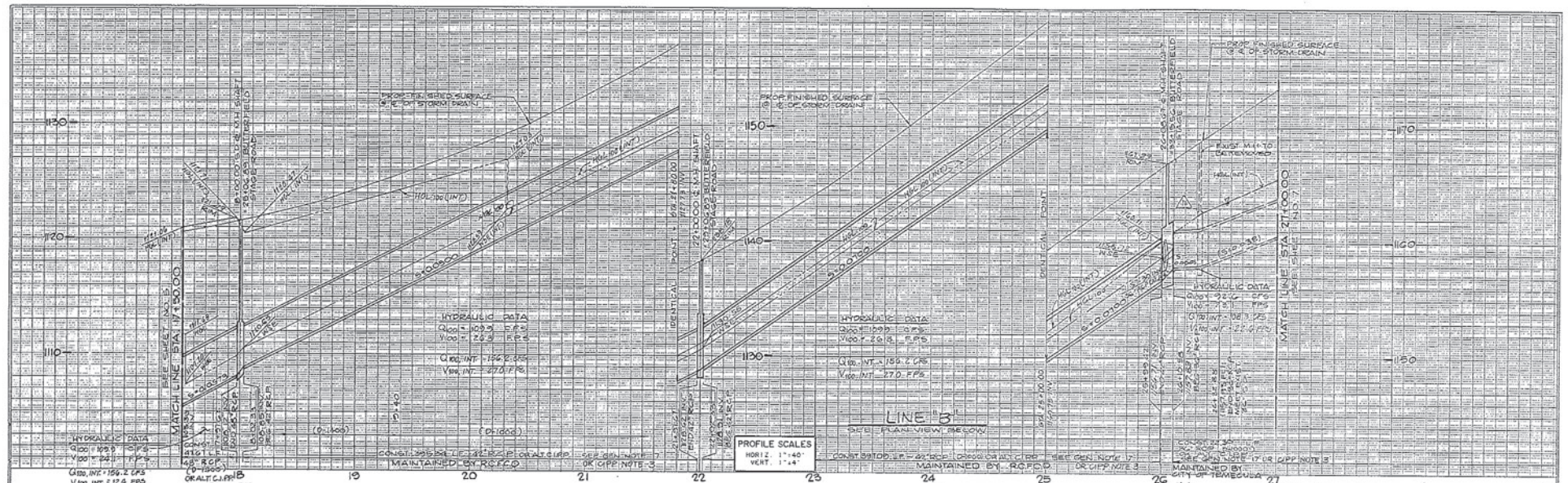
REVISIONS				
REF.	DESCRIPTION	ENGR.	DATE	RCFCD DATE

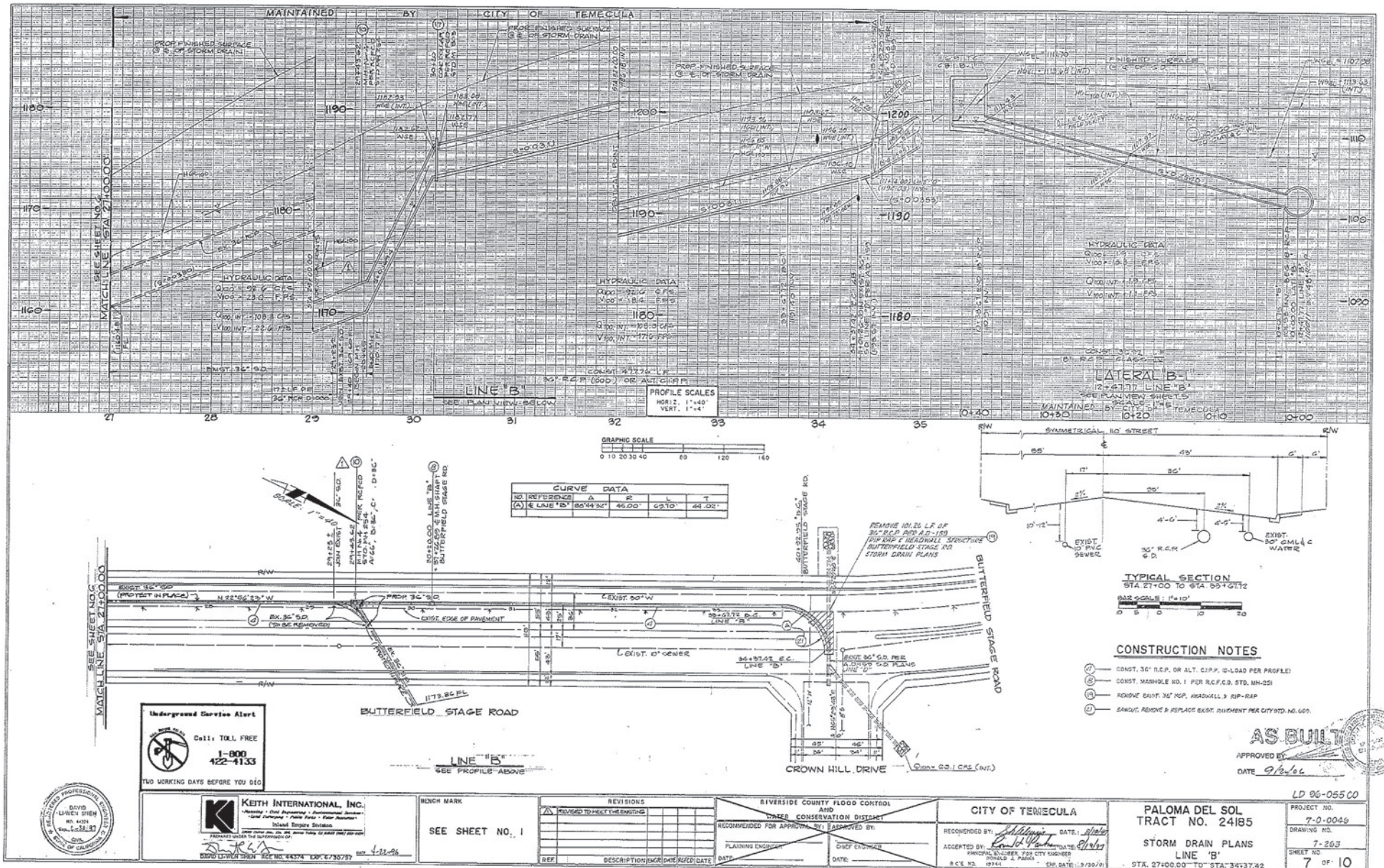
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER — DATE: 9/20/97
APPROVED BY: CHIEF ENGINEER — DATE: 9/15/97

CITY OF TEMECULA
RECOMENDED BY: — DATE: 8/19/97
ACCEPTED BY: PRINCIPAL ENGINEER-FORESTRY SUPERVISOR RONALD A. PARKS — DATE: 8/19/97
R.C.E. NO. 13744 — EXP. DATE: 9/30/98

PALOMA DEL SOL
TRACT NO. 24185
STORM DRAIN PLANS
LINE 'B'
STA. 10+00.00 TO STA. 17+50.00

PROJECT NO. 7-0-0046
DRAWING NO. 7-263
SHEET NO. 5 OF 10


PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=4'
LINE "B"
SEE PLAN VIEW BELOW
MATCH LINE STA. 17+50.00
SEE SHEET NO. 5
MATCH LINE STA. 27+00.00
SEE SHEET NO. 7
HYDRAULIC DATA
Q100 = 109.9 CFS
V100 = 26.8 FPS
Q100, INT. = 156.2 CFS
V100, INT. = 27.0 FPS
PROP. FINISHED SURFACE @ E. OF STORM DRAIN
EXIST. M.H. TO BE EXTENDED
EXIST. 12" SEWER
EXIST. 30" CML & C
EXIST. 10" SEWER
BUTTERFIELD STAGE ROAD
EXIST. 12" M.H. SHAFT
EXIST. 18" M.H. SHAFT
EXIST. EDGE OF PVMT.
EX. 12" SEWER
R/W
N22°56'23"W
SYMMETRICAL 80' STREET
TYPICAL SECTION
STA. 17+50.00 TO STA. 27+00.00
EXIST. 12" V.C.P. SEWER
36"-42" R.C.P. S.D.
EXIST. 30" CML & C WATER
EXIST. 30" R.C.P. SEWER
EXIST. M.H. TO BE REMOVED
EXIST. 18" R.C.P. STORM DRAIN
EXIST. 24" R.C.P. STORM DRAIN
EXIST. 36" R.C.P. STORM DRAIN
EXIST. 42" R.C.P. STORM DRAIN
EXIST. 48" R.C.P. STORM DRAIN
EXIST. 54" R.C.P. STORM DRAIN
EXIST. 60" R.C.P. STORM DRAIN
EXIST. 66" R.C.P. STORM DRAIN
EXIST. 72" R.C.P. STORM DRAIN
EXIST. 78" R.C.P. STORM DRAIN
EXIST.



GRAPHIC SCALE

0 10 20 30 40 80 120 160

CURVE DATA					
NO.	REFERENCE	Δ	R	L	T
(A)	℄ LINE "B"	86°44'36"	46.00'	69.10'	44.02'

TYPICAL SECTION
STA. 27+00 TO STA. 35+67.72

SCALE: 1"=10'

0 5 0 10 20

CONSTRUCTION NOTES

(17) CONST. 36" R.C.P. OR ALT. C.I.P.P. (D-LOAD PER PROFILE)
(18) CONST. MANHOLE NO. 1 PER R.C.F.C.D. STD. MH-251
(19) REMOVE EXIST. 36" RGP, HEADWALL & RIP-RAP
(21) SAWCUT, REMOVE & REPLACE EXIST. PAVEMENT PER CITY STD. NO. 600.

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APPROVED BY
DATE 9/2/06

LD 96-055 CO

DAVID LI-WEN SHEN No. 44374 Exp. 6-30-97 CIVIL STATE OF CALIFORNIA REGISTERED PROFESSIONAL ENGINEER

KEITH INTERNATIONAL, INC.
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Inland Empire Division
PREPARED UNDER THE SUPERVISION OF:
DAVID LI-WEN SHEN RCE NO. 44374 EXP. 6/30/97
DATE 4-22-96

BENCH MARK
SEE SHEET NO. 1

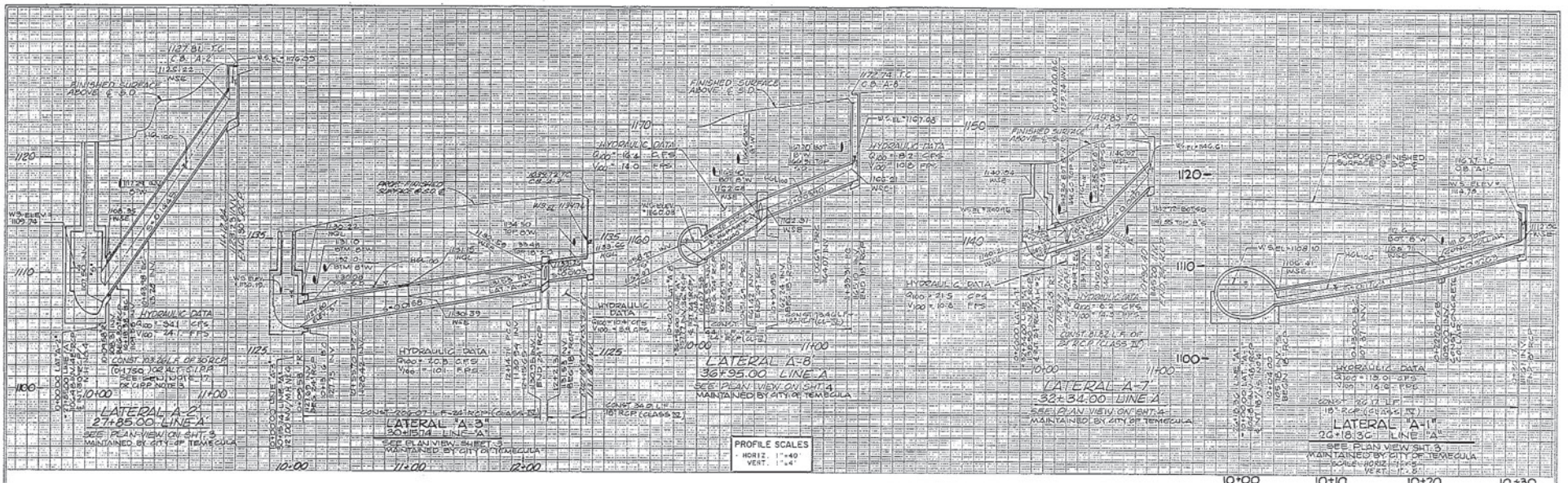
REVISIONS				
REF.	DESCRIPTION	ENGR.	DATE	APVD. DATE
1	REVISED TO MEET THE EXISTING			

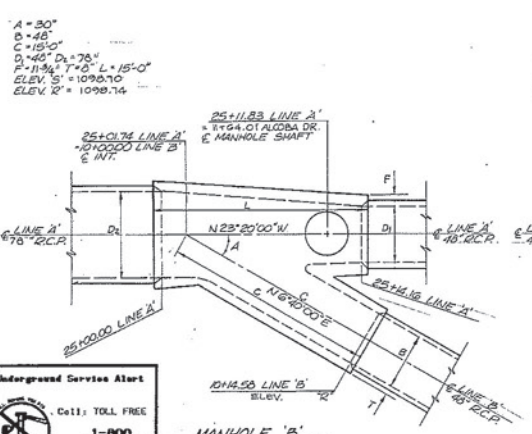
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER DATE
APPROVED BY: CHIEF ENGINEER DATE

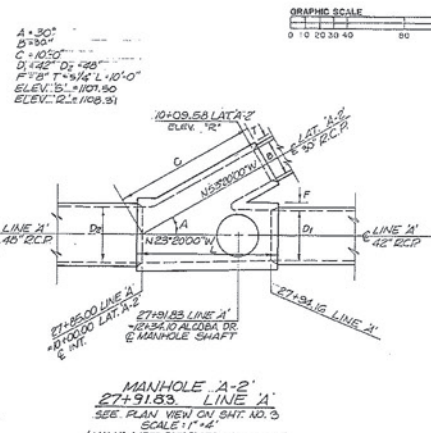
CITY OF TEMECULA
RECOMENDED BY: DATE: 8/16/07
ACCEPTED BY: DATE: 8/16/07
PRINCIPAL ENGINEER, 739 CITY ENGINEER
RONALD L. PARKS
R.C.E. NO. 43744 EXP. DATE: 9/30/08

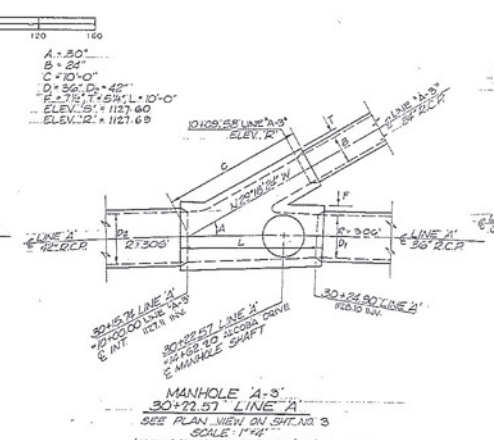
PALOMA DEL SOL
TRACT NO. 24185
STORM DRAIN PLANS
LINE 'B'
STA. 27+00.00 TO STA. 34+37.42

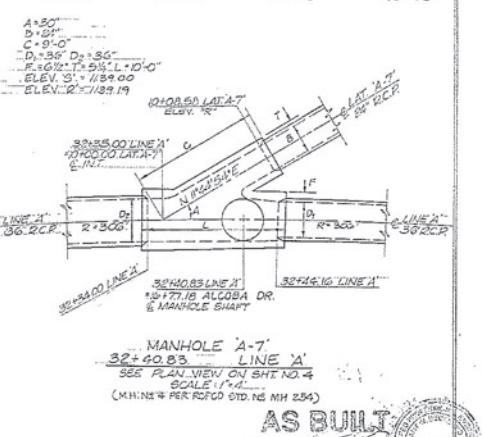
PROJECT NO. 7-0-0049
DRAWING NO. 7-263
SHEET NO. 7 OF 10











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AS BUILT
APPROVED BY:
DATE 5/20/96

LD 96-055 CO

REGISTERED PROFESSIONAL ENGINEER
DAVID LI-WEN SHEN
NO. 44274
Exp. 6-30-97
CIVIL
STATE OF CALIFORNIA

KEITH INTERNATIONAL, INC.
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Land Surveying • Public Parks • Park Resources
Inland Empire Division
PREPARED UNDER THE SUPERVISION OF
DATE 4-22-96

BENCH MARK
SEE SHEET NO. 1

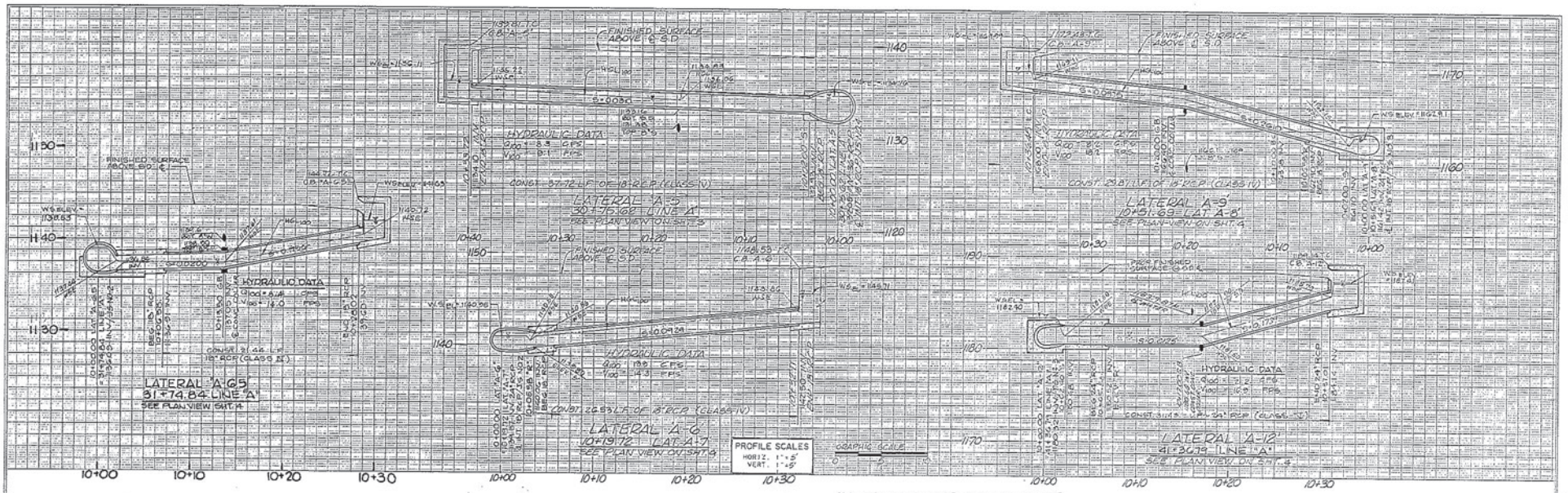
REVISIONS				
REF.	DESCRIPTION	INIT.	DATE	RCFCD DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER DATE 8/20/97
APPROVED BY: CHIEF ENGINEER DATE 9/3/97

CITY OF TEMECULA
RECOMMENDED BY: DATE 8/19/97
ACCEPTED BY: DATE 8/19/97
PRINCIPAL ENGINEER, FOR CITY ENGINEER
RONALD A. PARKS
R.C.E. NO. 15744 EXP. DATE: 9/30/98

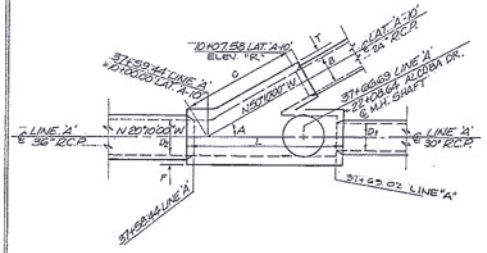
PALOMA DEL SOL
TRACT NO. 24185
STORM DRAIN PLANS
LATERALS AND DETAILS

PROJECT NO. 7-0-0046
DRAWING NO. 7-263
SHEET NO. 8 OF 10



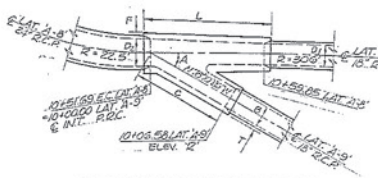
ALL STORM DRAINS ON THIS SHEET TO BE MAINTAINED BY CITY OF TEMECULA

A = 30"
B = 24"
C = 8'-0"
D_1 = 30", D_2 = 30"
E = C, T = 6¼", L = 11'-0"
ELEV. 'S' = 1160.20
ELEV. 'R' = 1161.86

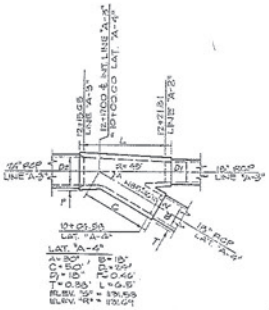


MANHOLE 'A-10'
37+66.69 LINE 'A'
SEE PLAN VIEW ON SHT. NO. 4
SCALE: 1"=4'
(M.H. NO. 4 PER RCFCD STD. NO. MH 284)

A = 30"
B = 18"
C = 7'-0"
D_1 = 18", D_2 = 24"
F = 5¼", P = 5", T = 4½", L = 9.0'
ELEV. 'S' = 1161.10
ELEV. 'R' = 1162.90



TRANSITION STRUCTURE 'A-9'
10+51.69 LATERAL 'A-8'
SEE PLAN VIEW ON SHT. NO. 4
(T.S. NO. 3 PER RCFCD STD. NO. T.S. 303)



TRANSITION STRUCTURE 'A-4'
12+17.00 LINE 'A-4'
SEE PLAN VIEW SHEET NO. 3
(T.S. NO. 3 PER RCFCD STD. NO. 303)
SCALE: 1"=4'

AS BUILT
APPROVED BY:
DATE 9/24/96

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DAVID LAWEN JOHEN
No. 44374
Exp. 6-30-97
CIVIL
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA

KEITH INTERNATIONAL, INC.
Planning • Civil Engineering • Environmental Services
Inland Empire Division
PREPARED UNDER THE SUPERVISION OF
DAVID LAWEN JOHEN, RCE NO. 44374 EXP. 6/30/97
DATE 4-22-96

BENCH MARK
SEE SHEET NO. 1

REVISIONS					
REF.	DESCRIPTION	ENGR.	DATE	RCFCD	DATE

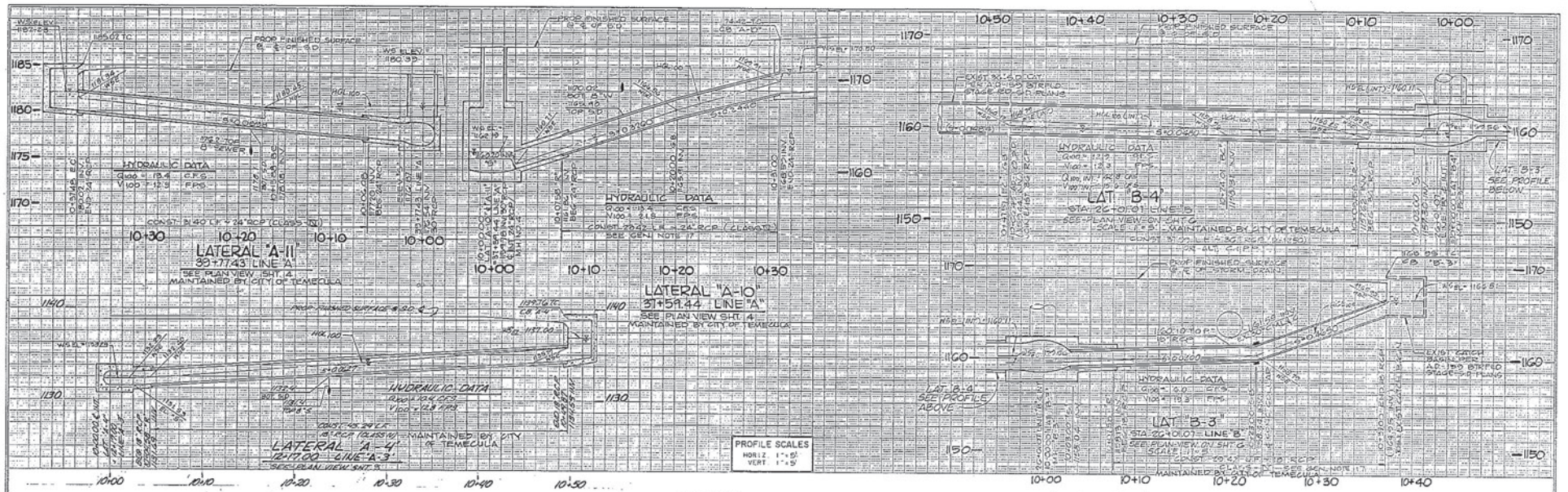
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: APPROVED BY:
PLANNING ENGINEER DATE
CHIEF ENGINEER DATE

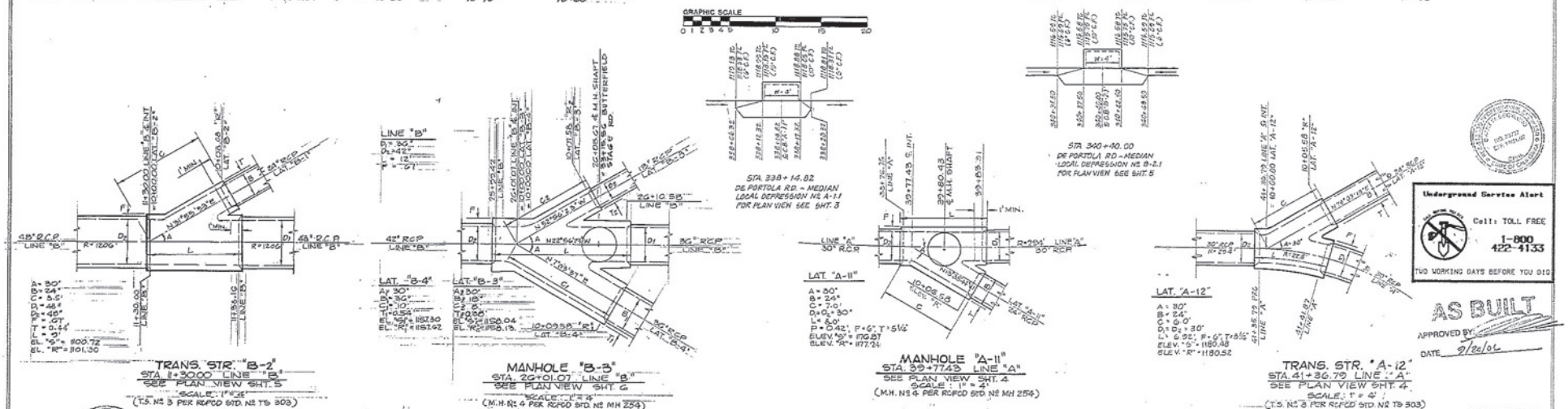
CITY OF TEMECULA
RECOMMENDED BY: DATE: 8/19/97
ACCEPTED BY: DATE: 8/19/97
PRINCIPAL ENGINEER, PUBLIC WORKS DEPARTMENT
RCE NO. 13744 EXP. DATE 3/31/98

LD 96-055 CO

PALOMA DEL SOL
TRACT NO. 24185
STORM DRAIN PLANS
LATERALS AND DETAILS

PROJECT NO. 7-0-0246
DRAWING NO. 7-203
SHEET NO. 9 OF 10





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AS BUILT
APPROVED BY:
DATE 9/26/01

LD 96-055 CO

DAVID LI-WEN SHEN
No. 44374
Exp. 6-30-97
CIVIL
STATE OF CALIFORNIA

KEITH INTERNATIONAL, INC.
Planning • Civil Engineering • Environmental Services
Land Surveying • Public Parks • Water Resources
Inland Empire Division.
PREPARED UNDER THE SUPERVISION OF:
DAVID LI-WEN SHEN RCE NO. 44374 EXP. 6/30/97
DATE 4-22-96

BENCH MARK
SEE SHEET NO. 1

REVISIONS

REF.	DESCRIPTION	ENGR.	DATE	RCFCD	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER
DATE: 8/29/97
APPROVED BY: CHIEF ENGINEER
DATE: 9/5/97

CITY OF TEMECULA
RECOMMENDED BY: DATE: 9/19/97
ACCEPTED BY: DATE: 9/19/97
PRINCIPAL ENGINEER, FOR CITY ENGINEER
RONALD J. PARKS
R.C.E. NO. 13744 EXP. DATE 3/30/01

PALOMA DEL SOL
TRACT NO. 24185
STORM DRAIN PLANS
LATERALS AND DETAILS

PROJECT NO. 7-0-0046
DRAWING NO. 7-263
SHEET NO. 10 OF 10

EXCERPT B: VILLAGES AT PASEO DEL SOL, TRACT 36483, PA 4A PRIVATE STORM DRAIN IMPROVEMENT PLANS

VILLAGES AT PASEO DEL SOL, TRACT 36483, PA 4
PRIVATE STORM DRAIN IMPROVEMENT PLAN

GENERAL NOTES

1. STANDARDS. ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF THE CURRENT EDITION OF THE CITY'S IMPROVEMENT STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION (AND SUBSEQUENT AMENDMENTS), THE CITY'S ENGINEERING AND CONSTRUCTION MANUAL, CITY CODES AND REQUIREMENTS.

2. EMERGENCY TELEPHONE NUMBERS. (ANSWERING MACHINE IS NOT ACCEPTABLE).

MIKE RUST	NEWLAND REAL ESTATE GROUP, LLC	858-217-2706
(RESPONSIBLE PERSON/DEVELOPER)	(COMPANY)	(24-HR PHONE NUMBER)
(RESPONSIBLE PERSON/CONTRACTOR)	(COMPANY)	(24-HR PHONE NUMBER)

3. LICENSE/PERMIT REQUIREMENT.
   a. PRIOR TO START OF ANY WORK, A BUSINESS LICENSE SHALL BE OBTAINED FROM THE CITY.
   b. A GRADING PERMIT SHALL BE OBTAINED, PRIOR TO ANY WORK ON PRIVATE DEVELOPMENT. THE PERMIT AND AN APPROVED SET OF IMPROVEMENT PLANS MUST BE PRESENT AT THE JOBSITE DURING CONSTRUCTION.

4. ERRORS OR OMISSIONS. APPROVAL OF THESE PLANS BY THE CITY DOES NOT RELIEVE THE APPLICANT AND ENGINEER OF RECORD FROM THE RESPONSIBILITY FOR THE CORRECTION OF ERRORS OR OMISSIONS DISCOVERED DURING CONSTRUCTION.

5. WORKING HOURS. CITY ORDINANCE NO. 94-25 STATES THAT NO PERSON SHALL ENGAGE IN OR CONDUCT CONSTRUCTION ACTIVITY, WHEN THE CONSTRUCTION SITE IS WITHIN ONE-QUARTER OF A MILE OF AN OCCUPIED RESIDENCE, BETWEEN THE HOURS OF 6:30 PM AND 6:30 AM, MONDAY THROUGH FRIDAY AND SHALL ONLY ENGAGE IN OR CONDUCT CONSTRUCTION ACTIVITY BETWEEN THE HOURS OF 7:00 AM AND 6:30 PM ON SATURDAY. NO CONSTRUCTION ACTIVITY SHALL BE UNDERTAKEN ON SUNDAY AND NATIONALLY RECOGNIZED HOLIDAYS.

6. REGULATORY AGENCY CLEARANCES. THE ISSUANCE OF A PERMIT BY THE CITY DOES NOT IMPLY OR PROVIDE ANY CLEARANCES FROM STATE OR FEDERAL AGENCIES REGULATING THE PROVISIONS OF STATE OR FEDERAL ENDANGERED SPECIES ACTS OR WATER QUALITY REGULATIONS. THE APPROPRIATE CLEARANCES FROM THESE AGENCIES SHALL BE OBTAINED PRIOR TO ANY SITE DISTURBANCE OR GRADING.

7. CONSTRUCTION CHANGE. ANY CONSTRUCTION CHANGE MUST BE FIRST SUBMITTED TO THE CITY AS A REDLINE REVISION FOR REVIEW AND APPROVAL PRIOR TO IMPLEMENTING THE CHANGE IN THE FIELD. REFER TO THE CITY'S ENGINEERING AND CONSTRUCTION MANUAL.

8. PRE-CONSTRUCTION MEETING. A PRE-CONSTRUCTION MEETING SHALL BE SCHEDULED TWO WORK DAYS PRIOR TO THE START OF CONSTRUCTION. DURING CONSTRUCTION, A DEPENDABLE AND RESPONSIVE CONTRACTOR'S REPRESENTATIVE SHALL BE AT THE JOB SITE AT ALL TIMES.

9. UTILITIES. APPROVAL OF THESE PLANS BY THE CITY DOES NOT CONSTITUTE A REPRESENTATION AS TO THE ACCURACY OR COMPLETENESS OF THE LOCATION, NOR THE EXISTENCE OR NON-EXISTENCE OF ANY UNDERGROUND UTILITIES WITHIN THE PROJECT LIMITS. ANY UTILITY DAMAGED DURING THE PERFORMANCE OF THE WORK SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE GOVERNING AGENCY BY THE CONTRACTOR, AT HIS EXPENSE.

10. SURVEY. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY THE ENGINEER OF RECORD AND TO INSTALL STREET CENTERLINE MONUMENTS, AS REQUIRED BY RIVERSIDE COUNTY ORDINANCE NO. 461. CENTERLINE TIES SHALL BE PROVIDED TO THE CITY ENGINEER, UPON COMPLETION OF THE PROJECT AND BEFORE ACCEPTANCE IS GRANTED. ALL EXISTING MONUMENTATION (DISTURBED OR DESTROYED DURING CONSTRUCTION) SHALL BE REPLACED TO CITY STANDARDS IN ACCORDANCE WITH THE LAND SURVEYORS ACT AND THE STREETS AND HIGHWAY CODE, AND AS APPROVED BY THE CITY ENGINEER UPON REQUEST. SURVEY CUTS SHEETS SHALL BE PROVIDED TO THE CITY ENGINEER.

11. DUST CONTROL. DUST SHALL BE CONTROLLED BY WATERING OR OTHER METHODS, AS APPROVED BY THE CITY ENGINEER AND SHALL COMPLY WITH SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT'S (SCAQMD) RULE 403.

12. CONSTRUCTION FENCING. A SIX FOOT CHAIN LINK FENCE IS REQUIRED ON ALL INDUSTRIAL AND COMMERCIAL PROJECTS UNTIL ROOF SYSTEMS ARE COMPLETED OR AS DEEMED NECESSARY BY THE CITY ENGINEER FOR PUBLIC SAFETY. THE MAINTENANCE OF THE FENCE IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR.

13. INSPECTIONS. ALL WORK PERFORMED WITHOUT PROPER INSPECTION FROM THE CITY MAY BE SUBJECT TO REJECTION.

14. OTHER CONSTRUCTION NOTES. REFER TO SEPARATE NOTES FOR GRADING, EROSION AND SEDIMENT CONTROL, PAVING AND TRAFFIC REQUIREMENTS, IF APPLICABLE.

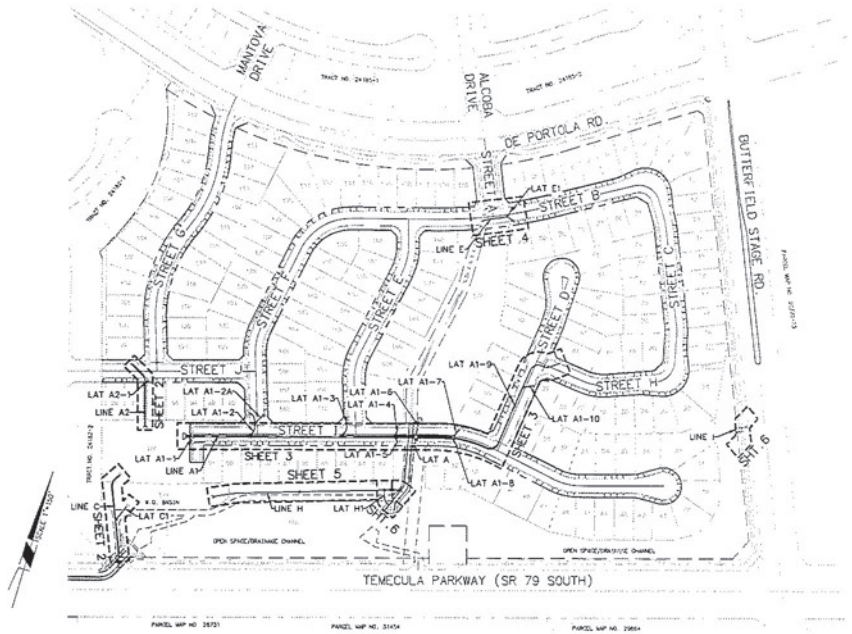
ENGINEER'S NOTICE TO CONTRACTORS

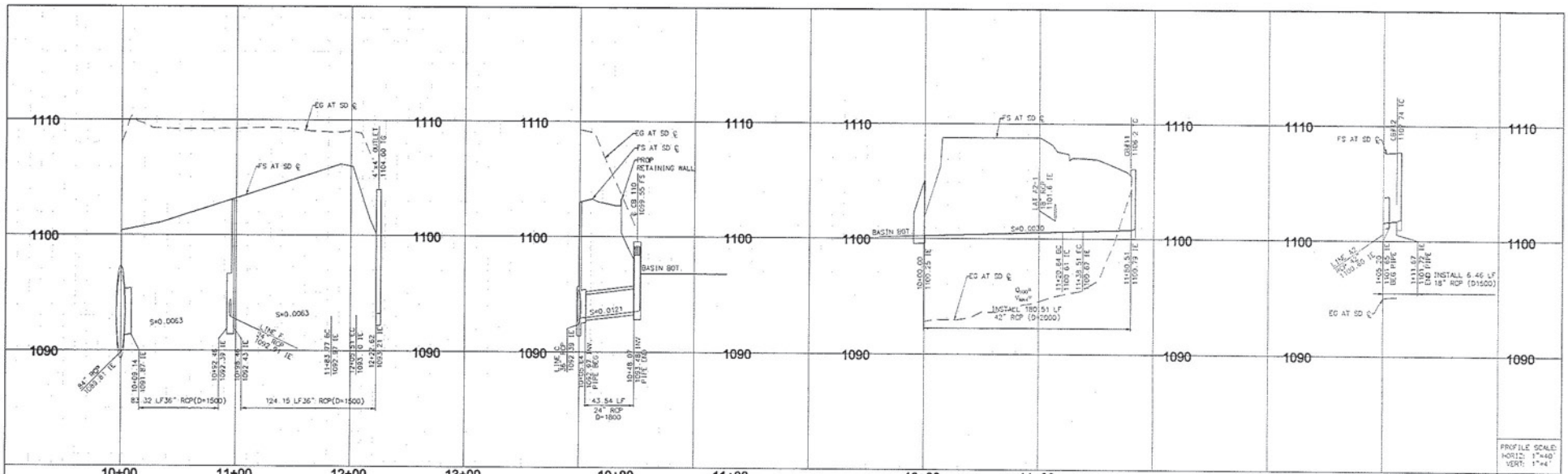
THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITIES OR STRUCTURES SHOWN ON THESE PLANS ARE OBTAINED BY SEARCH OF AVAILABLE RECORDS AND TO THE BEST OF OUR KNOWLEDGE, THERE ARE NO EXISTING UTILITIES EXCEPT THOSE SHOWN ON THIS PLAN. THE CONTRACTOR IS REQUIRED TO TAKE ALL PRECAUTIONARY MEASURES TO PROTECT THE UTILITIES SHOWN, AND ANY OTHER LINES OR STRUCTURES NOT SHOWN ON THESE PLANS, AND IS RESPONSIBLE FOR PROTECTION OF AND ANY DAMAGE TO THESE LINES OR STRUCTURES.

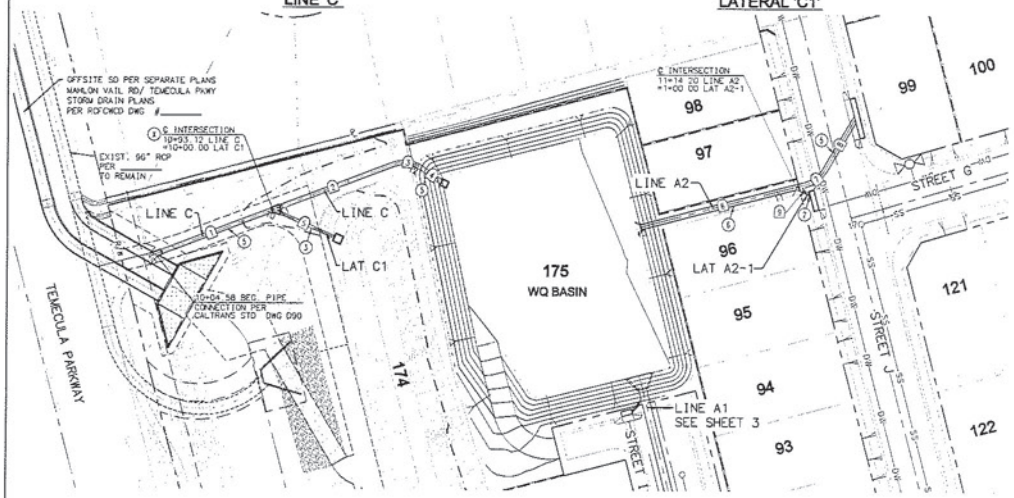
CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTORS WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO, DEFEND, INDEMNIFY, AND HOLD DESIGN PROFESSIONAL AND OWNER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT.

THE CONTRACTOR SHALL BE RESPONSIBLE TO REPORT DISCREPANCIES IN PLANS AND/OR FIELD CONDITIONS IMMEDIATELY TO THE DESIGN ENGINEER FOR RESOLUTION PRIOR TO CONSTRUCTION, AND SHALL BE RESPONSIBLE FOR DISCREPANCIES NOT SO REPORTED AND RESOLVED.

CAUTION: THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE "PLANS".





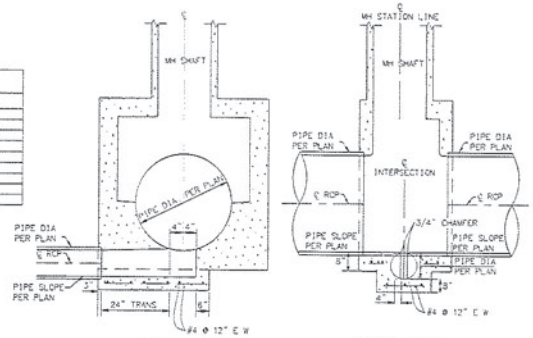


CONSTRUCTION NOTES

(2) INSTALL 18" RCP
(3) INSTALL 24" RCP
(5) INSTALL 36" RCP
(6) INSTALL 42" RCP

LINE/CURVE DATA TABLE

(#)	BEARING/DELTA	RADIUS	LENGTH	TANGENT	NOTE
1	N22°41'53"W	---	93.12'	---	LINE C
2	N22°41'53"W	---	99.69'	---	LINE C
3	55°21'07"	22.50'	21.74'	11.80'	LINE C
4	N33°39'16"E	---	17.11'	---	LINE C
5	N21°24'49"E	---	48.07'	---	LAT C1
6	N16°39'40"W	---	120.84'	---	LINE A2
7	45°00'00"	22.50'	17.67'	9.32'	LINE A2
8	N61°36'40"W	---	42.00'	---	LINE A2
9	N28°53'20"E	---	11.67'	---	LAT A2-1



MODIFIED MANHOLE NO.1 DETAIL
NTS

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE (951)676-8942
MBAKERINTL.COM

CONSTRUCTION RECORD	DATE	BY	REVISIONS	DATE	ACC'D
CONTRACTOR					
INSPECTOR					
DATE COMPLETED					

BENCH MARK
RIVERSIDE COUNTY B.M. 600-6-81
INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY 79 AND I-15E 300' N OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE
997.721 EL

SCALE
HORIZONTAL
AS NOTED
VERTICAL
N/A

DESIGNED BY	DRAWN BY	CHECKED BY
T. BURNSIDE	T. BURNSIDE	K. HADHOH

PLANS PREPARED UNDER THE SUPERVISION OF

DATE:

JOHN D. TANNER III
R C E 60132

RECOMMENDED BY: DATE:

ACCEPTED BY: DATE:
PATRICK A. THOMAS
DIRECTOR OF PUBLIC WORKS/CITY ENGINEER
R C E 44225

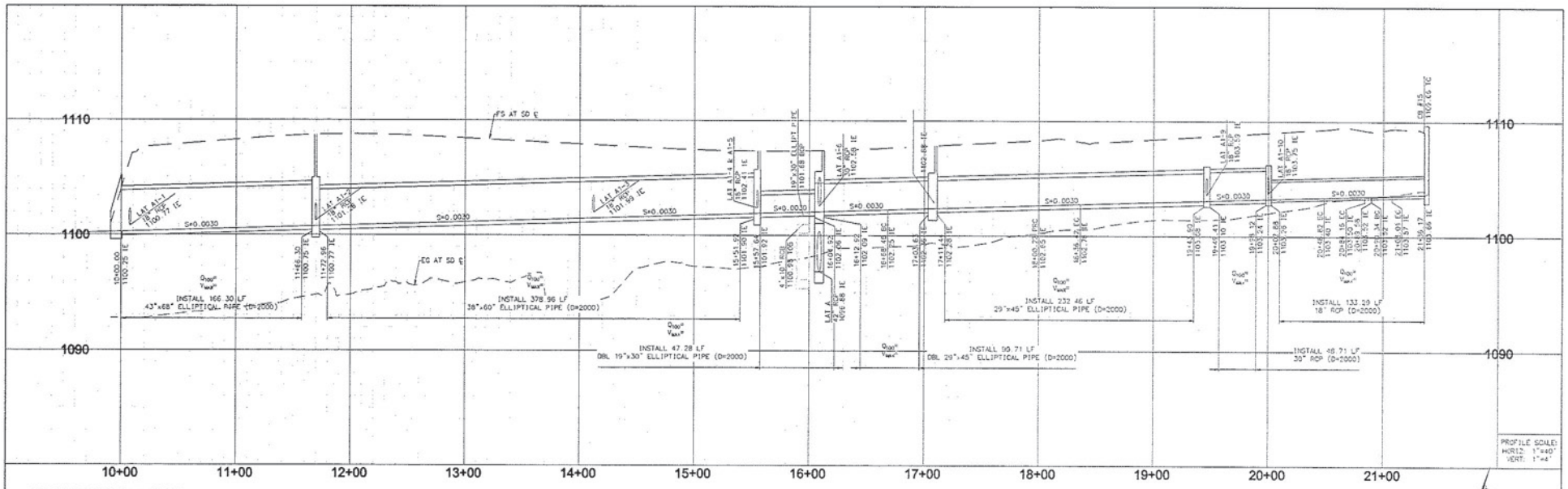
CITY OF TEMECULA — DEPARTMENT OF PUBLIC WORKS

PRIVATE STORM DRAIN IMPROVEMENT PLAN
VILLAGES AT PASEO DEL SOL
TRACT 36483, PA 4

PW17-XX

SHEET NO 2
OF 7 SHEETS

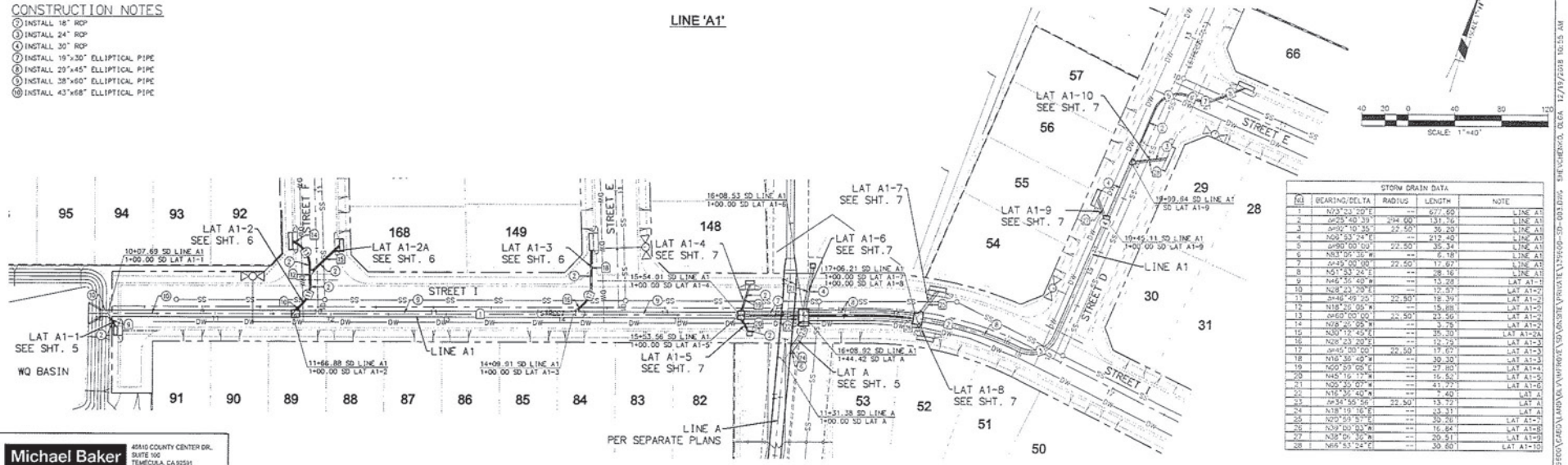
\\TEMECAFS1\WRGDTPDATA\33600\CAD\CIVIL\PRIVATE\33600-SD-002.DWG 12/19/2018 11:01 AM DKLEVEMEMO



CONSTRUCTION NOTES

(2) INSTALL 18" RCP
(3) INSTALL 24" RCP
(4) INSTALL 30" RCP
(7) INSTALL 19"x30" ELLIPTICAL PIPE
(8) INSTALL 29"x45" ELLIPTICAL PIPE
(9) INSTALL 38"x60" ELLIPTICAL PIPE
(10) INSTALL 43"x68" ELLIPTICAL PIPE

LINE 'A1'



STORM DRAIN DATA

NO.	BEARING/DELTA	RADIUS	LENGTH	NOTE
1	N73°03'20"E	--	677.60	LINE A1
2	Δ25°40'39"	294.00	131.76	LINE A1
3	Δ90°10'35"	22.50	35.20	LINE A1
4	N26°53'24"E	--	212.40	LINE A1
5	Δ90°00'00"	22.50	35.34	LINE A1
6	N63°06'36"W	--	6.18	LINE A1
7	Δ45°00'00"	22.50	17.67	LINE A1
8	N51°53'24"E	--	28.16	LINE A1
9	N46°36'40"W	--	13.28	LAT A1-1
10	N28°23'20"E	--	12.57	LAT A1-2
11	Δ46°49'20"	22.50'	18.39	LAT A1-2
12	N18°26'00"W	--	15.89	LAT A1-2
13	Δ60°00'00"	22.50'	23.56	LAT A1-2
14	N78°26'00"W	--	3.75	LAT A1-2
15	N30°26'45"E	--	35.20	LAT A1-2A
16	N28°23'20"E	--	12.79	LAT A1-3
17	Δ45°00'00"	22.50'	17.67	LAT A1-3
18	N16°36'40"W	--	30.30	LAT A1-3
19	N09°30'00"E	--	27.80	LAT A1-4
20	N45°19'12"W	--	15.52	LAT A1-5
21	N09°30'00"E	--	41.72	LAT A1-6
22	N16°36'40"W	--	5.40	LAT A
23	Δ34°55'56"	22.50'	13.72	LAT A
24	N18°19'16"E	--	23.31	LAT A
25	N20°59'57"E	--	30.20	LAT A1-7
26	N09°00'03"W	--	16.84	LAT A1-8
27	N38°01'36"W	--	20.51	LAT A1-9
28	N69°53'24"E	--	30.60	LAT A1-10

Michael Baker INTERNATIONAL
41810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

PW17-XX

CONSTRUCTION RECORD	DATE	BY	REVISIONS	DATE	ACC'D
CONTRACTOR					
INSPECTOR					
DATE COMPLETED					

BENCH MARK
RIVERSIDE COUNTY B.M. 600-6-81 INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15SE. 300' W OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY R/W FENCE 75.4' S OF LIGHT POLE 997.721 EL.

SCALE: HORIZONTAL AS NOTED; VERTICAL N/A

REGISTERED PROFESSIONAL ENGINEER JOHN D. TANNER III No. 50132 CIVIL STATE OF CALIFORNIA

DESIGNED BY	DRAWN BY	CHECKED BY
T.BURNSIDE	T.BURNSIDE	K. MADHIGHI

PLANS PREPARED UNDER THE SUPERVISION OF

DATE:

JOHN D. TANNER III
R.C.E. 50132

RECOMMENDED BY: DATE:

ACCEPTED BY: DATE:

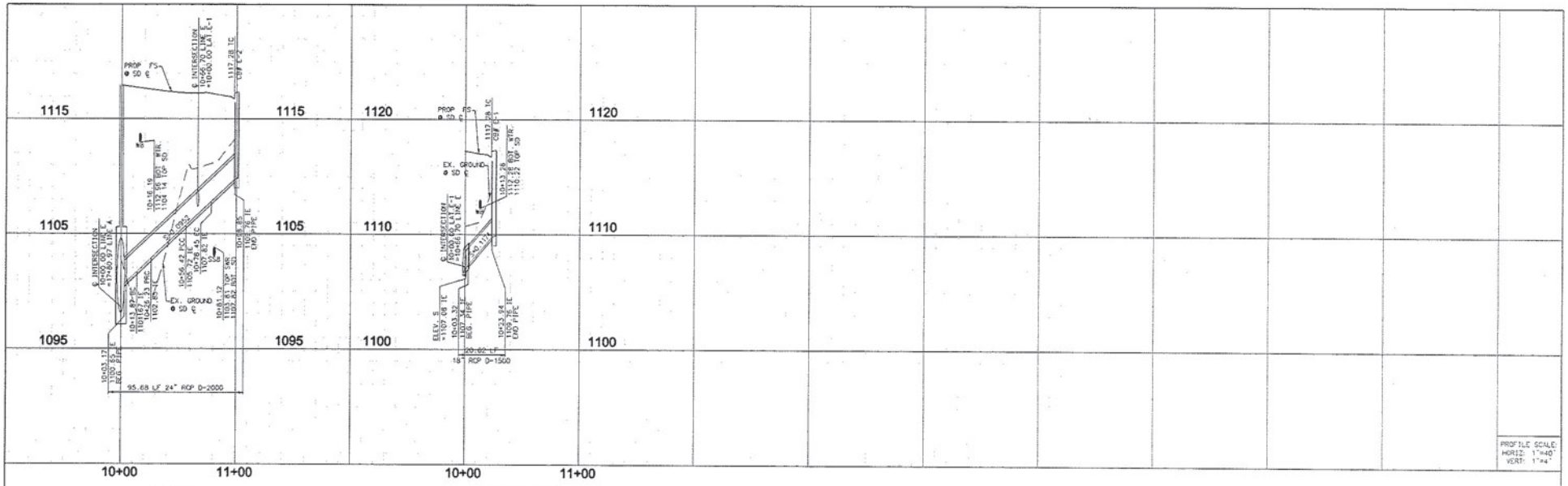
PATRICK A. THOMAS
DIRECTOR OF PUBLIC WORKS/CITY ENGINEER
P.C.E. 44223

CITY OF TEMECULA — DEPARTMENT OF PUBLIC WORKS

PRIVATE STORM DRAIN IMPROVEMENT PLAN
VILLAGES AT PASEO DEL SOL
TRACT 36483, PA 4

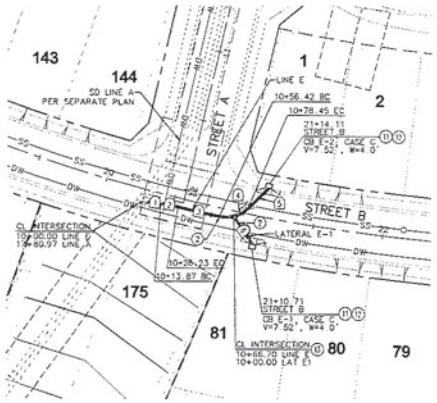
SHEET NO 3 OF 7 SHEETS

\\TEMECAFS1\PROJECTS\PW\PW17-00006\CAD\LAYOUTS\PW17-00006-SD-003.DWG 12/19/2018 10:55 AM SHEVCHENKO, OLGA



LINE 'E'

LATERAL 'E-1'



LINE 'E' PLAN

DIMENSIONS FOR JUNCTION STRUCTURE NO. 2 (STD. DWG. NO. JS227)											
MAIN LINE STA.	CONNECTING LAT.	A	B	C	D	E	F	G	L	ELEV. R	ELEV. S
10+66.70	LATERAL E1	69°50'	18"	3.74'	24"	1.56'	0.54'	0.44'	2.27'	1107.34	1107.08

LINE/CURVE DATA TABLE					
NO.	BEARING/DELTA	RADIUS	LENGTH	TANGENT	NOTE
1	N59°10'00"E	---	13.87'	---	℄ LINE E
2	07°02'12"	90.00'	12.38'	6.19'	℄ LINE E
3	01°23'59"	1238.00'	30.20'	15.10'	℄ LINE E
4	56°05'29"	22.50'	22.03'	11.99'	℄ LINE E
5	N09°32'44"E	---	20.39'	---	℄ LINE E
6	N70°41'54"W	---	23.94'	---	℄ LAT E1

CONSTRUCTION NOTES

(2) INSTALL 18" RCP
(11) CONSTRUCT CATCH BASIN NO. 1 PER RCTD STD. NO. 300 (H & W PER PLAN)
(12) CONSTRUCT LOCAL DEPRESSION PERRCTD STD. NO. 311
(13) CONSTRUCT JUNCTION STRUCTURE NO. 2 PER RCTD & WCD STD. NO. JS227

Michael Baker INTERNATIONAL
41810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

40 20 0 40 80 120
SCALE: 1"=40'

SCALE: 1"=40'

CONSTRUCTION RECORD	DATE	BY	REVISIONS	DATE	ACC'D	BENCH MARK
CONTRACTOR						RIVERSIDE COUNTY B.M. 600-6-81 INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' N OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY R/W FENCE 75.4' S OF LIGHT POLE 997.721 EL
INSPECTOR						
DATE COMPLETED						

SCALE
HORIZONTAL
AS NOTED
VERTICAL
N/A

DESIGNED BY	DRAWN BY	CHECKED BY
T.BURNSIDE	T.BURNSIDE	K. HACHOSHI

PLANS PREPARED UNDER THE SUPERVISION OF

DATE:

JOHN D. TANNER III
R.C.E. 60132

RECOMMENDED BY: DATE:

ACCEPTED BY: DATE:

PATRICK A. THOMAS
DIRECTOR OF PUBLIC WORKS/CITY ENGINEER
R.C.E. 44223

CITY OF TEMECULA — DEPARTMENT OF PUBLIC WORKS

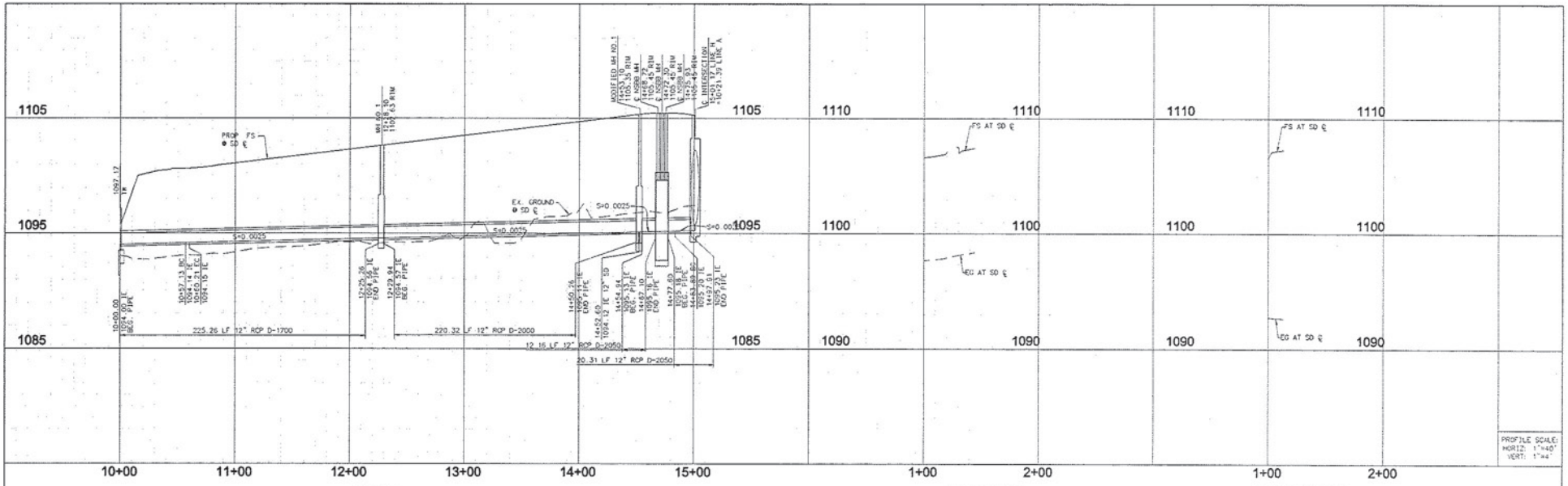
PRIVATE STORM DRAIN IMPROVEMENT PLAN
VILLAGES AT PASEO DEL SOL
TRACT 36483, PA 4

PW17-XX

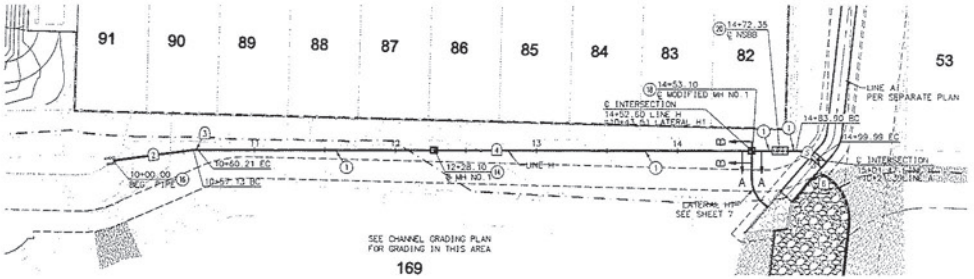
SHEET NO 4

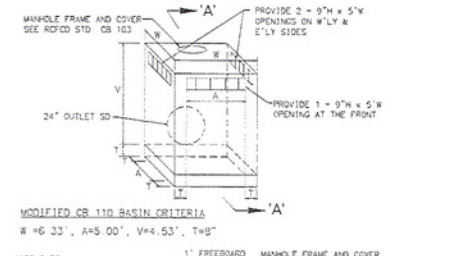
OF 7 SHEETS

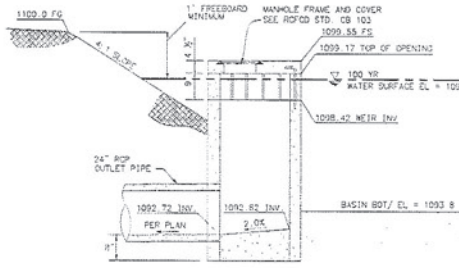
\\TEMECAFS1\SYSDATA\ENGINEERING\CAD\LAND\LAYOUT\PROJECTS\PRIVATE\36483-SD-004.DWG 12/19/2016 10:55 AM



LINE 'H' LATERAL 'A' LATERAL 'A1-1'







SECTION A-A
N.T.S.

MODIFIED CB110 DROP INLET STRUCTURE
NOT TO SCALE

LINE/CURVE DATA TABLE					
NO	BEARING/DELTA	RADIUS	LENGTH	TANGENT	NOTE
1	N21°24'49"E	---	48.07'	---	℄ LINE F
2	N64°34'27"E	---	57.13'	---	℄ LINE H
3	08°48'53"	20.00'	3.08'	1.54'	℄ LINE H
4	N72°00'32"E	---	423.69'	---	℄ LINE H
5	40°58'49"	22.50'	16.09'	8.41'	℄ LINE H
6	N67°00'43"W	---	1.17'	---	℄ LINE H

CONSTRUCTION NOTES

1. INSTALL 12" RCP
14. CONSTRUCT MANHOLE NO. 1 PER RCFC & WCD STD. DWG. NO. M-251
16. CONSTRUCT PIPE CULVERT HEADWALL PER CALTRANS STD. NO. D89
18. CONSTRUCT MODIFIED MANHOLE NO. 1 PER RCFC & WCD STD. DWG. NO. M-251 AND DETAIL ON SHEET 2
20. INSTALL BIOCLEAN HYDRODYNAMIC SEPERATOR MODEL MSBB-5-10.5-84 PER BIOCLEAN STD. DETAIL

SCALE: 1"=40'

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

CONSTRUCTION RECORD	DATE	BY	REVISIONS	DATE	ACC'D
CONTRACTOR					
INSPECTOR					
DATE COMPLETED					

BENCH MARK: RIVERSIDE COUNTY B.M. 600-6-81 INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' N OF OVERPASS BRIDGE, 67.9' SE OF BCG. OF 6' FWY. R/W FENCE, 2' N OF FWY R/W FENCE 75.4' S OF LIGHT POLE. 997.721 EL.

SCALE: HORIZONTAL AS NOTED; VERTICAL N/A

DESIGNED BY	DRAWN BY	CHECKED BY
T.BURNSIDE	T.BURNSIDE	K. HASHIGHI

PLANS PREPARED UNDER THE SUPERVISION OF

JOHN D. TANNER III
R.C.E. 60132
DATE:

RECOMMENDED BY: _____ DATE: _____

ACCEPTED BY: _____ DATE: _____
PATRICK A. THOMAS
DIRECTOR OF PUBLIC WORKS/CITY ENGINEER
R.C.E. 44223

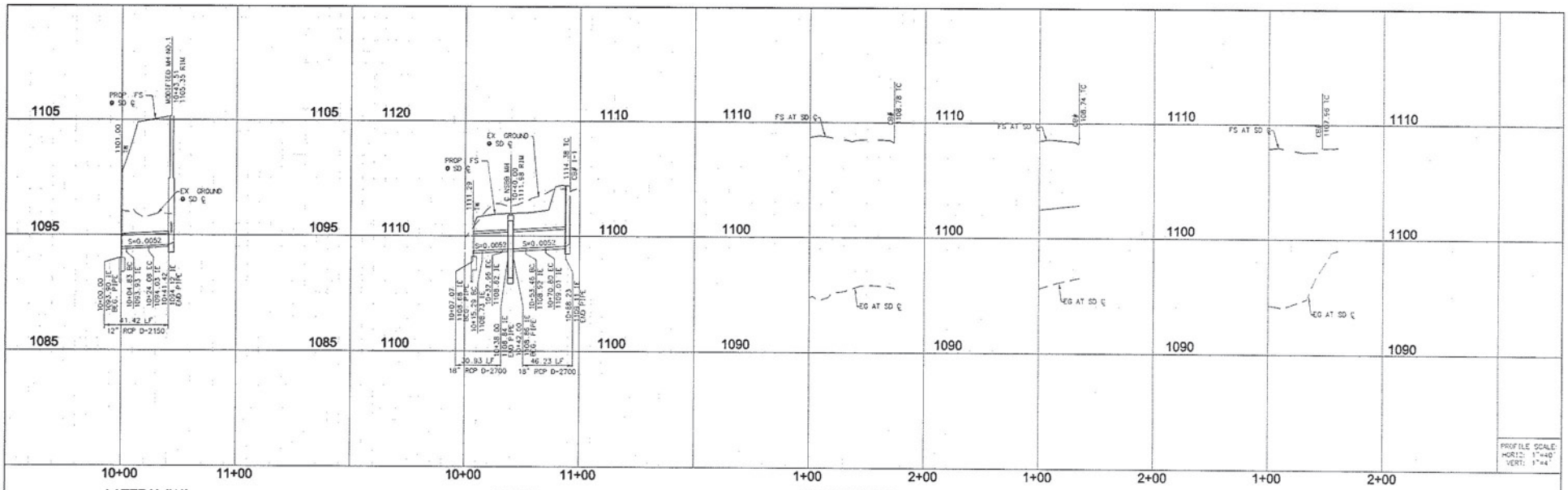
CITY OF TEMECULA — DEPARTMENT OF PUBLIC WORKS

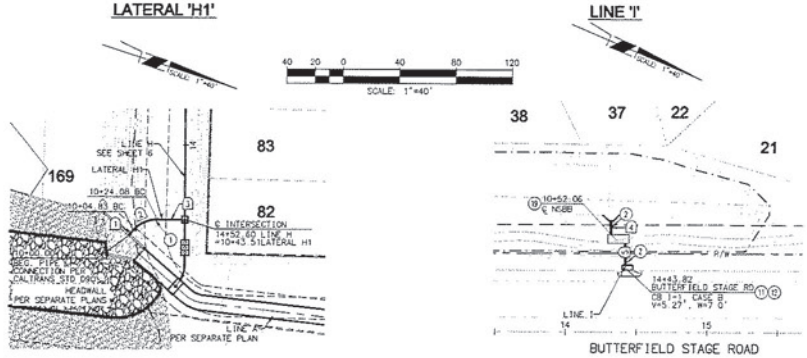
PRIVATE STORM DRAIN IMPROVEMENT PLAN
VILLAGES AT PASEO DEL SOL
TRACT 36483, PA 4

PW17-XX

SHEET NO 5 OF 7 SHEETS

\\TEMECHFS1\SHARED\PROJECTS\25500\CAD\LAND\PLANS\PRIVATE\125500-SD-005.DWG SHEYCHENKO, OLEA 12/15/2016 10:55 AM





STORM DRAIN DATA

[N]	BEARING/DELTA	RADIUS	LENGTH	NOTE
1	N67°00'43"W	--	4.83'	LAT H1
2	6°49'01.11"	22.50'	19.15'	LAT H1
3	N17°59'32"W	--	19.43'	LAT H1
4	N66°13'29"E	--	10.02'	LINE I
5	N66°13'29"E	--	39.60'	LINE I

CONSTRUCTION NOTES

1. INSTALL 12" RCP
2. INSTALL 18" RCP
11. CONSTRUCT CATCH BASIN NO. 1 PER RCTD STD. NO. 300 (H & W PER PLAN)
12. CONSTRUCT LOCAL DEPRESSION PERRCTD STD. NO. 311
15. INSTALL BIOCLEAN HYDRODYNAMIC SEPERATOR MODEL NSBB-2 5-4-60 PER BIOCLEAN STD. DETAIL

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8442
MBAKERINTL.COM

CONSTRUCTION RECORD	DATE	BY	REVISIONS	DATE	ACC'D
CONTRACTOR					
INSPECTOR					
DATE COMPLETED					

BENCH MARK
RIVERSIDE COUNTY B.M. 6GG-6-83
INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY 79 AND I-15E. 300' N OF OVERPASS BRIDGE, 67.9' SE OF BEG. OF 6' FWY R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE. 997.721 EL.

SCALE
HORIZONTAL
AS NOTED
VERTICAL
N/A

JOHN D. TANNER III — No. 60132 — REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

DESIGNED BY	DRAWN BY	CHECKED BY
T. BURNSIDE	T. BURNSIDE	K. MADHOKI

PLANS PREPARED UNDER THE SUPERVISION OF

_____ DATE: _____
JOHN D. TANNER III
R.C.E. 60132

RECOMMENDED BY: _____ DATE: _____

ACCEPTED BY: _____ DATE: _____
PATRICK A. THOMAS
DIRECTOR OF PUBLIC WORKS/CITY ENGINEER
R.C.E. 44223

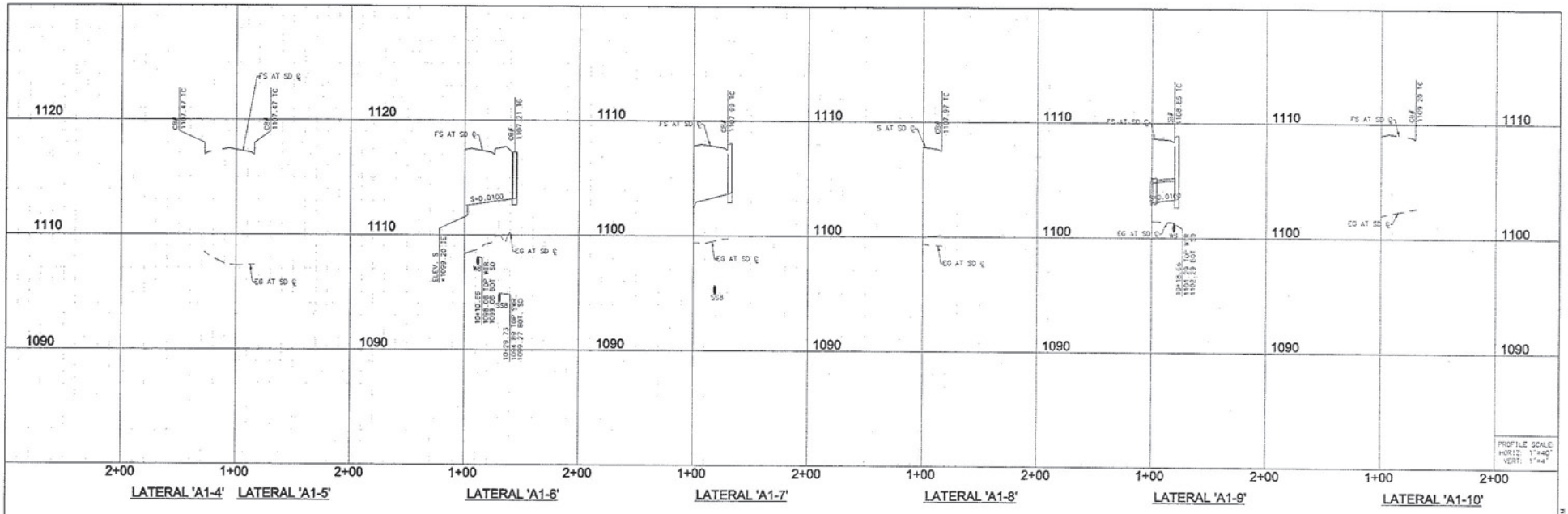
CITY OF TEMECULA — DEPARTMENT OF PUBLIC WORKS

PRIVATE STORM DRAIN IMPROVEMENT PLAN
VILLAGES AT PASEO DEL SOL
TRACT 36483, PA 4

PW17-XX

SHEET NO 6 OF 7 SHEETS

\\TEMECAFS1\WORK\PROJECTS\36000\36000\ADMIN\DESIGN\PRIVATE\36000-03-006.DWG SHEVENKMS OLGA 12/19/2018 11:02 AM



Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR.
SUITE 100
TEMECULA, CA 92591
PHONE (951) 676-8042
MBAKERINTL.COM

CONSTRUCTION RECORD	DATE	BY	REVISIONS	DATE	ACC'D
CONTRACTOR					
INSPECTOR					
DATE COMPLETED					

BENCH MARK
RIVERSIDE COUNTY B.M. 600-6-B1
INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' W OF OVERPASS BRIDGE., 87.9' SE OF BCG. OF 6' FWY. R/W FENCE, 2' N OF FWY R/W FENCE 75.4' S OF LIGHT POLE
997.721 EL.

SCALE
HORIZONTAL
AS NOTED
VERTICAL
N/A

DESIGNED BY	DRAWN BY	CHECKED BY
T. BURNSIDE	T. BURNSIDE	K. HASHIOKI

PLANS PREPARED UNDER THE SUPERVISION OF

DATE:

JOHN D. TANNER III
R.C.E. 60132

RECOMMENDED BY: DATE:

ACCEPTED BY: DATE:

PATRICK A. THOMAS
DIRECTOR OF PUBLIC WORKS/CITY ENGINEER
R.C.E. 44223

CITY OF TEMECULA — DEPARTMENT OF PUBLIC WORKS

PRIVATE STORM DRAIN IMPROVEMENT PLAN
VILLAGES AT PASEO DEL SOL
TRACT 36483, PA 4

PW17-XX

SHEET NO 7 OF 7 SHEETS

\\TEMCAIFSIVHOOT\DATA\13560\CAD\LAND\LV\MPROVE\DSD\DRDTE\PRIVATE\13560-SD-007.DWG 12/19/2018 10:58 AM

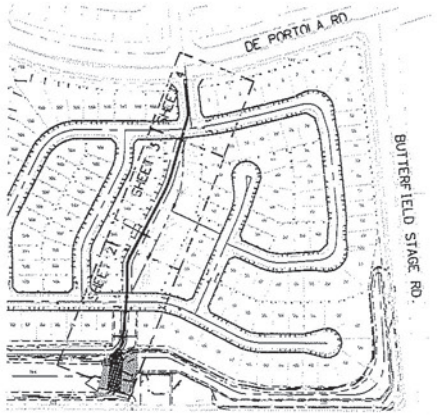
EXCERPT C: TENTATIVE TRACT MAP 36483 STORM DRAIN PLAN

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

GENERAL NOTES

1. THE CONTRACTOR SHALL CONSTRUCT THE FLOOD CONTROL IMPROVEMENTS SHOWN ON THE DRAWINGS IN CONFORMANCE WITH THE REQUIREMENTS OF THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT'S M.O.U. STANDARD SPECIFICATIONS DATED JUNE 24, 2008, AND THE RCFC&WCD STANDARD MANUAL. FOR THE LATEST DRAWINGS OF THE STANDARD MANUAL, PLEASE REFER TO THE "PUBLICATIONS AND RECORDS" PAGE FOUND ON THE DISTRICT'S WEBSITE.
2. CONTACT PERMIT ENGINEER AT 951/955-1266 IF AN ENCROACHMENT PERMIT IS REQUIRED FROM RIVERSIDE COUNTY FLOOD CONTROL. AFTER THE PERMIT IS ISSUED THE DISTRICT MUST BE NOTIFIED ONE WEEK PRIOR TO CONSTRUCTION.
3. CONTACT CONTRACT ADMINISTRATION AT 951/955-1288 IF CONSTRUCTION INSPECTION WILL BE PERFORMED BY RIVERSIDE COUNTY FLOOD CONTROL. THE DISTRICT MUST BE NOTIFIED TWENTY DAYS (20) PRIOR TO CONSTRUCTION.
4. ALL STATIONING REFERS TO CENTERLINE OF CONSTRUCTION UNLESS OTHERWISE NOTED.
5. STATIONING FOR LATERALS AND CONNECTOR PIPE REFER TO THE CENTERLINE INTERSECTION STATIONS.
6. FORTY-EIGHT HOURS BEFORE EXCAVATION, CALL UNDERGROUND SERVICE ALERT 1-800-227-2600.
7. ALL ELEVATIONS SHOWN ARE IN FEET AND DECIMALS THEREOF BASED ON THE NATIONAL GEODETIC VERTICAL DATUM (NGVD 29).
8. ALL COORDINATES ARE SHOWN IN FEET AND DECIMALS THEREOF BASED ON THE NORTH AMERICAN DATUM (NAD 83), CALIFORNIA COORDINATE SYSTEM (CCS), ZONE 6 AND EPOCH 2007.00.
9. ALL CROSS SECTIONS ARE TAKEN LOOKING DOWNSTREAM.
10. ELEVATIONS OF UTILITIES ARE APPROXIMATE UNLESS OTHERWISE NOTED.
11. UNLESS OTHERWISE SPECIFIED, MINIMUM STREET RECONSTRUCTION SHALL BE 4" TYPE "B" HOT MIX ASPHALT OVER 6" CLASS 2 AGGREGATE BASE OR AS SPECIFIED BY THE ENGINEER.
12. OPENINGS RESULTING FROM THE CUTTING OR PARTIAL REMOVAL OF EXISTING CULVERTS, PIPES OR SIMILAR STRUCTURES TO BE ABANDONED SHALL BE SEALED WITH 6" OF CLASS "B" CONCRETE.
13. PIPE CONNECTED TO THE MAINLINE PIPE SHALL CONFORM TO JUNCTION STRUCTURE NO.4 (JS 229) UNLESS OTHERWISE NOTED.
14. PIPE BEDDING SHALL CONFORM TO RCFC&WCD STD. DWG. NO. M815 EXCEPT FOR COVER<2 FEET. FOR COVER<2 FEET, CONCRETE SLURRY (2000 PSI - 2 SACK) SHALL BE USED. THE ENTIRE TRENCH SHALL BE SLURRY EXTENDING 4 INCHES MINIMUM AND 12 INCHES MAXIMUM ABOVE THE TOP OF THE PIPE.
15. BH-10 INDICATES SOIL BORING LOCATION BASED ON THE SOILS REPORT DATED JULY 14, 2015. LOCATIONS SHOWN ARE APPROXIMATE.
16. "V" IS THE DEPTH OF CATCH BASINS MEASURED FROM THE TOP OF CURB TO INVERT OF CONNECTOR PIPE.
17. CATCH BASINS SHALL BE LOCATED SO THAT LOCAL DEPRESSION SHALL BEGIN AT EXISTING CURB RETURN JOINT, UNLESS OTHERWISE SPECIFIED.
18. ALL CURBS, GUTTERS, SIDEWALKS, DRIVEWAYS AND OTHER EXISTING IMPROVEMENTS TO BE RECONSTRUCTED IN KIND AND AT THE SAME ELEVATION AND LOCATION AS THE EXISTING IMPROVEMENTS UNLESS OTHERWISE NOTED.
19. STANDARD DRAWINGS CALLED FOR ON THE PLAN AND PROFILE SHALL CONFORM TO DISTRICT STANDARD DRAWINGS UNLESS NOTED OTHERWISE.
20. THE CONTRACTOR IS REQUIRED TO CALL ALL UTILITY AGENCIES REGARDING TEMPORARY SHORING AND SUPPORT REQUIREMENTS FOR THE VARIOUS UTILITY LINES SHOWN ON THESE PLANS
21. DURING ROUGH GRADING OPERATIONS AND PRIOR TO CONSTRUCTION OF PERMANENT DRAINAGE STRUCTURES, TEMPORARY DRAINAGE CONTROL SHOULD BE PROVIDED TO PREVENT PONDING WATER AND DAMAGE TO ADJACENT PROPERTIES.
22. APPROVAL OF THESE PLANS BY THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT DOES NOT RELIEVE THE DEVELOPER'S ENGINEER OF RESPONSIBILITY FOR THE ENGINEERING DESIGN. IF FIELD CHANGES ARE REQUIRED, IT WILL BE THE RESPONSIBILITY OF THE DESIGN ENGINEER TO MAKE THE NECESSARY CORRECTIONS.
23. THE CONTRACTOR OR DEVELOPER SHALL SECURE ALL THE REQUIRED ENCROACHMENT AND/OR STATE AND FEDERAL REGULATORY PERMITS PRIOR TO THE COMMENCEMENT OF ANY WORK.
24. THE CONCRETE COATING ON THE INSIDE OF ALL REINFORCED CONCRETE PIPES MUST BE INCREASED TO PROVIDE A MINIMUM OF 1-1/2 INCHES OVER THE REINFORCING AND INCREASED TO A MINIMUM OF 3-1/2 INCHES OVER REINFORCING FOR BOX CULVERTS WHEN DESIGN VELOCITIES EXCEED 20 FEET PER SECOND. THE CONCRETE DESIGN STRENGTH IN THESE REACHES SHALL BE F'C=5,000 PSI FOR VELOCITIES EXCEEDING 20 FEET PER SECOND AND F'C=6,000 PSI FOR VELOCITIES EXCEEDING 30 FEET PER SECOND.
25. CONSTRUCTION JOINT FOR CALTRANS STANDARD REINFORCED CONCRETE BOX SHALL BE ACCORDING TO RCFC&WCD STD. DWG. NO. BX401.

VICINITY MAP
NTS



INDEX MAP
1"=200'

SCALE: 1"=200'

SHEET INDEX

	SHEET NO.
TITLE SHEET	1
INDEX MAP	1
SD LINE 'A' PLAN & PROFILE	2-4
DETAILS	4

R.C.F.C. & W.C.D. STANDARD DRAWINGS

MH252	MANHOLE NO. 2
M803	CONCRETE COLLAR
JS229	JUNCTION STRUCTURE NO. 4
JS231	JUNCTION STRUCTURE NO. 5

CALTRANS STANDARD DRAWINGS

D-90A HEADWALL AND WINGWALL

STORM DRAIN MAINTENANCE RESPONSIBILITIES

RCFC & WCD WILL MAINTAIN ALL LINES LARGER THAN 36" INCLUDING: SD LINE 'A'

STORM DRAIN MAINTENANCE RESPONSIBILITIES

THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY PIPES, CONDUITS, OR STRUCTURES SHOWN ON THESE PLANS WERE OBTAINED BY A SEARCH OF AVAILABLE RECORDS. TO THE BEST OF OUR KNOWLEDGE, THERE ARE NO EXISTING UTILITIES EXCEPT THOSE SHOWN ON THESE PLANS. THE CONTRACTOR IS REQUIRED TO TAKE PRECAUTIONARY MEASURES TO PROTECT THE UTILITY LINES SHOWN ON THESE DRAWINGS. THE CONTRACTOR FURTHER ASSUMES ALL LIABILITY AND RESPONSIBILITY FOR THE UTILITY PIPES, CONDUITS OR STRUCTURES, SHOWN OR NOT SHOWN ON THESE PLANS.

★PRELIMINARY★
FIRST PLAN CHECK
SUBJECT TO REVISION

CITY OF TEMECULA DEPARTMENT OF PUBLIC WORKS

RECOMMENDED BY: _____ DATE: _____
AMER ATTAR, PRINCIPAL ENGINEER

ACCEPTED BY: _____ DATE: _____
PATRICK THOMAS
DIRECTOR OF PUBLIC WORKS/CITY ENGINEER
R.C.E. 44223

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services. TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
RIVERSIDE COUNTY B.M. 600-6-81
INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' N OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE.
997.721 EL. (NGVD 29 DATUM)

REF.	DESCRIPTION	APPR.	DATE
	REVISIONS		

DESIGNED BY: C. MORLOK
DRAWN BY: C. MORLOK
DATE DRAWN: 7-2016
CHECKED BY: K. MACHIORI

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 200
TEMECULA, CA 92591
PHONE: (951) 676-8342
MBAKERINTL.COM

JOHN D. TANNER, III RCE 60132 DATE:

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

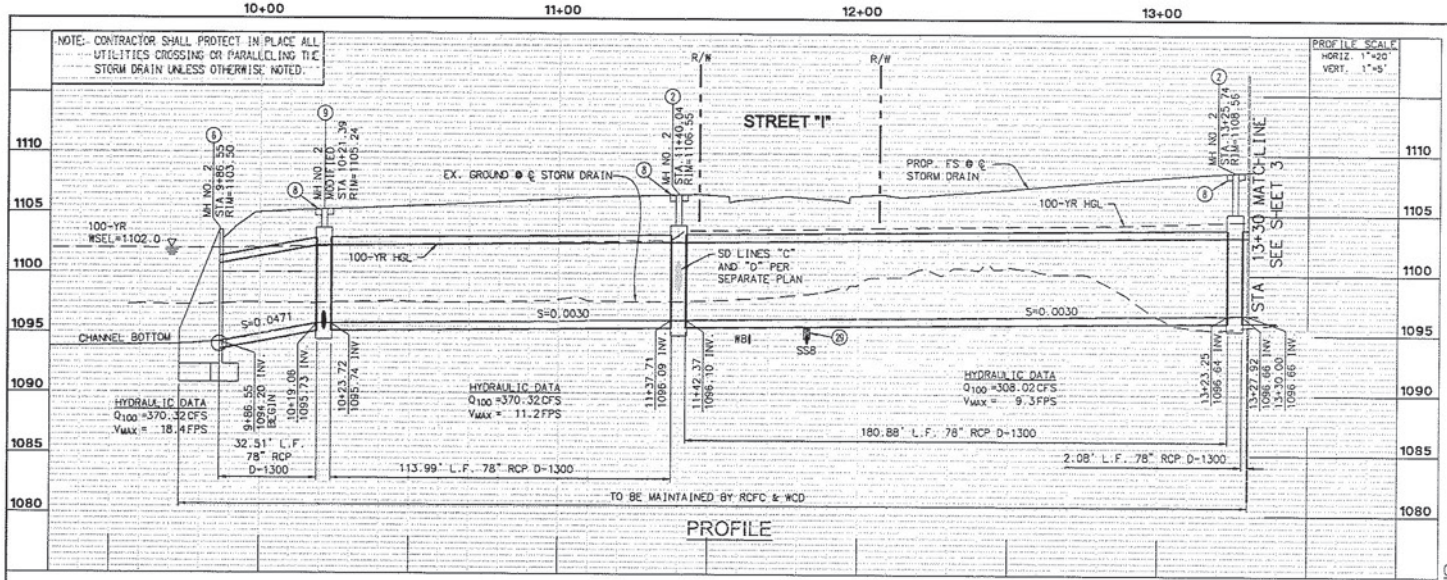
RECOMMENDED FOR APPROVAL BY: _____ DATE: _____ PLANNING ENGINEER

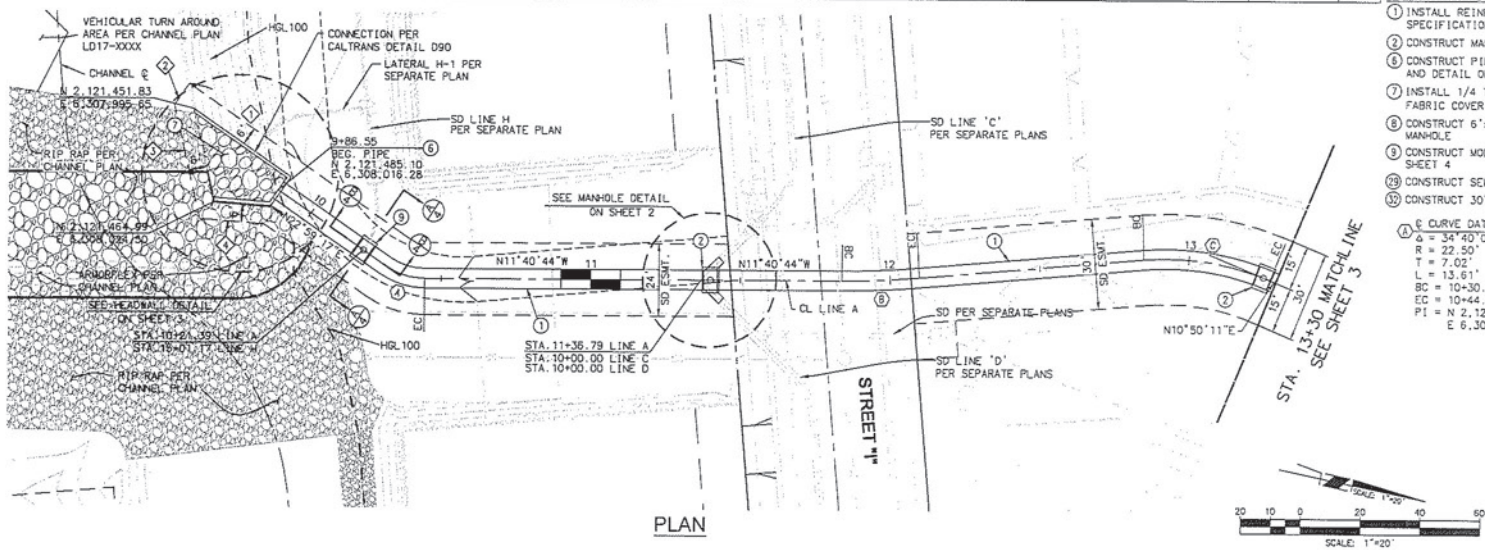
APPROVED BY: _____ DATE: _____ CHIEF ENGINEER

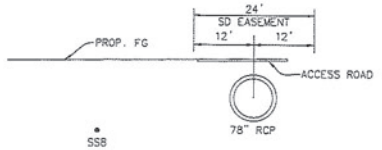
TTM 36483 STORM DRAIN PLAN
STORM DRAIN
TITLE SHEET

PROJECT NO. 0-0-0000
DRAWING NO. 0-000
SHEET NO. 1 OF 4

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

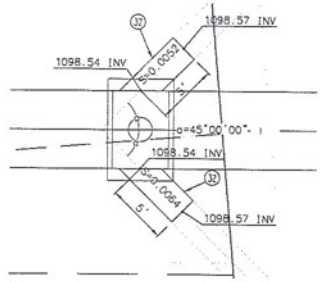






SECTION AT SD STA. 11+00

X-SECTION TAKEN LOOKING DOWNSTREAM
NTS



(2) MANHOLE DETAIL

NTS

CONSTRUCTION NOTES

1. INSTALL REINFORCED CONCRETE PIPE PER RCFC & WCD M.O.U. STANDARD SPECIFICATIONS PER GENERAL NOTE 1. D-LOAD PER PLAN.
2. CONSTRUCT MANHOLE NO. 2 PER STD. DWG. NO. MH252 AND DETAIL ON SHEET 2
6. CONSTRUCT PIPE CULVERT HEADWALL AND WINGWALLS PER CALTRANS STD. NO. D90 AND DETAIL ON SHEET 3
7. INSTALL 1/4 TON ROCK CLASS RIP RAP(3.3' THICK) OVER 4" CLASS 2 BASE FABRIC COVER OVER MIRAFI 700X (OR EQUIV.) FILTER FABRIC.
8. CONSTRUCT 6'x6'x6" THICK PCC PAD WITH #4 @ 18" OC EW., CENTERED ON MANHOLE
9. CONSTRUCT MODIFIED MANHOLE NO. 2 PER STD. DWG. NO. MH 252 AND DETAIL ON SHEET 4
29. CONSTRUCT SEWER PROTECTION PER STD. DWG. MB07
32. CONSTRUCT 30" RCP STUB-OUT WITH BULKHEAD PER MB16

(A) ℄ CURVE DATA	(9) ℄ CURVE DATA	(C) ℄ CURVE DATA
Δ = 34°40'01"	Δ = 04°55'56"	Δ = 27°26'51"
R = 22.50'	R = 300.00'	R = 90.00'
T = 7.02'	T = 12.92'	T = 21.98'
L = 13.61'	L = 25.83'	L = 43.11'
BC = 10+30.75	BC = 11+83.94	BC = 12+84.80
EC = 10+44.36	EC = 12+09.77	EC = 13+27.91
PI = N 2,121,532.25 E 6,308,036.29	PI = N 2,121,688.47 E 6,308,003.99	PI = N 2,121,793.82 E 6,307,972.57

STORM DRAIN EASEMENT DATA TABLE

NO.	BEARING/DELTA	LENGTH
1	N22°59'17"E	45.69'
2	N67°00'43"W	8.64'
3	N65°28'10"E	38.75'
4	N07°00'43"W	21.62'

★PRELIMINARY★
FIRST PLAN CHECK
SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services. TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
RIVERSIDE COUNTY B.M. 500-6-81
INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' W OF OVERPASS BRIDGE. 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE.
997.721 EL. (NGVD 29 DATUM)

REF.	DESCRIPTION	APPR.	DATE
	REVISIONS		

DESIGNED BY: C. MORLOK
DRAWN BY: C. MORLOK
DATE DRAWN: 7-2016
CHECKED BY: K. MACHIGHI

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 200 TEMECULA, CA 92591 PHONE: (951) 676-8042 MBAKERINTL.COM

JOHN D. TANNER, III RCE 60132 DATE:

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

RECOMMENDED FOR APPROVAL BY: DATE:
APPROVED BY: DATE:

TTM 36483 STORM DRAIN PLAN STORM DRAIN

LINE 'A' STATION: 10+00 TO 13+30

PROJECT NO. 0-0-0000
DRAWING NO. 0-000
SHEET NO. 2 OF 4

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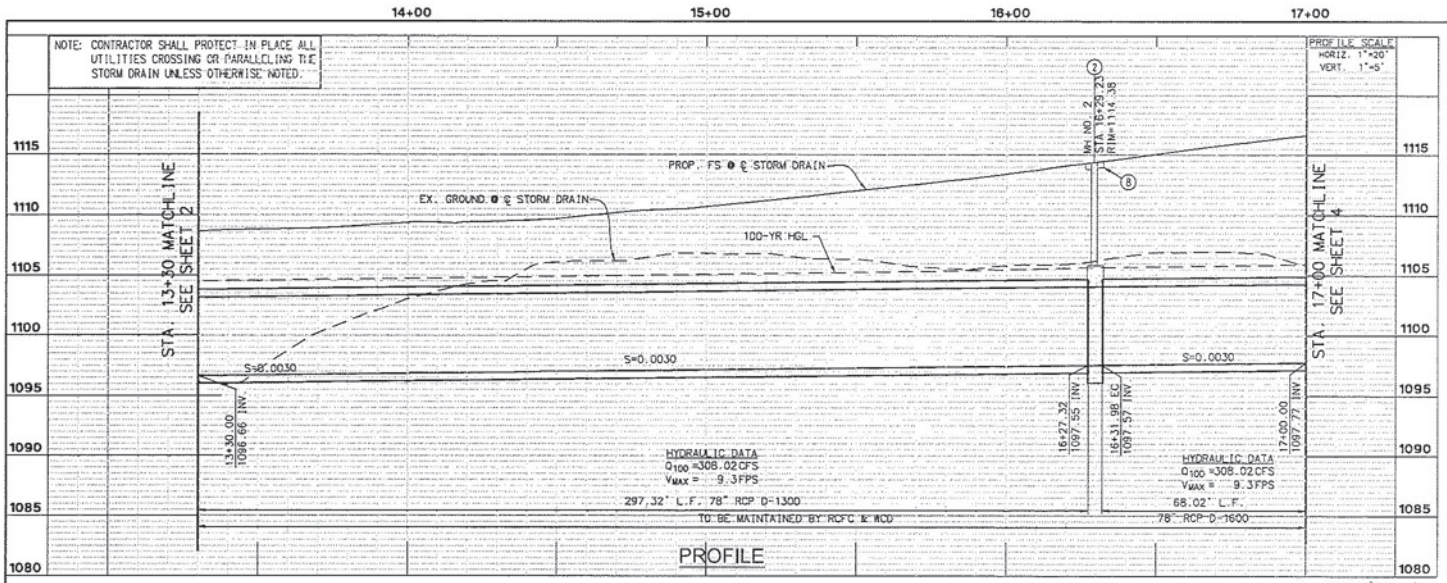
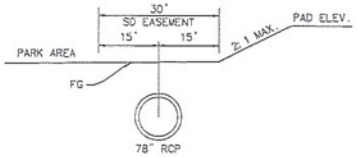
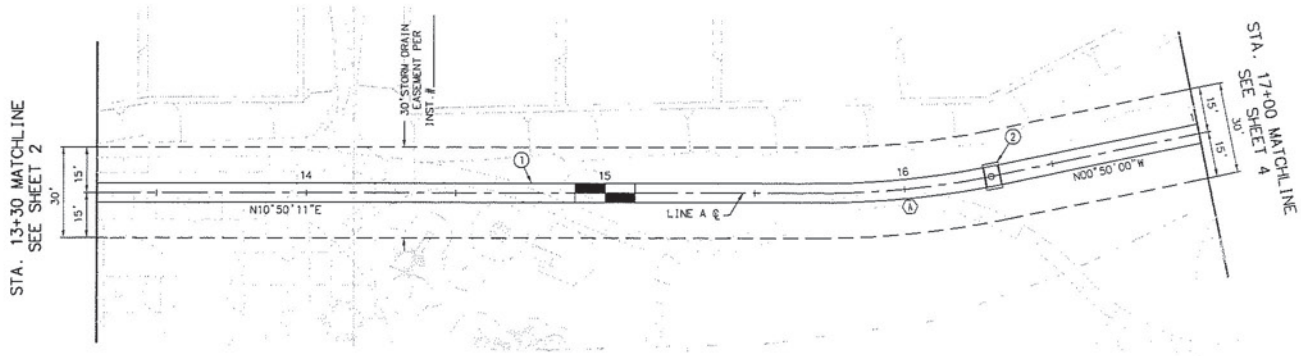
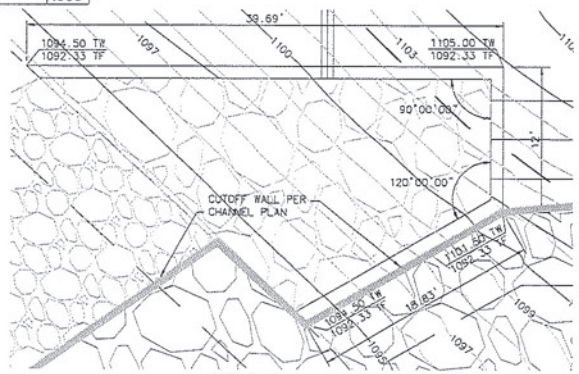




SECTION AT SD STA. 15+00
X-SECTION TAKEN LOOKING DOWNSTREAM
NTS





HEADWALL DETAIL
SCALE: 1"=5'
SEE SHEET 2 FOR PLAN AND PROFILE

℄ CURVE DATA
Δ = 11°40'11"
R = 300.00'
T = 30.66'
L = 61.10'
BC = 15+70.88
EC = 16+31.98
PI = N 2,122,084.14
E 6,308,028.14

PLAN

CONSTRUCTION NOTES
1. INSTALL REINFORCED CONCRETE PIPE PER RCFC & WCD M.O.U. STANDARD SPECIFICATIONS PER GENERAL NOTE 1. D-LOAD PER PLAN.
2. CONSTRUCT MANHOLE NO. 2 PER STD. DWG. NO. MH252 AND DETAIL ON SHEET 2
8. CONSTRUCT 6'x6'x6" THICK PCC PAD WITH #4 @ 18" OC E/W, CENTERED ON MANHOLE

SCALE: 1"=10'
20 10 0 20 40 60
SCALE: 1"=20'

★PRELIMINARY★
FIRST PLAN CHECK
SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.
TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
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INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15EC. 300' W OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE.
997.721 EL. (NGVD 29 DATUM)

REF.	REVISIONS	APPR.	DATE

DESIGNED BY: C. WORLOK
DRAWN BY: C. WORLOK
DATE DRAWN: 7-2016
CHECKED BY: K. MAGHIGHI

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 200
TEMECULA, CA 92591
PHONE: (951) 676-6042
MBAKERINTL.COM

JOHN D. TANNER, III RCE 60132 DATE:

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: DATE:
APPROVED BY: DATE:

TTM 36483 STORM DRAIN PLAN
STORM DRAIN
LINE 'A' STATION 13+30 TO 17+30

PROJECT NO. 0-0-0000
DRAWING NO. 0-000
SHEET NO. 3 OF 4

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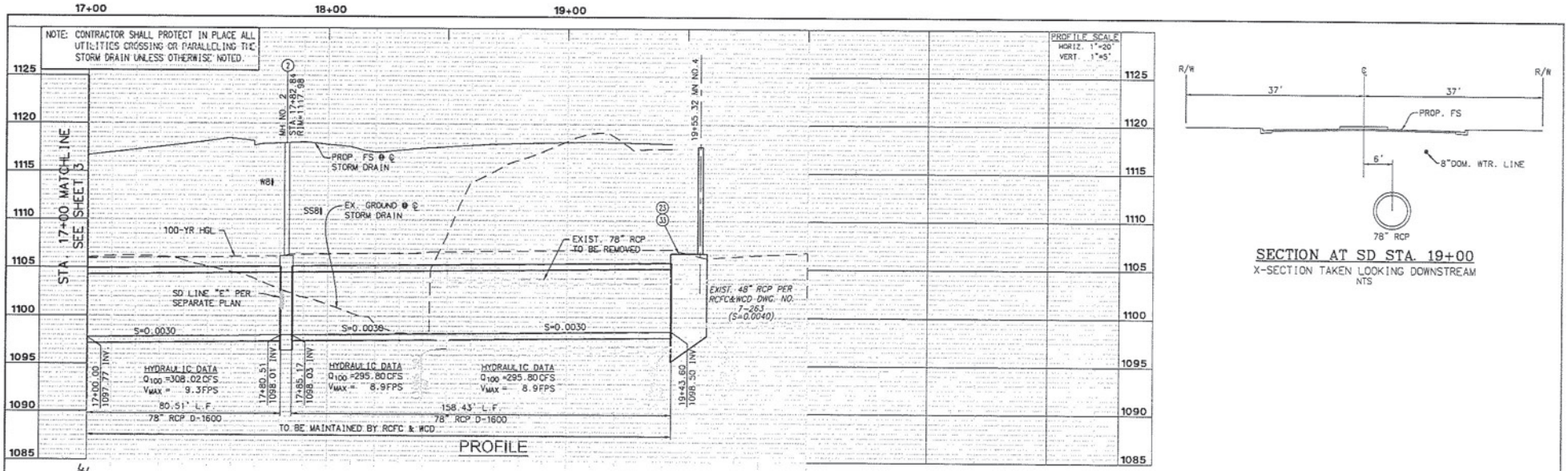
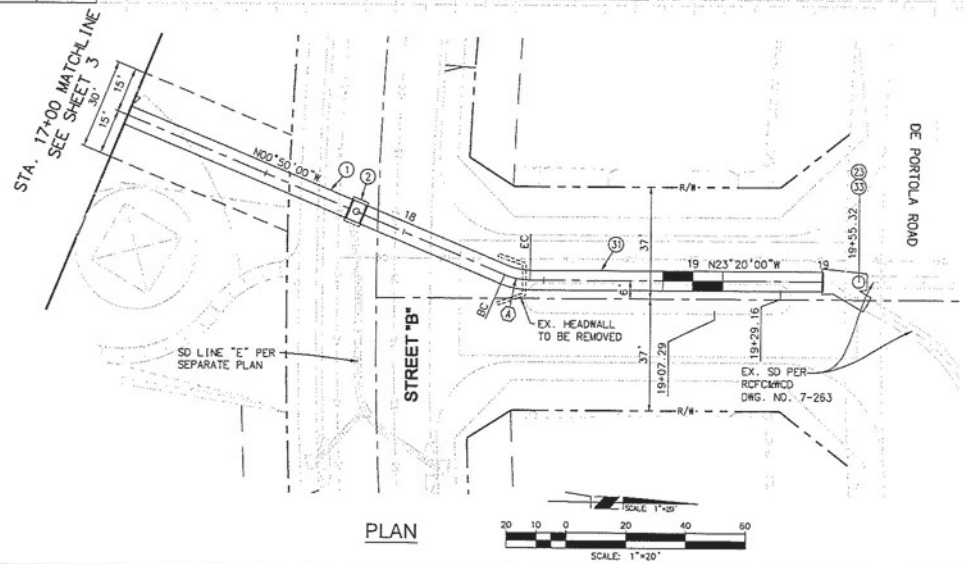


PROFILE

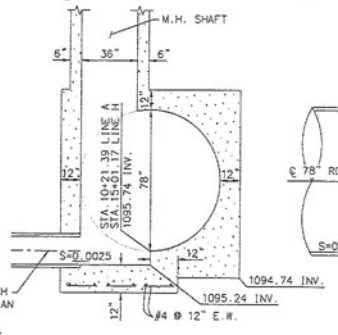
SECTION AT SD STA. 19+00
X-SECTION TAKEN LOOKING DOWNSTREAM
NTS



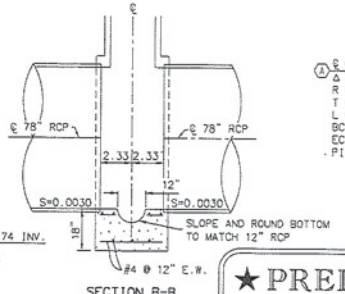
PLAN

CONSTRUCTION NOTES

1. INSTALL REINFORCED CONCRETE PIPE PER RCFC & WCD M.O.U. STANDARD SPECIFICATIONS PER GENERAL NOTE 1. D-LOAD PER PLAN.
2. CONSTRUCT MANHOLE NO. 2 PER STD. DWG. NO. MH252 AND DETAIL ON SHEET 2
23. REMOVE AND DISPOSE OF EXIST. MH
31. REMOVE AND REPLACE 100LF+/- OF EX. 78"RCP AT HIGHER ELEVATION PER PROFILE
32. CONSTRUCT MH NO.4 PER STD. DWG. MH254.



SECTION A-A
NOT TO SCALE



SECTION B-B
NOT TO SCALE

℄ CURVE DATA
Δ = 22°30'00"
R = 22.50'
T = 4.48'
L = 8.84'
BC = 18+36.74
EC = 18+45.57
PI = N 2,122,324.01
E 6,308,024.65

MODIFIED MANHOLE NO. 2
NOT TO SCALE
SEE SHEET 2

★PRELIMINARY★
FIRST PLAN CHECK
SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.
TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
RIVERSIDE COUNTY B.M. 600-6-81
INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' N OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE.
997.721 EL. (NGVD 29 DATUM)

REVISIONS			
REV.	DESCRIPTION	APPR.	DATE

DESIGNED BY: C. MORLOK
DRAWN BY: C. MORLOK
DATE DRAWN: 7-2016
CHECKED BY: K. MAGHIDI

Michael Baker INTERNATIONAL
JOHN D. TANNER, III RCE 60132 DATE:
41610 COUNTY CENTER DR., SUITE 200 TEMECULA, CA 92591 PHONE: (951) 676-8042 MBAKERINTL.COM

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: DATE:
APPROVED BY: DATE:

TTM 36483 STORM DRAIN PLAN
STORM DRAIN
LINE 'A' STATION: 17+30 TO 19+43.60

PROJECT NO. 0-0-0000
DRAWING NO. 0-000
SHEET NO. 4 OF 4

PLOTTED: 3/20/2018 9:45 AM BY: SCHUYLER MOORE
FILE: C:\Users\SCHUYLER.MOORE\DOCUMENTS\TTM36483\DRAWINGS\TTM36483_SD_PLAN_A.DGN

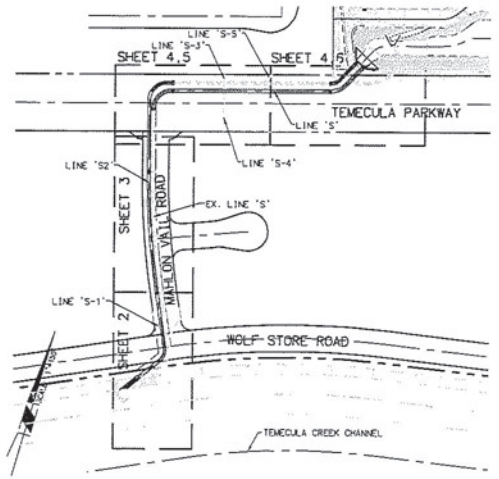
EXCERPT D: MAHLON VAIL ROAD/TEMECULA PARKWAY STORM DRAIN PLANS

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

GENERAL NOTES

1. THE CONTRACTOR SHALL CONSTRUCT THE FLOOD CONTROL IMPROVEMENTS SHOWN ON THE DRAWINGS IN CONFORMANCE WITH THE REQUIREMENTS OF THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT'S M.O.U. STANDARD SPECIFICATIONS DATED JUNE 24, 2008, AND THE RCFC&WCD STANDARD MANUAL, AND RCFC&WCD STANDARD MANUAL DATED JULY 8, 2010. FOR THE LATEST DRAWINGS OF THE STANDARD MANUAL, PLEASE REFER TO THE "PUBLICATIONS AND RECORDS" PAGE FOUND ON THE DISTRICT'S WEBSITE.
2. (IF) AN ENCROACHMENT PERMIT IS REQUIRED FROM THE RIVERSIDE COUNTY FLOOD CONTROL, CONTACT PERMIT ENGINEER AT 951/955-1266. AFTER THE PERMIT IS ISSUED THE DISTRICT MUST BE NOTIFIED ONE WEEK PRIOR TO CONSTRUCTION.
3. CONSTRUCTION INSPECTION WILL BE PERFORMED BY RIVERSIDE COUNTY FLOOD CONTROL. CONTACT CONTRACT ADMINISTRATOR AT 951/955-1288. THE DISTRICT MUST BE NOTIFIED TWENTY DAYS (20) PRIOR TO CONSTRUCTION.
4. ALL STATIONING REFERS TO CENTERLINE OF CONSTRUCTION UNLESS OTHERWISE NOTED.
5. STATIONING FOR LATERALS AND CONNECTOR PIPE REFER TO THE CENTERLINE INTERSECTION STATIONS.
6. FORTY-EIGHT HOURS BEFORE EXCAVATION, CALL UNDERGROUND SERVICE ALERT 1-800-227-2600.
7. ALL ELEVATIONS SHOWN ARE IN FEET AND DECIMALS THEREOF BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD 88).
8. ALL COORDINATES ARE SHOWN IN FEET AND DECIMALS THEREOF BASED ON THE NORTH AMERICAN DATUM (NAD 83), CALIFORNIA COORDINATE SYSTEM (CCS), ZONE 6 AND EPOCH 2007.00.
9. ALL CROSS SECTIONS ARE TAKEN LOOKING DOWNSTREAM.
10. ELEVATIONS OF UTILITIES ARE APPROXIMATE UNLESS OTHERWISE NOTED.
11. UNLESS OTHERWISE SPECIFIED, MINIMUM STREET RECONSTRUCTION SHALL BE 4" TYPE "B" HOT MIX ASPHALT OVER 6" CLASS 2 AGGREGATE BASE OR AS SPECIFIED BY THE ENGINEER.
12. OPENINGS RESULTING FROM THE CUTTING OR PARTIAL REMOVAL OF EXISTING CULVERTS, PIPES OR SIMILAR STRUCTURES TO BE ABANDONED SHALL BE SEALED WITH 6" OF CLASS "B" CONCRETE.
13. PIPE CONNECTED TO THE MAINLINE PIPE SHALL CONFORM TO JUNCTION STRUCTURE NO.4 (JS 229) UNLESS OTHERWISE NOTED.
14. PIPE BEDDING SHALL CONFORM TO RCFC&WCD STD. DWG. NO. M815 EXCEPT FOR COVER<2 FEET. FOR COVER<2 FEET, CONCRETE SLURRY (2000 PSI - 2 SACK) SHALL BE USED. THE ENTIRE TRENCH SHALL BE SLURRY EXTENDING 4 INCHES MINIMUM AND 12 INCHES MAXIMUM ABOVE THE TOP OF THE PIPE.
15. BH-10 INDICATES SOIL BORING LOCATION BASED ON THE SOILS REPORT DATED JULY 14, 2015. LOCATIONS SHOWN ARE APPROXIMATE.
16. "V" IS THE DEPTH OF CATCH BASINS MEASURED FROM THE TOP OF CURB TO INVERT OF CONNECTOR PIPE.
17. CATCH BASINS SHALL BE LOCATED SO THAT LOCAL DEPRESSION SHALL BEGIN AT EXISTING CURB RETURN JOINT, UNLESS OTHERWISE SPECIFIED.
18. ALL CURBS, GUTTERS, SIDEWALKS, DRIVEWAYS AND OTHER EXISTING IMPROVEMENTS TO BE RECONSTRUCTED IN KIND AND AT THE SAME ELEVATION AND LOCATION AS THE EXISTING IMPROVEMENTS UNLESS OTHERWISE NOTED.
19. STANDARD DRAWINGS CALLED FOR ON THE PLAN AND PROFILE SHALL CONFORM TO DISTRICT STANDARD DRAWINGS UNLESS NOTED OTHERWISE.
20. THE CONTRACTOR IS REQUIRED TO CALL ALL UTILITY AGENCIES REGARDING TEMPORARY SHORING AND SUPPORT REQUIREMENTS FOR THE VARIOUS UTILITY LINES SHOWN ON THESE PLANS
21. DURING ROUGH GRADING OPERATIONS AND PRIOR TO CONSTRUCTION OF PERMANENT DRAINAGE STRUCTURES, TEMPORARY DRAINAGE CONTROL SHOULD BE PROVIDED TO PREVENT PONDING WATER AND DAMAGE TO ADJACENT PROPERTIES.
22. APPROVAL OF THESE PLANS BY THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT DOES NOT RELIEVE THE DEVELOPER'S ENGINEER OF RESPONSIBILITY FOR THE ENGINEERING DESIGN. IF FIELD CHANGES ARE REQUIRED, IT WILL BE THE RESPONSIBILITY OF THE DESIGN ENGINEER TO MAKE THE NECESSARY CORRECTIONS.
23. THE CONTRACTOR OR DEVELOPER SHALL SECURE ALL THE REQUIRED ENCROACHMENT AND/OR STATE AND FEDERAL REGULATORY PERMITS PRIOR TO THE COMMENCEMENT OF ANY WORK.
24. THE CONCRETE COATING ON THE INSIDE OF ALL REINFORCED CONCRETE PIPES MUST BE INCREASED TO PROVIDE A MINIMUM OF 1-1/2 INCHES OVER THE REINFORCING AND INCREASED TO A MINIMUM OF 3-1/2 INCHES OVER REINFORCING FOR BOX CULVERTS WHEN DESIGN VELOCITIES EXCEED 20 FEET PER SECOND. THE CONCRETE DESIGN STRENGTH IN THESE REACHES SHALL BE F'C=5,000 PSI FOR VELOCITIES EXCEEDING 20 FEET PER SECOND AND F'C=6,000 PSI FOR VELOCITIES EXCEEDING 30 FEET PER SECOND.
25. CONSTRUCTION JOINT FOR CALTRANS STANDARD REINFORCED CONCRETE BOX SHALL BE ACCORDING TO RCFC&WCD STD. DWG. NO. BX401.

VICINITY MAP
NTS



150 75 0 150 300 450
SCALE: 1"=150'

INDEX MAP
1"=150'

SHEET INDEX

	SHEET NO.
TITLE SHEET & INDEX MAP	1
SD PLAN & PROFILE	2-7

R.C.F.C. & W.C.D. STANDARD DRAWINGS

MH252	MANHOLE NO. 2
M803	CONCRETE COLLAR
JS229	JUNCTION STRUCTURE NO. 4
JS231	JUNCTION STRUCTURE NO. 6

CALTRANS STANDARD DRAWINGS

D-86B	HEADWALL AND WARPED WINGWALL
D-90A	HEADWALL AND WINGWALL

STORM DRAIN MAINTENANCE RESPONSIBILITIES

RCFC & WCD WILL MAINTAIN ALL LINES LARGER THAN 36" INCLUDING:
SD LINE 'S' AND SD LINE 'S2'

STORM DRAIN MAINTENANCE RESPONSIBILITIES

THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY PIPES, CONDUITS, OR STRUCTURES SHOWN ON THESE PLANS WERE OBTAINED BY A SEARCH OF AVAILABLE RECORDS. TO THE BEST OF OUR KNOWLEDGE, THERE ARE NO EXISTING UTILITIES EXCEPT THOSE SHOWN ON THESE PLANS. THE CONTRACTOR IS REQUIRED TO TAKE PRECAUTIONARY MEASURES TO PROTECT THE UTILITY LINES SHOWN ON THESE DRAWINGS. THE CONTRACTOR FURTHER ASSUMES ALL LIABILITY AND RESPONSIBILITY FOR THE UTILITY PIPES, CONDUITS OR STRUCTURES, SHOWN OR NOT SHOWN ON THESE PLANS.

CONSTRUCTION NOTES

1. INSTALL REINFORCED CONCRETE PIPE PER RCFC & WCD SPECS. (SIZES AS SHOWN ON PROFILE)
2. CONSTRUCT MANHOLE NO. 2 PER RCFC & WCD STD. DWG. NO. MH252
3. CONSTRUCT MODIFIED CONCRETE COLLAR PER STD. DWG. NO. M803 AND DETAIL ON SHEET 6
4. CONSTRUCT JUNCTION STRUCTURE NO. 4 PER RCFC & WCD STD. DWG. NO. JS229
5. CONSTRUCT JUNCTION STRUCTURE NO. 6 PER RCFC & WCD STD. DWG. NO. JS231
6. CONSTRUCT HEADWALL AND WINGWALLS PER CALTRANS STD. NO. D90
7. INSTALL RIP RAP (SIZES AS SHOWN ON PLANS)
8. VEHICULAR TURN AROUND AREA PER RCFC & WCD STD. DWG. NO. M827

★PRELIMINARY★
SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.
TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
RIVERSIDE COUNTY B.M. 600-6-S1
INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' N OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE.
997.721 EL.

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

DESIGNED BY: C. WORLOK
DRAWN BY: C. WORLOK
DATE DRAWN: 7-2016
CHECKED BY: C. WORLOK

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM
JOHN D. TANNER, III RCE 60132 DATE:

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

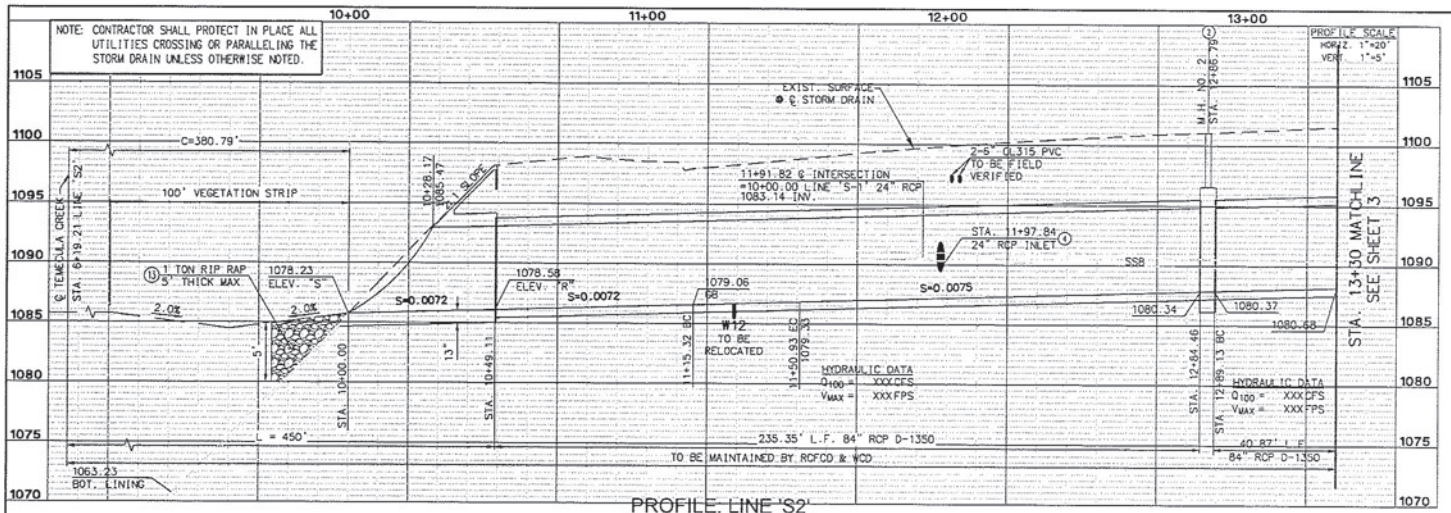
RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER DATE:
APPROVED BY: CHIEF ENGINEER DATE:

MAHLON VAIL RD/TEMECULA PKWY STORM DRAIN

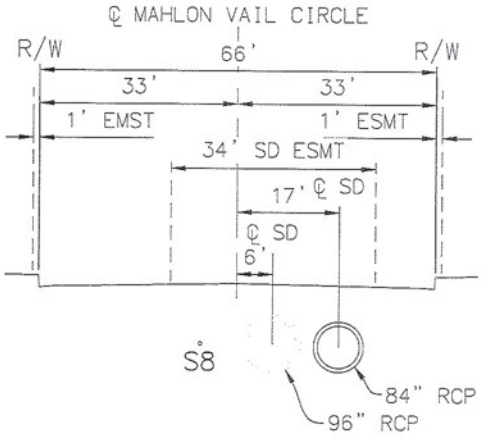
TITLE SHEET

PROJECT NO. 0-0-0000
DRAWING NO. 0-000
SHEET NO. 1 OF 6

H:\PDATA\13960B\CADD\LAND\OLV\IMPROVE\SD\DFS\TE\139600-SD-DFT-001.DWG TBURNSIDE 3/24/17 2:14 pm

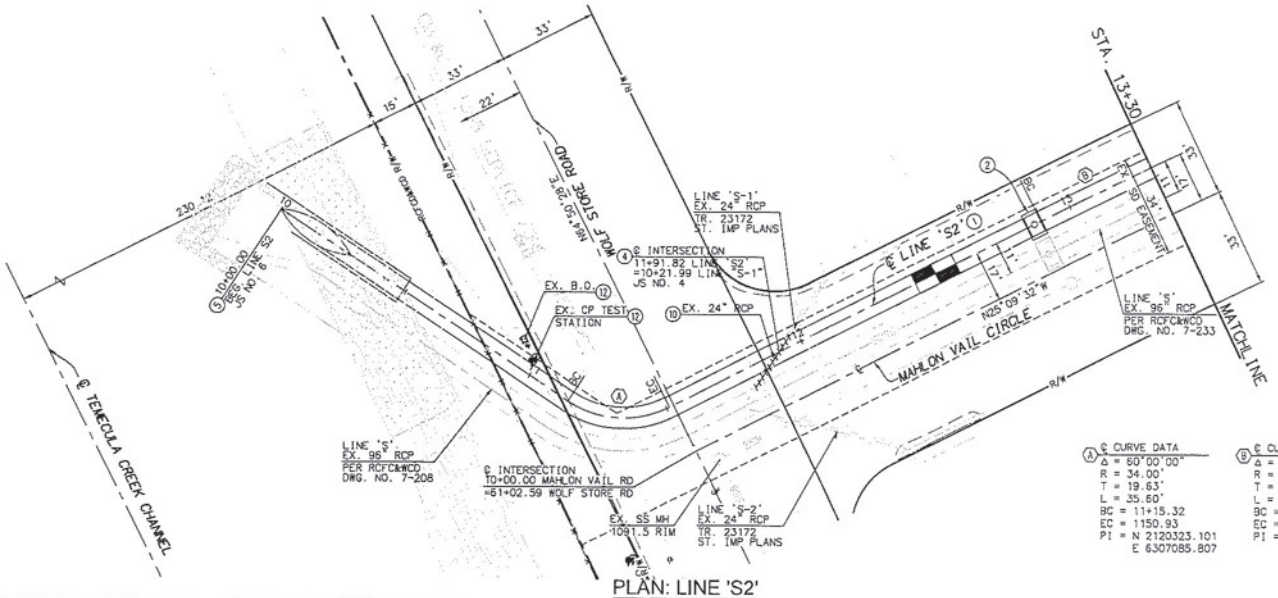


PROFILE: LINE 'S2'



SECTION AT SD STA. 12+50

SCALE: 1"=10'



PLAN: LINE 'S2'

CONSTRUCTION NOTES

1. INSTALL REINFORCED CONCRETE PIPE PER RCFC & WCD SPECS. (SIZES AS SHOWN ON PROFILE)
2. CONSTRUCT MANHOLE NO. 2 PER RCFC & WCD STD. DWG. NO. MH252
4. CONSTRUCT JUNCTION STRUCTURE NO. 4 PER RCFC & WCD STD. DWG. NO. JS229
5. CONSTRUCT JUNCTION STRUCTURE NO. 5 PER RCFC & WCD STD. DWG. NO. JS231
10. REMOVE AND DISPOSE
12. TO BE RELOCATED

Ⓐ ℄ CURVE DATA
Δ = 50°00'00"
R = 34.00'
T = 19.63'
L = 35.60'
BC = 11+15.32
EC = 1150.93
PI = N 2120323.101
E 6307085.807

Ⓑ ℄ CURVE DATA (FULL)
Δ = 8°32'52"
R = 2017.00'
T = 150.73'
L = 300.91'
BC = 12+89.13
EC = 15+90.04
PI = N 2121320.132
E 6308883.480

SCALE: 1"=20'

20 10 0 20 40 50

SCALE: 1"=20'

★PRELIMINARY★
FIRST PLAN CHECK
SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.
TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
RIVERSIDE COUNTY B.M. 600-6-81
INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' W OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE.
997.721 EL.

REVISIONS			
REV.	DESCRIPTION	APPR.	DATE

DESIGNED BY: C. MORLOK
DRAWN BY: C. MORLOK
DATE DRAWN: 7-2016
CHECKED BY: C. MORLOK

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

JOHN D. TANNER, III RCE 60132 DATE:

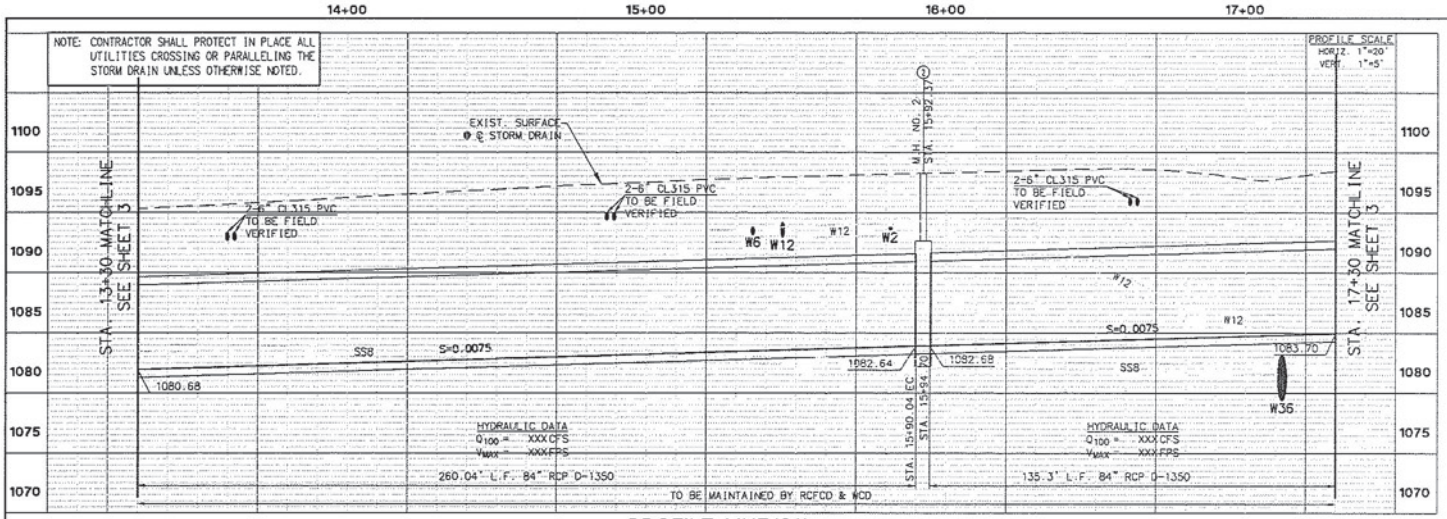
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: APPROVED BY:
PLANNING ENGINEER DATE: CHIEF ENGINEER DATE:

MAHLON VAIL RD/TEMECULA PKWY STORM DRAIN

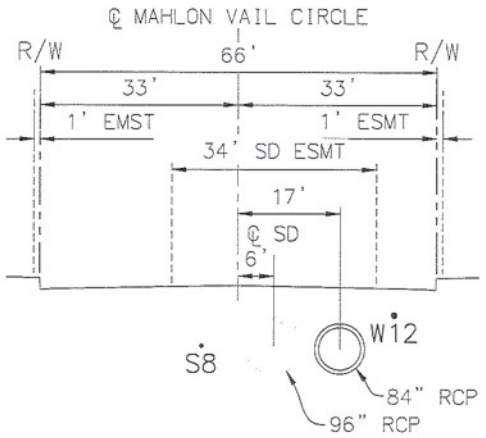
LINE 'S2' STATION: 10+00 TO 13+30

PROJECT NO. 0-0-0000
DRAWING NO. 0-000
SHEET NO. 2 OF 6

M:\PROJ\A13\39500\CAD\TOL\LANDV\LAYOUT\SHEET\13950D-SD-SHT-002.DWG TBARNSIDE 3/24/2017 3:16 PM



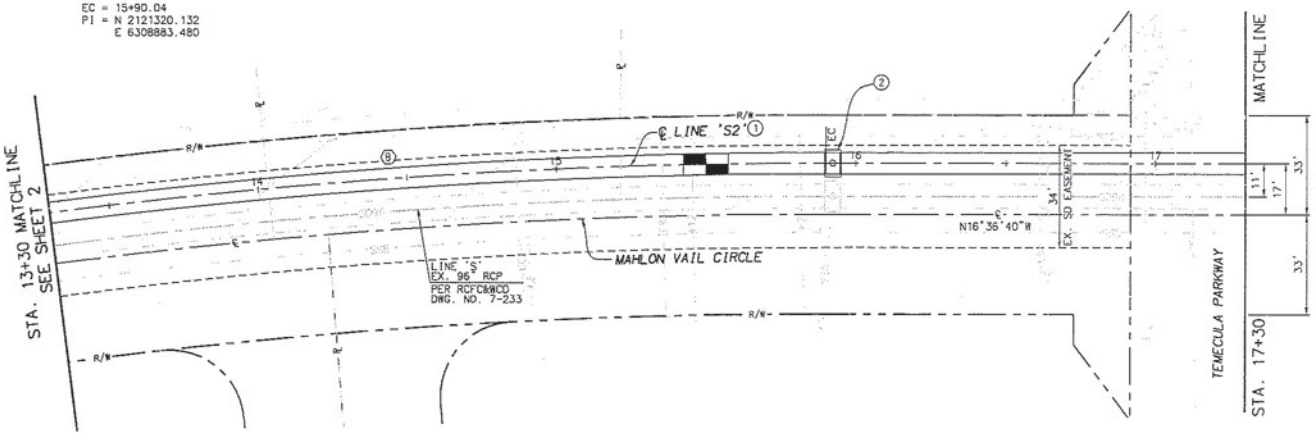
PROFILE: LINE 'S2'



SECTION AT SD STA. 15+50

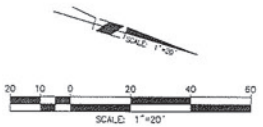
SCALE: 1"=10'

℄ CURVE DATA (FULL)
Δ = 8°32'52"
R = 2017.00'
T = 150.73'
L = 300.91'
BC = 12+89.13
EC = 15+90.04
PI = N 2121320.132
E 6308883.480



PLAN: LINE 'S2'

CONSTRUCTION NOTES
1. INSTALL REINFORCED CONCRETE PIPE PER RCFC & WCD SPECS. (SIZES AS SHOWN ON PROFILE)
2. CONSTRUCT MANHOLE NO. 2 PER RCFC & WCD STD. DWG. NO. MH252



★PRELIMINARY★
FIRST PLAN CHECK
SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services. TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
RIVERSIDE COUNTY B.M. 600-6-81
INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' W OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE.
997.721 EL.

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

DESIGNED BY: C. MORLOK
DRAWN BY: C. MORLOK
DATE DRAWN: 7-2016
CHECKED BY: C. MORLOK

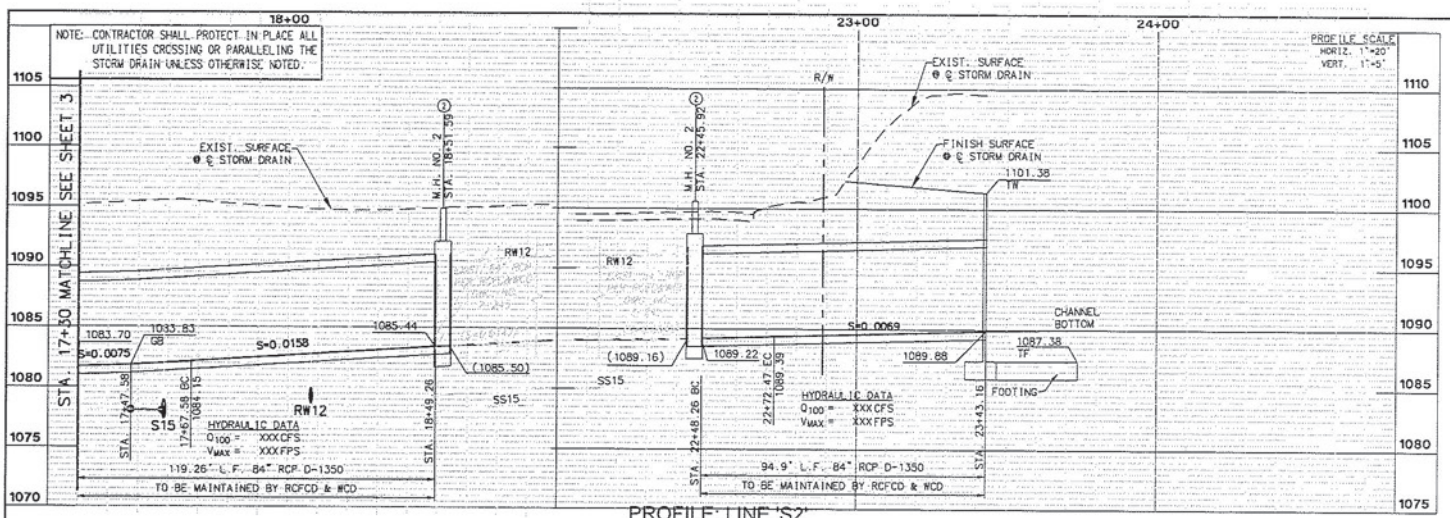
Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100 TEMECULA, CA 92591 PHONE: (951) 676-8042 MBAKERINTL.COM
JOHN D. TANNER, III RCE 60132 DATE:

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER DATE:
APPROVED BY: CHIEF ENGINEER DATE:

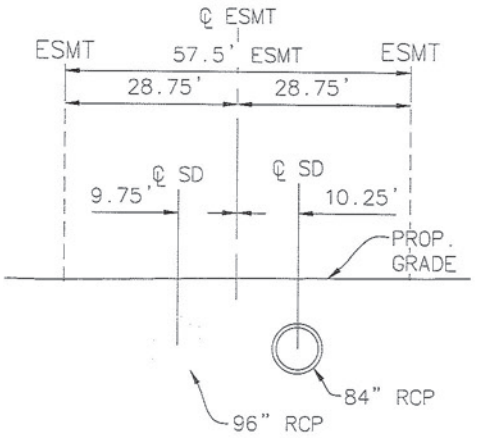
MAHLON VAIL RD/TEMECULA PKWY STORM DRAIN
LINE 'S2' STATION: 13+30 TO 17+30

PROJECT NO. 0-0-0000
DRAWING NO. 0-000
SHEET NO. 3 OF 5

H:\PROJECTS\135600\CADD\PLANS\MAHLON_VAIL_TEMECULA_PKWY_STORM_DRAIN\PRELIMINARY\135600-SD-PLAN-003.DWG TIMPRIDGE 3/24/2017 3:17 PM



PROFILE: LINE 'S2'



SECTION AT SD STA. 15+50

SCALE: 1"=10'

℄ CURVE DATA
Δ = 90°00'00"
R = 45.00'
T = 45.00'
L = 70.69'
BC = STA. 17+67.58
EC = STA. 18+38.26
PI = N 2120926.519
E 6306943.023

℄ CURVE DATA
Δ = 46°14'30"
R = 30.00'
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EC = STA. 22+72.47
PI = N 2121115.595
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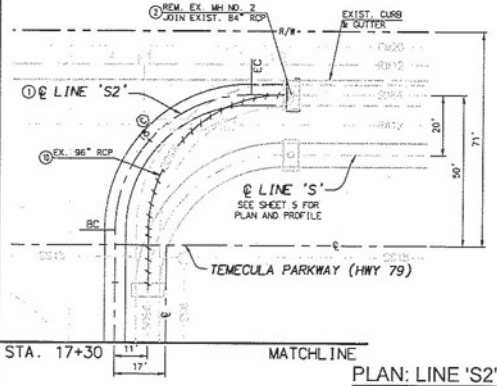

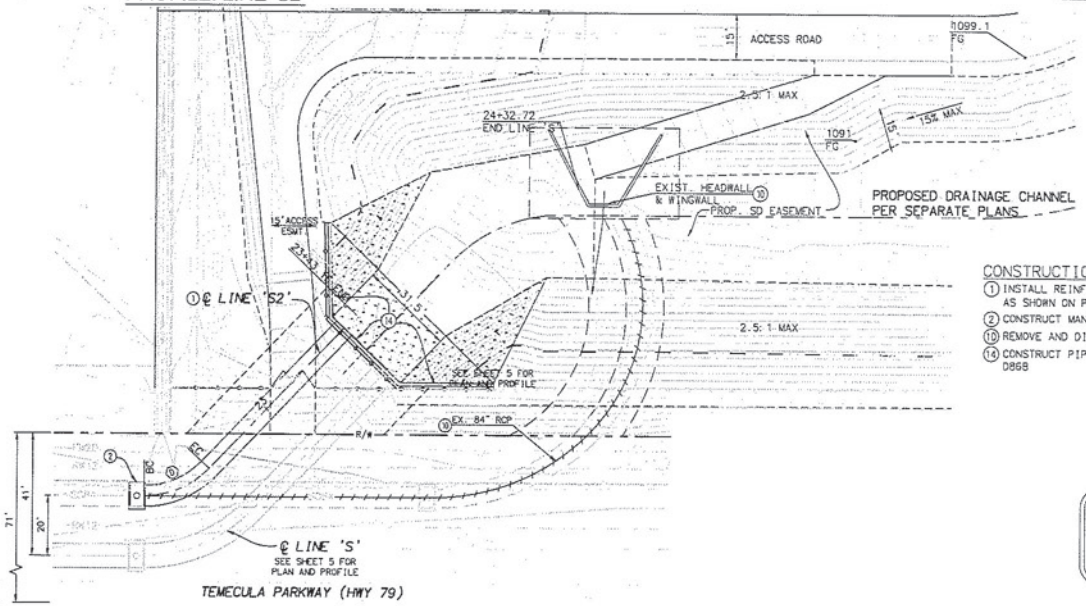

CONSTRUCTION NOTES

1. INSTALL REINFORCED CONCRETE PIPE PER RCFC & WCD SPECS. (SIZES AS SHOWN ON PROFILE)
2. CONSTRUCT MANHOLE NO. 2 PER RCFC & WCD STD. DWG. NO. MH252
10. REMOVE AND DISPOSE
14. CONSTRUCT PIPE CULVERT WARPED WINGWALLS PER CALTRANS STD. NO. D85B

★PRELIMINARY★
FIRST PLAN CHECK
SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.
TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
RIVERSIDE COUNTY B.M. 600-6-81
INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' W OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE.
997.721 EL.

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

DESIGNED BY: C. MORLOK
DRAWN BY: C. MORLOK
DATE DRAWN: 7-2016
CHECKED BY: C. MORLOK

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

JOHN D. TANNER, III — RCE 60132 — DATE:

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

RECOMMENDED FOR APPROVAL BY: _____ APPROVED BY: _____
PLANNING ENGINEER — DATE: _____ CHIEF ENGINEER — DATE: _____

MAHLON VAIL RD/TEMECULA PKWY STORM DRAIN

LINE 'S2' STA: 17+30.00 TO 18+49.26
LINE 'S2' STA: 22+48.26 TO 24+32.72

PROJECT NO. 0-0-0000
DRAWING NO. 0-000
SHEET NO. 4 OF 6

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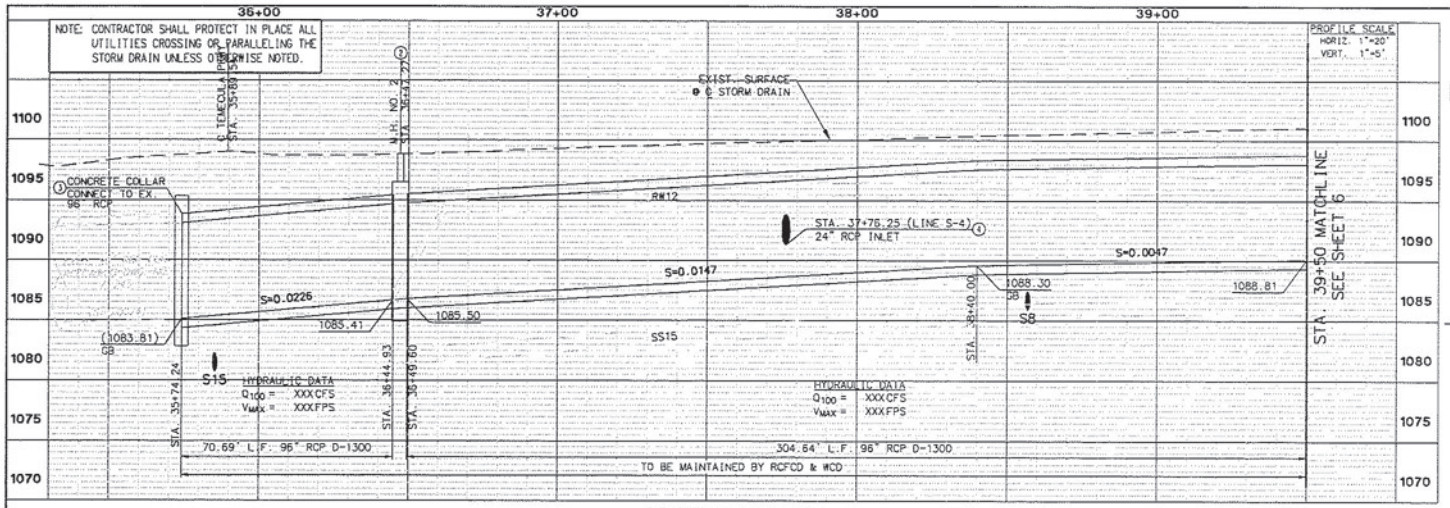
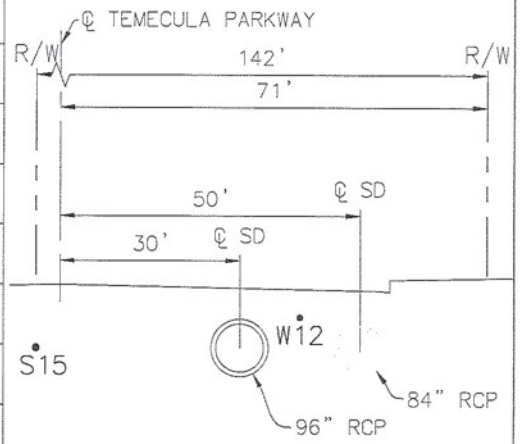


PROFILE: LINE 'S'



SECTION AT SD STA. 37+50

SCALE: 1"=10'

℄ CURVE DATA
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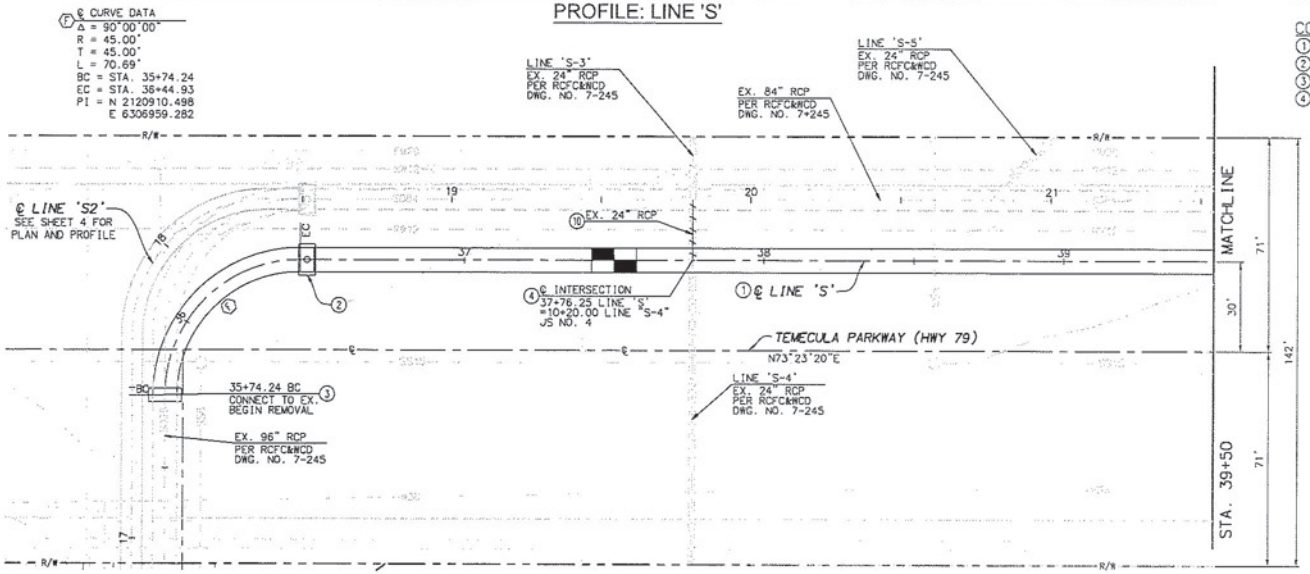
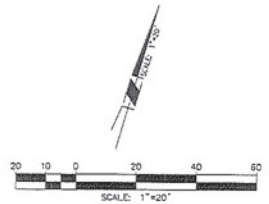
R = 45.00'
T = 45.00'
L = 70.69'
BC = STA. 35+74.24
EC = STA. 36+44.93
PI = N 2120910.498
E 6306959.282



PLAN: LINE 'S'

CONSTRUCTION NOTES

1. INSTALL REINFORCED CONCRETE PIPE PER RCFC & WCD SPECS. (SIZES AS SHOWN ON PROFILE)
2. CONSTRUCT MANHOLE NO. 2 PER RCFC & WCD STD. DWG. NO. MH252
3. CONSTRUCT MODIFIED CONCRETE COLLAR PER STD. DWG. NO. M803 AND DETAIL ON SHEET 6
4. CONSTRUCT JUNCTION STRUCTURE NO. 4 PER RCFC & WCD STD. DWG. NO. JS229



★PRELIMINARY★
FIRST PLAN CHECK
SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.
TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
RIVERSIDE COUNTY B.M. 600-6-81
INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' N OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 6' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 79.4' S OF LIGHT POLE.
997.721 EL.

REF.	REVISIONS DESCRIPTION	APPR.	DATE

DESIGNED BY: C. MORLOK
DRAWN BY: C. MORLOK
DATE DRAWN: 7-2016
CHECKED BY: C. MORLOK

Michael Baker INTERNATIONAL
45810 COUNTY CENTER DR., SUITE 100
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

JOHN D. TANNER, III RCE 60132 DATE(

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER DATE:

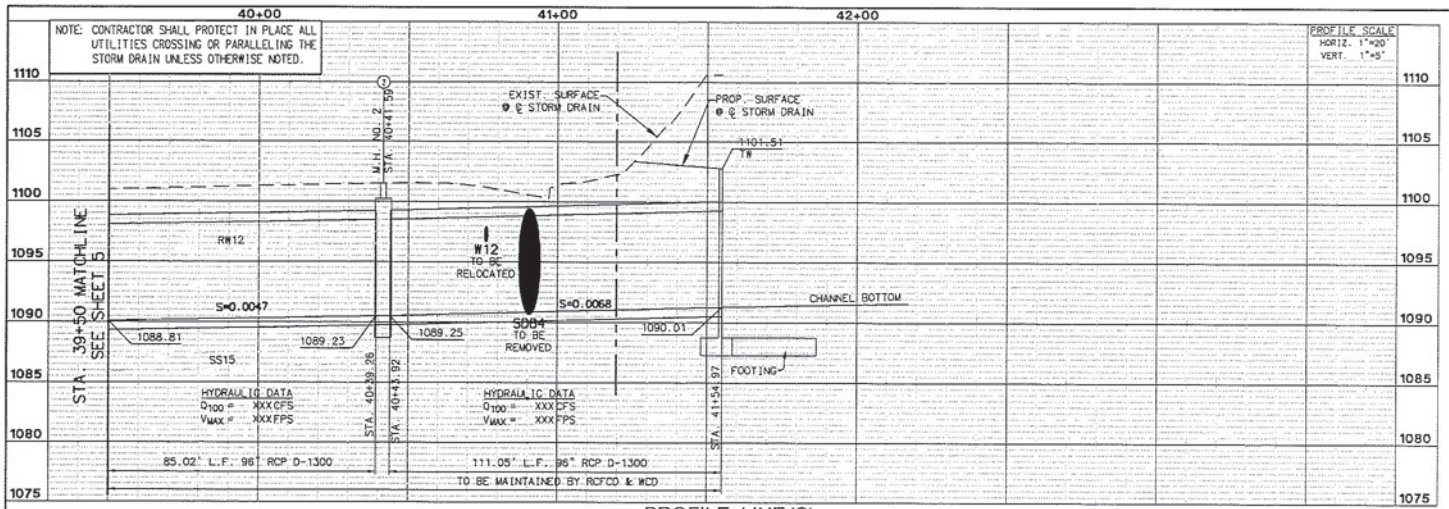
APPROVED BY: CHIEF ENGINEER DATE:

MAHLON VAIL RD/TEMECULA PKWY STORM DRAIN

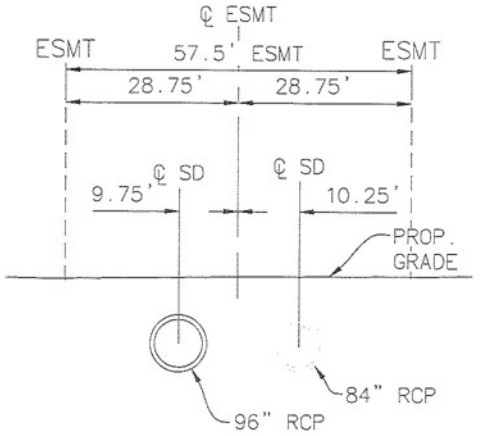
LINE 'S' STATION: 35+74.24 TO 39+50

PROJECT NO. 0-0-0000
DRAWING NO. 0-000
SHEET NO. 5 OF 6

M:\04 2017 PROJECTS\0000\0000-00-000\DWG\0000-00-000-SHEET.DWG 3/24/2017 11:51:15 AM PDT

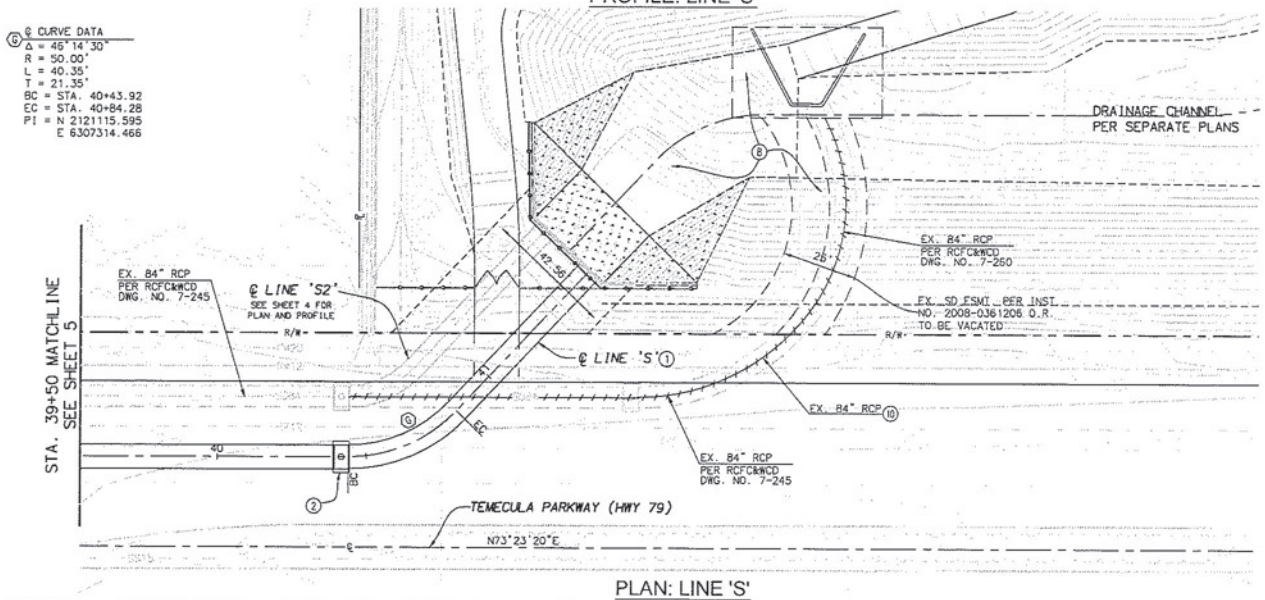


PROFILE: LINE 'S'



SECTION AT SD STA. 15+50

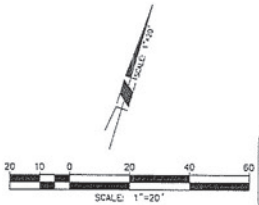
SCALE: 1"=10'



PLAN: LINE 'S'

CONSTRUCTION NOTES

① INSTALL REINFORCED CONCRETE PIPE PER RCFC & WCD SPECS. (SIZES AS SHOWN ON PROFILE)
② CONSTRUCT MANHOLE NO. 2 PER RCFC & WCD STD. DWG. NO. MH252
⑥ CONSTRUCT PIPE CULVERT HEADWALL AND WINGWALLS PER CALTRANS STD. NO. D90
⑧ VEHICULAR TURN AROUND AREA PER RCFC & WCD STD. DWG. NO. M827



★PRELIMINARY★
FIRST PLAN CHECK
SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.
TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
RIVERSIDE COUNTY B.M. 600-6-81
INSIDE FREEWAY R/W AT THE SW CORNER OF THE INT. OF HWY. 79 AND I-15E. 300' N OF OVERPASS BRIDGE, 87.9' SE OF BEG. OF 5' FWY. R/W FENCE, 2' N OF FWY. R/W FENCE 75.4' S OF LIGHT POLE.
997.721 EL.

REF.	REVISIONS	APPR.	DATE

DESIGNED BY: C. MORLOK
DRAWN BY: C. MORLOK
DATE DRAWN: 7-2016
CHECKED BY: C. MORLOK

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR. SUITE 100 TEMECULA, CA 92591 PHONE: (951) 676-8042 MBAKERINTL.COM
JOHN D. TANNER, III RCE 60132 DATE:

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER DATE:
APPROVED BY: CHIEF ENGINEER DATE:

MAHLON VAIL RD/TEMECULA PKWY STORM DRAIN
LINE 'S' STA: 39+50.00 TO 42+27.92

PROJECT NO. 0-0-0000
DRAWING NO. 0-000
SHEET NO. 6 OF 6

H:\PDATA\1396000\CADD\LANDDEV\PMPINS\1396000-SD-07-006.DWG TBARKSDALE 3/24/2017 2:38 PM

EXHIBITS

EXHIBIT A: POST-PROJECT CONDITION ONSITE RATIONAL METHOD HYDROLOGY MAP

SHEET 1 OF 1

TTM 36483 - PLANNING AREA 4

IN THE CITY OF TEMECULA, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

POST-PROJECT CONDITION SITE HYDROLOGY MAP

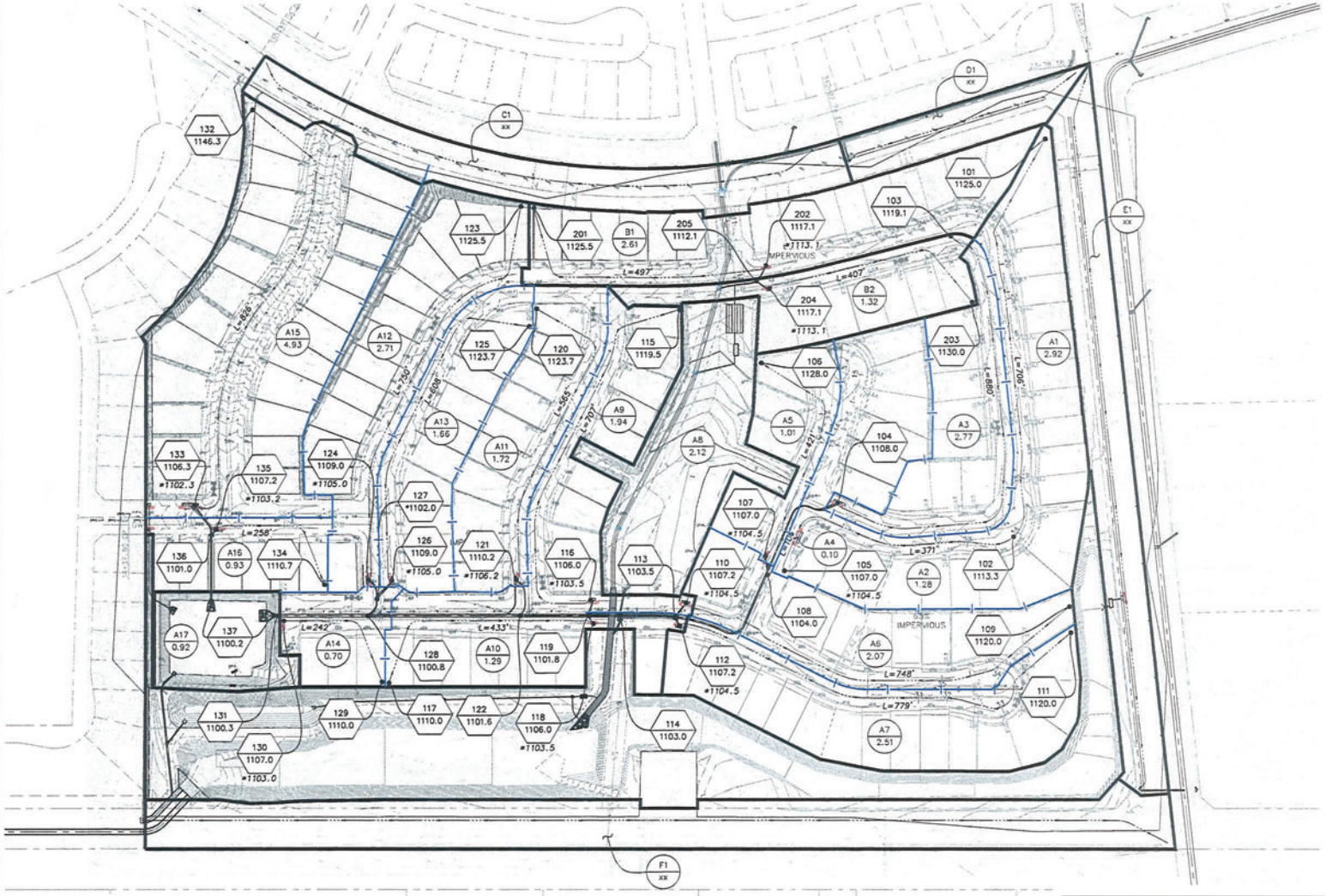


EXHIBIT "A"

JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

TTM NO. 36483 - PA 4

POST-PROJECT CONDITION SITE HYDROLOGY MAP

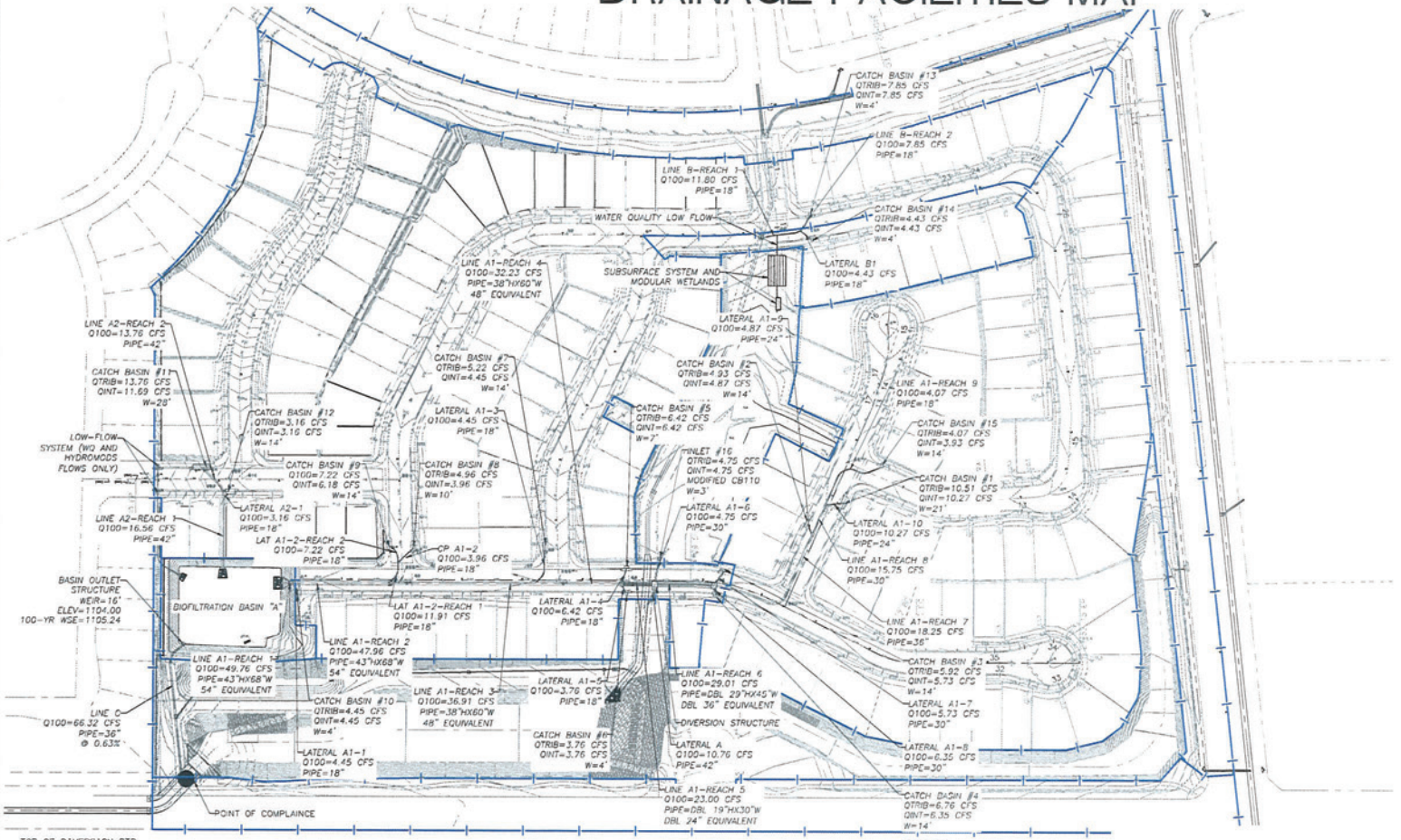
EXHIBIT B: DRAINAGE FACILITIES MAP

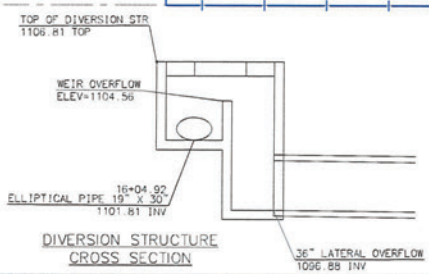
SHEET 1 OF 1

TTM 36483 - PLANNING AREA 4

IN THE CITY OF TEMECULA, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

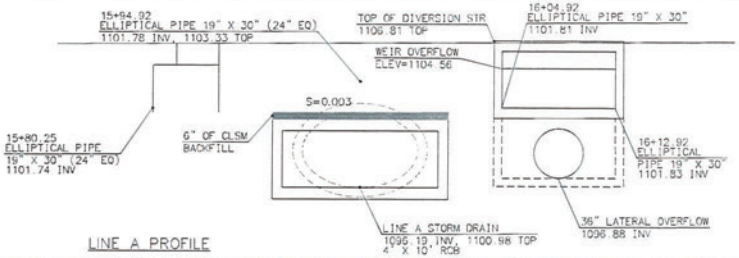
DRAINAGE FACILITIES MAP





DIVERSION STRUCTURE
CROSS SECTION

36" LATERAL OVERFLOW
1096.88 INV



LINE A PROFILE

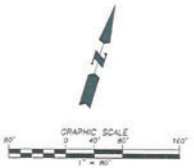


EXHIBIT "B"

JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

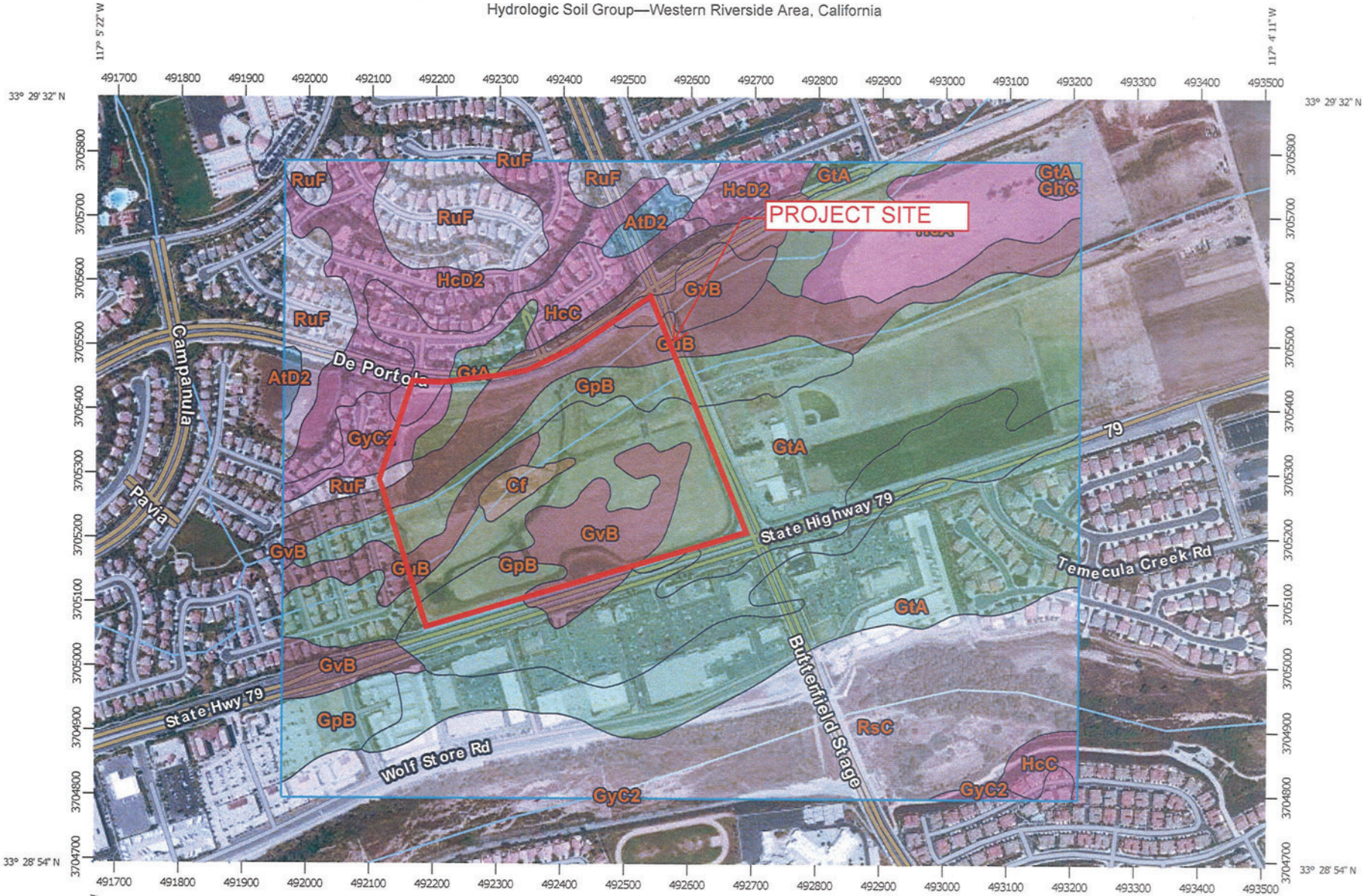
TTM NO. 36483 - PA4

DRAINAGE FACILITIES MAP

Drawing Name: G:\JOB_FILES\Engineering\Hydrology Plan\Exhibits\Drainage Facilities Map.dwg
Last Opened: Jun 06, 2019 - 1:23pm by jpyun

EXHIBIT C: HYDROLOGIC SOILS MAP

Hydrologic Soil Group—Western Riverside Area, California



Map Scale: 1:8,420 if printed on A landscape (11" x 8.5") sheet.

N

0 100 200 400 600 Meters

0 400 800 1600 2400 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Western Riverside Area, California
Survey Area Data: Version 6, Dec 9, 2013

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

Date(s) aerial images were photographed: May 3, 2010—Jun 19, 2010

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Western Riverside Area, California (CA679)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AtD2	Arlington and Greenfield fine sandy loams, 8 to 15 perc ent slopes, eroded	C	2.3	0.7%
Cf	Chino silt loam, drained, saline-alkali	C/D	1.5	0.5%
GhC	Gorgonio loamy sand, 0 to 8 percent slopes	A	0.4	0.1%
GpB	Grangeville sandy loam, drained, saline-alkali, 0 to 5 percent slopes	A/D	47.7	15.5%
GtA	Grangeville fine sandy loam, drained, 0 to 2 percent sl opes	A/D	89.4	29.0%
GuB	Grangeville fine sandy loam, poorly drained, saline-alk ali, 0 to 5 percent slopes	B/D	26.8	8.7%
GvB	Grangeville fine sandy loam, saline-alkali, 0 to 5 perc ent slopes	B/D	17.0	5.5%
GyC2	Greenfield sandy loam, 2 to 8 percent slopes, eroded	A	5.1	1.7%
HcA	Hanford coarse sandy loam, 0 to 2 percent slopes	A	13.4	4.4%
HcC	Hanford coarse sandy loam, 2 to 8 percent slopes	A	11.6	3.8%
HcD2	Hanford coarse sandy loam, 8 to 15 percent slopes, erod ed	A	21.9	7.1%
RsC	Riverwash		50.2	16.3%
RuF	Rough broken land		20.5	6.6%
Totals for Area of Interest			**307.8**	**100.0%**

Description

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

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

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

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

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

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

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

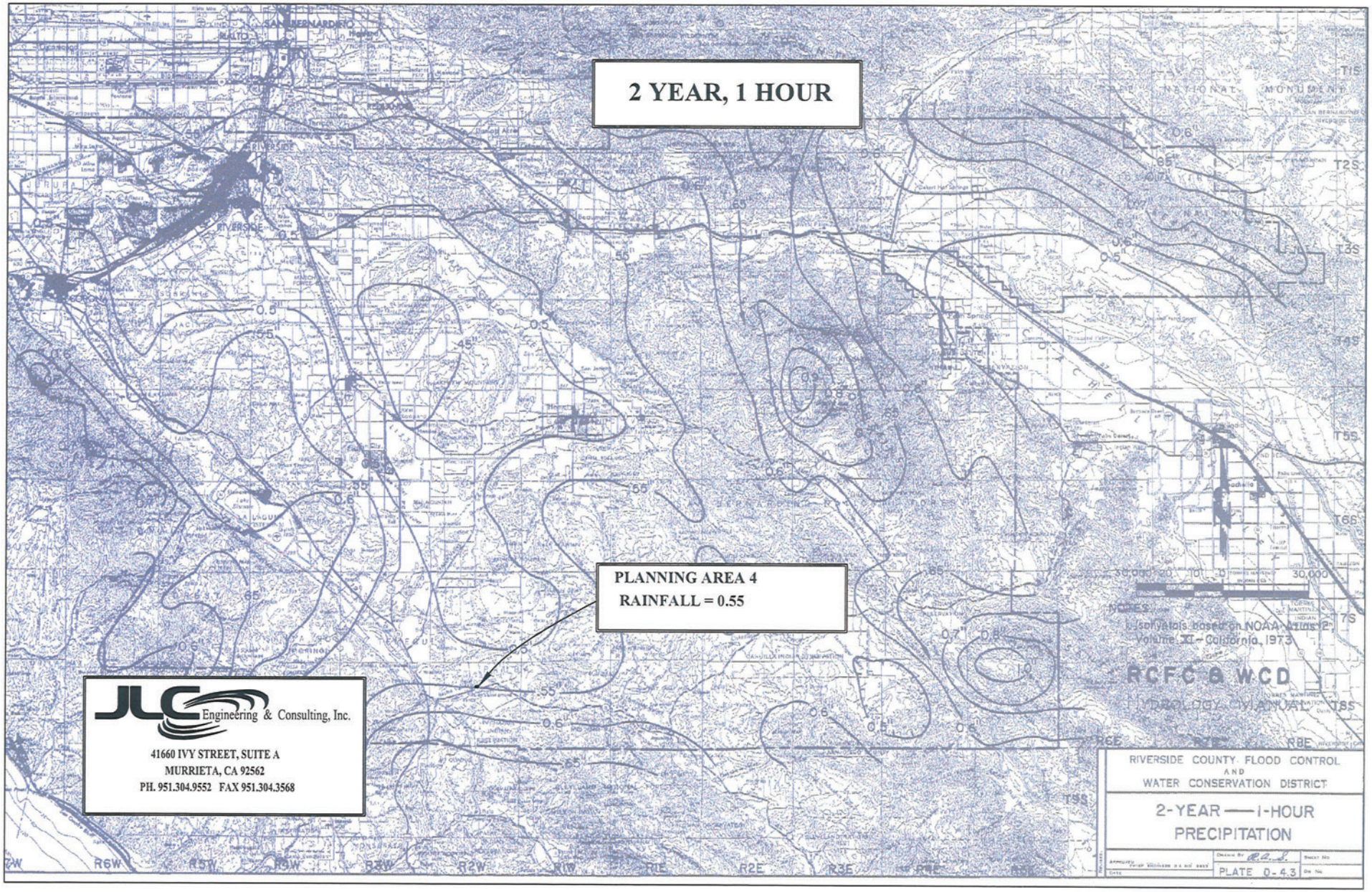
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

EXHIBIT D: RAINFALL MAPS


2 YEAR, 1 HOUR
PLANNING AREA 4
RAINFALL = 0.55
JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
2-YEAR — 1-HOUR PRECIPITATION
PLATE D-4.3
Isohyetals based on NOAA Atlas 2, Volume XI - California, 1973
RCFC & WCD
HYDROLOGY MANUAL

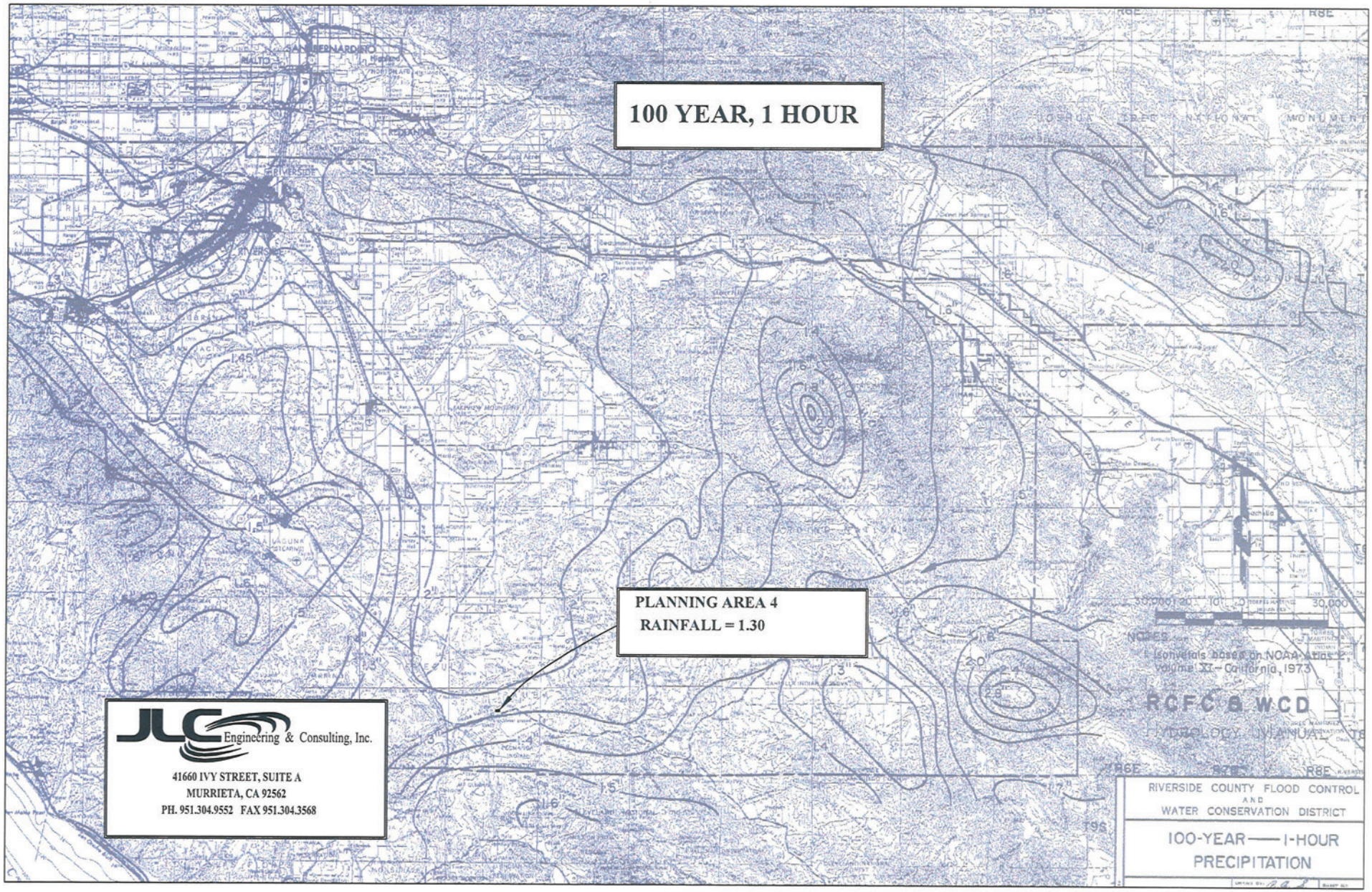
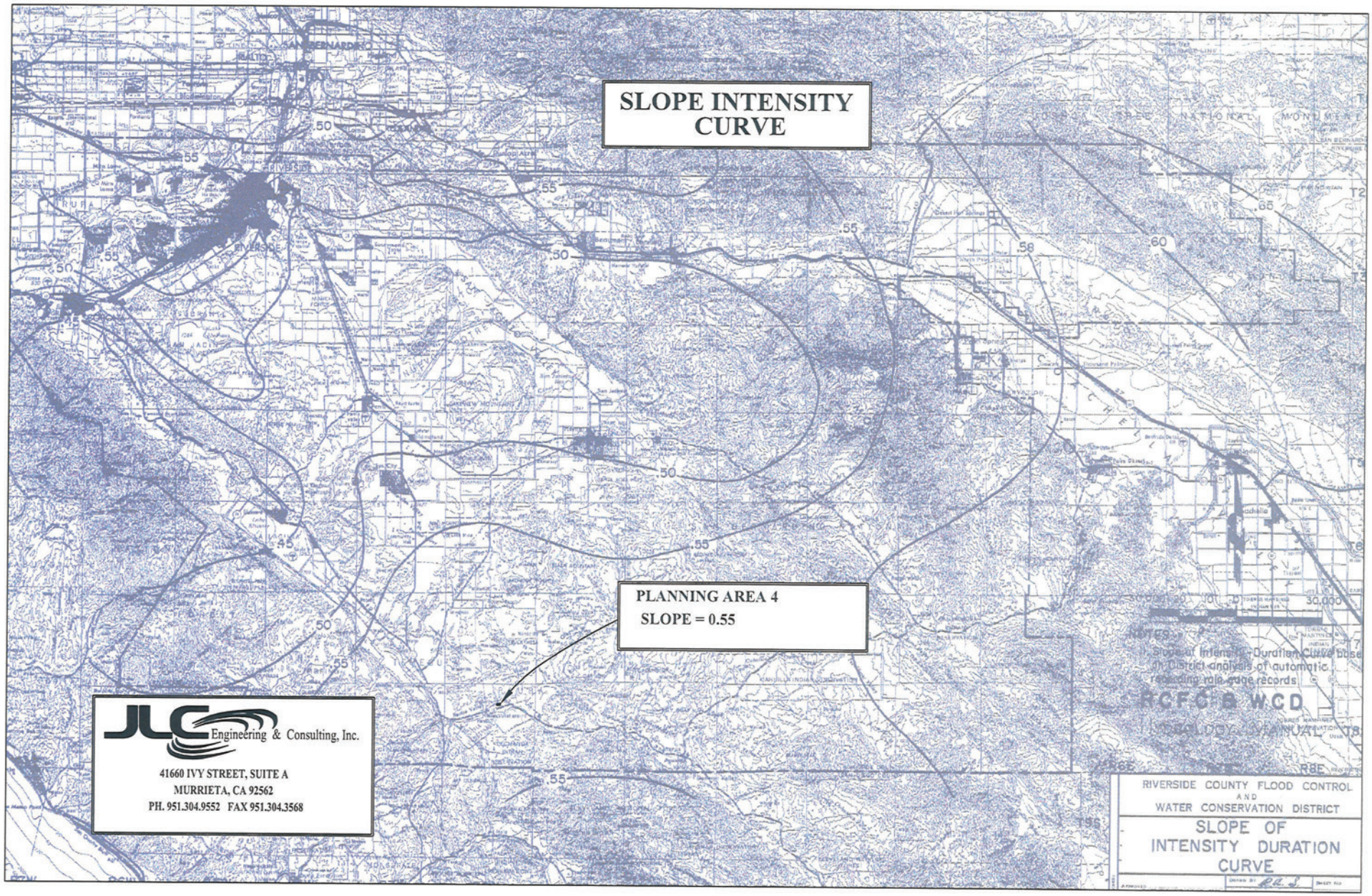

100 YEAR, 1 HOUR
PLANNING AREA 4
RAINFALL = 1.30
JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
100-YEAR — 1-HOUR PRECIPITATION

EXHIBIT E: SLOPE OF INTENSITY DURATION CURVES


SLOPE INTENSITY CURVE
PLANNING AREA 4
SLOPE = 0.55
JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
SLOPE OF INTENSITY DURATION CURVE

ATTACHMENT 7

Copy of Project's Geotechnical and Groundwater Investigation Report

☐ This attachment is empty because a geotechnical and groundwater report is not required.

If hardcopy or CD is not attached, the following information should be provided:

Title:
Prepared By:
Date:

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GEOTECHNICAL INVESTIGATION REPORT
FOR A COMMERCIAL AND MULTI-FAMILY DEVELOPMENT

Planning Area 4; Approximately 43 Acre Site
Northwest of the Intersection at Temecula Parkway & Butterfield Stage Road
City of Temecula, Riverside County, California
Converse Project No. 12-81-173-01

August 7, 2012

Prepared For:
Cal-Paseo Del Sol, LLC
9820 Towne Center Drive, Suite 100
San Diego, CA

Prepared By:

Converse Consultants
10391 Corporate Drive
Redlands, California 92374

Converse Consultants

Geotechnical Engineering, Environmental and Groundwater Science, Inspection and Testing Services

August 7, 2012

Mr. Gregor Connors
Project Manager
Cal-Paseo Del Sol, LLC
9820 Towne Center Drive, Suite 100
San Diego, CA

Subject: **GEOTECHNICAL INVESTIGATION REPORT FOR A COMMERCIAL AND MULTI-FAMILY DEVELOPMENT**
Planning Area 4; Approximately 43 Acre Site
Northwest of the Intersection at Temecula Parkway & Butterfield Stage Road
City of Temecula, Riverside County, California
Converse Project No. 12-81-173-01

Dear Mr. Connors:

Converse Consultants (Converse) has prepared this geotechnical investigation report to present our findings, conclusions and recommendations for the proposed 43-acre site, located northwest of the intersection of Temecula Parkway and Butterfield Stage Road in the City of Temecula, Riverside County, California. This report was prepared in accordance with our proposal dated May 11, 2012, your Agreement Number CON12-11915 and Notice to Proceed dated May 18, 2012.

It is our opinion that the subject site is suitable from a geotechnical standpoint for the proposed development, provided the findings, conclusions, and recommendations presented in this report are incorporated in the preparation of the final grading plan, foundation design, and construction of the project.

It has been our pleasure to be of service to Cal-Paseo Del Sol, LLC. If you should have any questions, please contact the undersigned at (909) 796-0544.

CONVERSE CONSULTANTS

Hashmi S. E. Quazi, Ph.D., G. E.
Principal Engineer

Dist.: 4/Addressee

HS/SM/HSQ/kvg

10391 Corporate Drive, Redlands, California 92374
Telephone: (909) 796-0544 ♦ Facsimile: (909) 796-7675 ♦ www.converseconsultants.com

PROFESSIONAL CERTIFICATION

This report has been prepared by the individuals whose seals and signatures appear hereon.

The findings, recommendations, specifications or professional opinions contained in this report were prepared in accordance with generally accepted professional engineering and engineering geologic principles and practice in this area of Southern California. There is no warranty, either expressed or implied.

REGISTERED PROFESSIONAL ENGINEER
HARIHAR SHIWAKOTI
No. C76035
EXP. 6/14
CIVIL
STATE OF CALIFORNIA

Harihar Shiwakoti, P.E.
Project Engineer

REGISTERED GEOLOGIST
SCOT A. MATHIS
No. 2307
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Scot Mathis, C.E.G.
Senior Geologist

EXECUTIVE SUMMARY

The following is a summary of our geotechnical investigation, conclusions and recommendations as presented in this report. Please refer to the pertinent section of the attached report for complete conclusions and recommendations. In the event of a conflict between this summary and the report, or an omission in the summary, the report shall prevail.

- The proposed 43-acre Paseo Del Sol site is located in the City of Temecula, Riverside County, California. The site is bounded to the north by De Portola Road, to the east by Butterfield Stage Road to the south by Temecula Parkway and to the west by Mantova Drive.

- The site contains three superpads, with two pads on an upper level and one on a lower level. The lower level is on the south of the site and the upper level is on the north. A fill slope, oriented in an east and west direction, separates the lower and upper levels. An existing drainage channel flows from the north central portion of the site, between the two upper superpads, and across the lower superpad to a pond and outlet in the southwest corner of the site. The lower superpad is surrounded by an earthen berm up to approximately 10 feet in height.

- A tentative site layout exhibit (Cal-Paseo Del Sol, 2012b) indicates that the site will be reconfigured during the proposed development. The northern, upper superpads will be lowered by approximately 10 to 20 feet and the southern, lower superpad will be raised by approximately 5 to 15 feet. The northwestern superpad and the western portion of the southern superpad will be used for multi-family residences. The northeastern superpad and the eastern two-thirds of the southern superpad will be combined and used for retail and commercial purposes.

- The site was previously graded under the geotechnical observation and testing of Converse. At the time of grading the western portion of the site was identified as Tract 21482-5 and the eastern half as 21482-F. The geotechnical report of rough grading (Converse, 1997) was reviewed during the current investigation; however, the available copy of the report did not include the map indicating the lateral and vertical extent of remedial grading and fill placement. During the grading, surficial colluvium and alluvium in the northern portion of the site was excavated to expose dense older alluvium or Pauba Formation bedrock. Surficial alluvium and up to 15 feet of existing fills were excavated from the southern portion of the site to expose fine to medium grained sandy alluvium.

- Subsurface exploration consisted of drilling twelve (12) exploratory borings (BH-1 through BH-12) within the project site on May 30, 2012. Borings BH-1 and BH-11 were drilled to the planned depth of 51.5 feet bgs. Borings BH-2 through BH-10, and BH-12 were drilled to the planned depth of 16.5 feet below ground surface (bgs).

- The project site is located within the Peninsular Ranges Geomorphic Province of Southern California. The site is located on the northern margin of the west-trending Pauba Valley. The Pauba Valley is a broad alluvial valley eroded into the Pleistocene Pauba Formation by the Temecula Creek. Regional mapping (Kennedy, 2000) indicates that, except for a small area in the northwestern corner, the site is underlain by Holocene alluvial deposits. The alluvium generally consists of unconsolidated to poorly consolidated sand and gravel deposits. Previous grading has placed fill soil over the site derived from alluvium, colluvium, older alluvium, or the Pauba Formation.

- The two northern, upper superpads are underlain by approximately 15 feet of fill soils on the east to approximately 35 feet of fill on the west. The fill soils generally consist of silty sand with occasional zones of clayey sand and sand with silt. The fill is generally dense; however, variations in the fill density were encountered. The fill soils are underlain by native alluvial soils. The alluvium primarily consists of silty sand, but includes layers of sand, silt, and clay mixtures. The alluvial soils are generally medium dense to dense.

- The southern superpad is underlain by fill soil consisting of silty sand with various layers of sand, silt, and clay mixtures. The transition from fill soil to the underlying alluvial soils is not readily apparent in the borings. The presence of organics at 15 feet bgs is consistent with the geotechnical report documenting the previous site grading (Converse, 1997), which indicates that 5 to 15 feet of previously existing fill soils were excavated and replaced with compacted fill. The berms surrounding the lower superpad are constructed of compacted fill.

- Groundwater was encountered during the field investigation at approximately 39.5 feet bgs (approximately 1,058.5 feet amsl) in boring BH-11. Groundwater was not encountered in the other borings. We have estimated a historical high groundwater level ranging from 1,080 feet amsl at the southwestern corner of the site to 1,100 feet amsl at the eastern site perimeter.

- The surface and subsurface soil materials for the proposed development are expected to be excavatable by conventional heavy-duty earth moving equipment.

- Results of the laboratory tests indicated that the site soils have 'slight' collapse potential, 'very low' to 'low' expansion potential and moderate shear strength. Results of corrosion tests indicate that the site soils have 'negligible' exposure to sulfate attack, and are 'moderately corrosive' to 'corrosive' to ferrous metals in contact with the soils.

- The site is not located within a currently designated Riverside County or State of California Earthquake Fault Zone. Based on a review of available geologic information no known active surface fault zone crosses or projects toward the site. CBC seismic parameters for the site are presented in the text of this report.

- Site-specific liquefaction analyses were performed using data obtained from borings BH-1 and BH-11. Groundwater depths at 40 feet bgs in boring BH-1 and 15 feet bgs in boring BH-11 have been used for the purpose of liquefaction analysis. The sediments encountered in BH-1 were not found to be susceptible to liquefaction. Boring BH-11, drilled in the lower superpad, encountered a medium dense sand layer between approximately 20 and 25 feet bgs in (1,073 to 1,078 feet amsl). This layer may be susceptible to liquefaction if subjected to ground shaking of sufficient intensity while saturated. Up to approximately 0.80 inches of liquefaction-induced settlement may occur. Surface manifestations of liquefaction, such as sand boils, are not anticipated due to the greater thickness of the overlying non-liquefiable layer in comparison to the relatively thin liquefiable layer.

- The existing superpads have irregular surface, with numerous soil piles, are locally loose, dry, or disturbed. Such soils are not considered suitable for the support of additional fills or structures, and should be overexcavated and recompacted. The depth and limits of the overexcavation should be determined by the geotechnical consultant based on the field conditions encountered. In general, the existing grade should be overexcavated to expose a fill with a minimum density of 90 percent, or an alluvium with a minimum density of 85 percent of laboratory maximum density, or, to a depth of three feet below existing grade.

- Building footings and slabs-on-grade should be uniformly supported by compacted fill. If after the planned lowering of the northern upper superpads, uncompacted alluvium soil is encountered, such alluvium should be overexcavated and recompacted to a minimum depth of three feet below the bottom of the footing elevation. Such overexcavation and recompaction should extend at least 5 feet beyond the building footprint. For sub-grade below planned asphalt concrete or Portland concrete paving, including driveways, access roads, sidewalks, street areas, curbs and gutters or other flatwork, overexcavation and

recompaction in alluvium soils should be to a depth of at least 2 feet, extending at least 2 feet beyond the pavement or flatwork.

- All areas to receive fill should be overexcavated to the depth where the existing soils have a relative compaction of at least 90 percent of the laboratory maximum dry density, or to a depth of three feet bgs. Any loose, soft, and unsuitable materials encountered during overexcavation should be removed from the site. The depth of such removal should be determined during the grading by the geotechnical consultant. After the required overexcavation as recommended in this report, or as recommended by the geotechnical consultant during remedial grading is performed, all surfaces to receive fill should be scarified to an additional depth of six inches.

- Onsite soils cleared of all debris, vegetation, rocks larger than 3 inches, and other deleterious materials may be re-used as compacted fill. Rocks larger than 1 inch in the largest dimension should not be placed within the upper 12 inches of fill beneath footings and slabs or the upper 18 inches of fill under paved areas.

- Fill soils should be evenly spread in horizontal, 8-inch-maximum, loose lifts. The fill materials should be thoroughly mixed and moisture conditioned to within 3 percent of optimum moisture content for granular soils and up to 2 percent above optimum moisture content for fine-grained soils. All fill placed at the site should be compacted to at least 90 percent of the laboratory maximum dry density as determined by ASTM Standard D1557 test method. The upper 12 inches of soil below footings and slabs, and the upper 12 inches of sub-grade soils underneath concrete aprons and asphalt concrete, should be compacted to at least 95 percent of laboratory maximum dry density.

- The proposed commercial and multifamily developments may be supported on continuous (strip) and/or isolated spread footings. Continuous and isolated spread footings should be at least 18 inches wide. The depth of embedment below lowest adjacent soil grade of interior and exterior footings should be at least 18 inches. Such footings can be designed based on an allowable net bearing capacity of 2,500 pounds per square foot (psf), plus 300 psf for each additional foot of depth and 150 psf for each foot of width. The maximum allowable bearing capacity should be limited to 3,000 psf.

- Resistance to lateral loads can be assumed to be provided by combination of friction acting at the base of foundations and by passive earth pressure. A coefficient of friction of 0.35 between concrete and soil and of 0.25 between soil and steel may be used with the dead load forces. Passive earth pressure of 270 psf per foot of depth may be used for the sides of footings poured against recompacted native soils. The maximum value of the passive earth pressure should be limited to 2,500 psf.

- The total settlement of shallow footings from static structural loads and short-term settlement of properly compacted fill is anticipated to be 0.5 inch or less. Dynamic settlement under seismic conditions is estimated to be up to 0.8 inch. The static and dynamic differential settlements can be taken as equal to one-half of the corresponding total settlement over a lateral distance of 50 feet.

- Preliminary pavement design recommendations are presented in the text of this report. Due to mixing and movement during grading, the R-values of the final sub-grade soil are likely to be different than tested. We recommend performing additional R-value tests at the completion of the sub-grade preparation, which could change the proposed preliminary pavement sections.

The site is suitable from a geotechnical standpoint for the proposed development, provided that the recommendations presented in this report are incorporated into the design and construction of the project.

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1.0 INTRODUCTION

This report contains the findings of our geotechnical investigation performed for the proposed development of a 43-acre site, located northwest of the intersection of Temecula parkway and Butterfield Stage Road in the City of Temecula, Riverside County, California. The site location is shown in Figure No. 1, *Site Location Map.*

The purpose of this investigation was to evaluate the nature and pertinent engineering properties of the subsurface materials and to provide geotechnical parameters for the design and construction of the proposed project.

This report is written for the project described herein and is intended for use solely by Cal-Paseo Del Sol, LLC and its design team. It should not be used as a bidding document but may be made available to the potential contractors for information on factual data only. For bidding purposes, the contractors should be responsible for making their own interpretation of the data contained in this report.

2.0 SITE DESCRIPTION

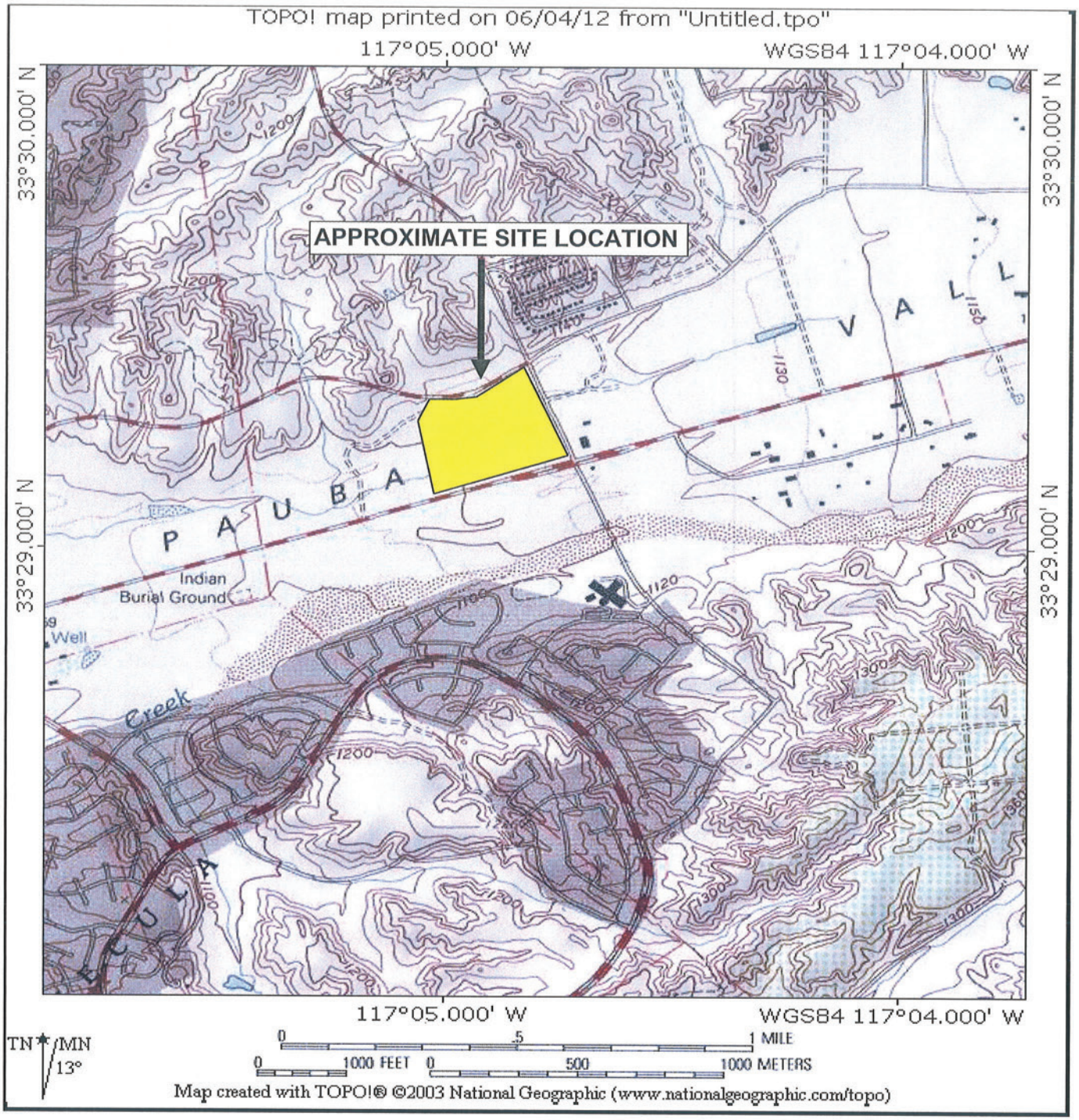
The proposed Paseo Del Sol site is located in the City of Temecula, Riverside County, California. The site is bounded to the north by De Portola Road, to the east by Butterfield Stage Road to the south by Temecula Parkway and to the west by Mantova Drive.

The site contains three superpads, with two pads on an upper level and one on a lower level. The lower level is on the south of the site and the upper level is on the north. A fill slope, oriented in an east and west direction, separates the lower and upper levels. An existing drainage channel flows from the north central portion of the site, between the two upper superpads, and across the lower superpad to a pond and outlet in the southwest corner of the site. The lower superpad is surrounded by an earthen berm up to approximately 10 feet in height.

The topography of the northern half of the site is mostly flat, with a few rises and depressions. The slope in this area is towards the south. The southern half of the site is mostly flat, with a slight slope towards the southwest corner of the site.

Scattered concrete and asphalt debris were observed in the northern half of the site, along with several areas covered by soil piles. Animal burrows were present, particularly in the northern portion of the site. Vegetation, primarily consisting of low grass, covers the entire site.

General views of the project site are shown on the following photographs.



APPROXIMATE SITE LOCATION MAP

PLANNING AREA 4- APPROXIMATELY 43 ACRE SITE

City of Temecula, County of Riverside, California

For: Cal-Paseo Del Sol, LLC

Project Number:

12-81-173-01

Figure No.:

1

Converse Consultants

Photo 1, View to west along slope between the upper and lower levels

Photo 2, Soil piles in the northern half of the project site.

Photo 3, View to northwest from the southeast corner of the project site.

3.0 PROJECT DESCRIPTION

A tentative site layout exhibit (Cal-Paseo Del Sol, 2012b) indicates that the site will be reconfigured during the proposed development. The northern, upper superpads will be lowered by approximately 10 to 20 feet and the southern, lower superpad will be raised by approximately 5 to 15 feet. The northwestern superpad and the western portion of the southern superpad will be used for multi-family residences. The northeastern superpad and the eastern two-thirds of the southern superpad will be combined and used for retail and commercial purposes.

The size and number of residential structures is not known at this time. The multi-family dwellings will likely be of wood frame construction with stucco walls and shallow footing foundations.

Approximately ten retail and commercial structures are proposed, with sizes ranging from approximately 4,000 to 140,000 square feet. The smaller retail and commercial buildings may be of wood frame construction with stucco walls and shallow footing foundations. The larger buildings will likely be masonry wall and/or tilt-up concrete construction.

The development will include parking lots, access roads, above-ground and underground utilities. A west-flowing drainage channel is proposed along the southern site perimeter.

4.0 PREVIOUS SITE GRADING

The site was previously graded under the geotechnical observation and testing of Converse. At the time of grading the western portion of the site was identified as Tract 21482-5 and the eastern half as 21482-F. The geotechnical report of rough grading (Converse, 1997) was reviewed during the current investigation; however, the available copy of the report did not include the map indicating the lateral and vertical extent of remedial grading and fill placement.

Site conditions during and following the previous grading are discussed in the following sections.

4.1 Remedial Grading

Remedial grading was conducted during the previous site grading. Surficial colluvium and alluvium in the northern portion of the site was excavated to expose dense older alluvium or Pauba Formation bedrock. Surficial alluvium and up to approximately 15 feet of existing fills were excavated from the southern portion of the site to expose fine to medium grained sandy alluvium.

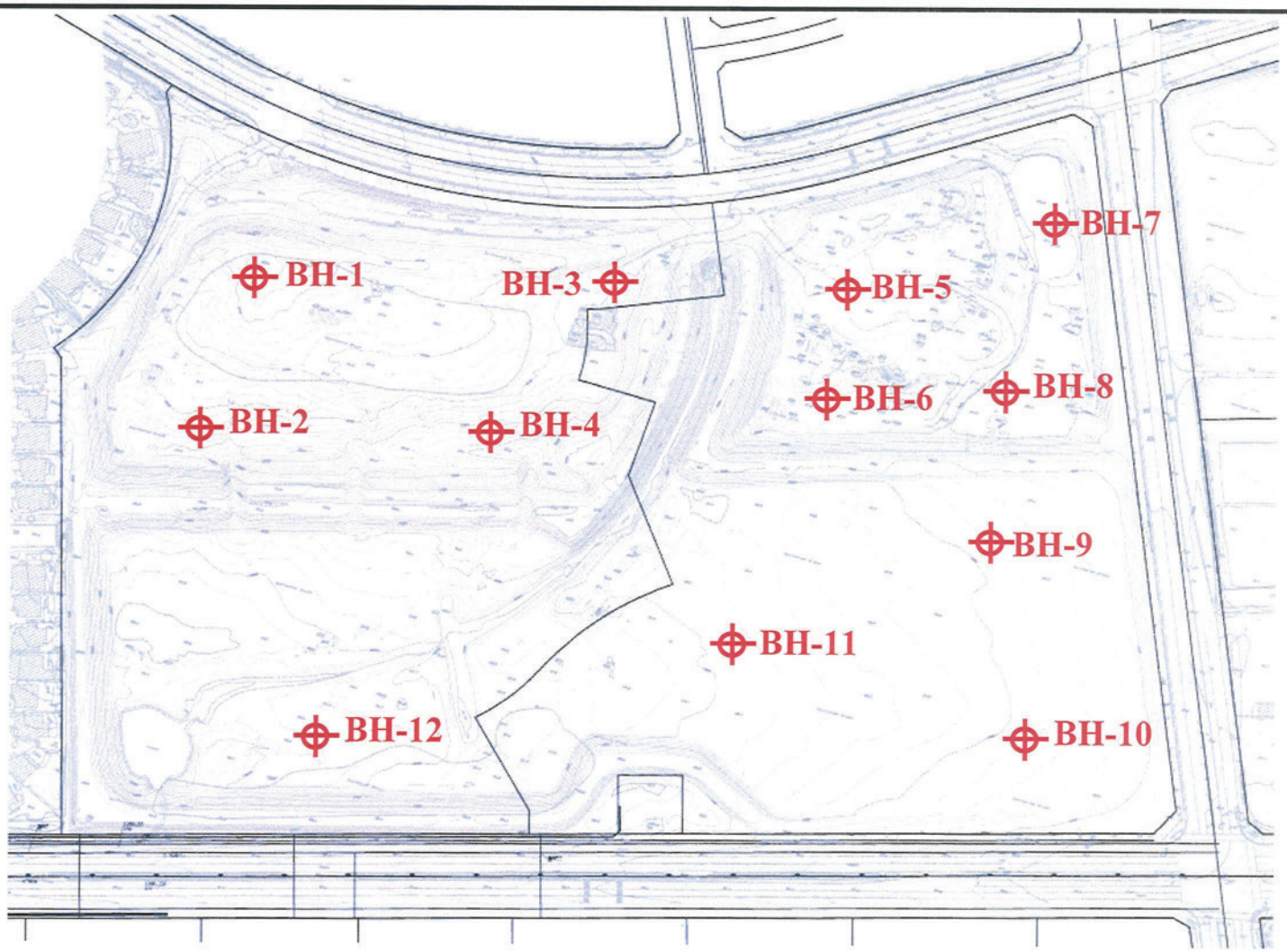
4.2 Compacted Fill

Excavated site soils were placed as compacted fill. The fills were compacted to at least 90 percent of the laboratory maximum dry density. Where structural fill was greater than 20 feet thick, fill soils placed below 20 feet from the proposed ground surface were compacted to at least 95 percent of the laboratory maximum dry density.

4.3 Compacted Fill Thickness

The copy of the geotechnical report of rough grading (Converse, 1997) reviewed by Converse during this investigation did not include the maps showing the lateral and vertical extent of fill placement. The fill thickness was evaluated based on historical and current site topography.

Historical topographic mapping (USGS, 1986) shows that the site was relatively flat with a gentle slope to the west-southwest. Two streams flowed through the site from east to west. The site elevations ranged from approximately 1,090 feet above mean sea level (amsl) at the southwestern corner to approximately 1,110 feet amsl along the western perimeter.



APPROXIMATE BORING LOCATION MAP

Explanation	PLANNING AREA 4- APPROXIMATELY 43 ACRE SITE	Project Number
Approximate Boring Location	City of Temecula, County of Riverside, California	12-81-173-01
	For: Cal-Paseo Del Sol, LLC	Scale: NTS
	Converse Consultants	Date: August 2012
		Figure No. 2

As described in Section 2.0, *Site Description*, the site currently contains three superpads at two elevations. A recent topographic map (Cal-Paseo del Sol, 2012a) indicates that the southern, lower superpad is at an elevations ranging from approximately 1,090 feet amsl in the southwestern corner to approximately 1,110 feet amsl in the northeastern corner. These elevations approximate the original elevations on the historical topographic map.

The northwestern superpad has a somewhat irregular upper surface, with elevations ranging from approximately 1,140 feet amsl in the northwestern corner to approximately 1,120 feet amsl in the southeastern corner. The northeastern superpad also has an irregular surface, with numerous soil piles. Elevations range from approximately 1,130 feet near the center of the pad to 1,125 feet amsl along the eastern perimeter.

Based on our review of topographic maps and aerial photographs, up to approximately 15 to 35 feet of fill was placed to create the two upper superpads. The lower superpad is at near the original, pre-grading elevation; however, based on the geotechnical report of rough grading, portions of the area may contain up to 15 feet of compacted fill.

4.4 Settlement Monuments

At the completion of the previous grading, settlement monuments were installed at the top and bottom of the compacted fill. Ten monuments were installed within Tract 24182, which included the current site. The location of the monuments is not known. The geotechnical report of rough grading (Converse, 1997) stated that ongoing monitoring of the monuments indicated a significant rate of ground settlement at the time of the report.

4.5 Post-Grading Site Conditions

Historical aerial photographs from 1953 to present (EDR, 2012; Google Earth, 2011) were reviewed to evaluate the site conditions following the site grading. The site was graded to approximately its present configuration between 1996 and 2002, which is consistent with the geotechnical report (Converse, 1997). Several construction office trailers were present in a fenced compound at the eastern end of the northeastern superpad from 2002 to 2007. During that time, numerous soil piles were placed on the upper superpads. The soil was either removed or spread on the site in 2007 or 2008. The site has remained essentially unchanged from 2009 to present.

5.0 SCOPE OF WORK

The scope of this investigation included the tasks described in the following sections.

5.1 Project Set-up

The project set-up consisted of the following:

- Conducted a site reconnaissance and stake/marked the exploration locations, such that drill rig access to all the locations is available
- Notified Underground Service Alert (USA) at least 48 hours prior to drilling to clear the boring locations of any conflict with existing underground utilities
- Arranged for a drill rig.

5.2 Subsurface Exploration

Subsurface exploration consisted of drilling twelve (12) exploratory borings (BH-1 through BH-12) within the site on May 30, 2012. Borings BH-1 and BH-11 were drilled to the planned depth of 51.5 feet bgs. Borings BH-2 through BH-10, and BH-12 were drilled to the planned depth of 16.5 feet below ground surface (bgs).

The exploratory borings were advanced using a truck mounted drill rig equipped with 8-inch diameter hollow-stem augers and a drive sampler for soil sampling. Standard penetration tests (SPT) were conducted in boring BH-1 and BH-11 starting at 20 feet bgs at 10 foot intervals. Encountered earth materials were continuously logged by a Converse geologist and classified in the field by visual examination in accordance with the Unified Soil Classification System.

The approximate locations of the borings are presented on Figure No. 2, *Approximate Boring Location Map.* For a description of the field exploration and sampling program see Appendix A, *Field Exploration*.

5.3 Laboratory Testing

Representative samples of the site soils were tested in the laboratory to aid in the classification and to evaluate relevant engineering properties. The tests performed included:

- *In situ* Moisture Contents and Dry Densities (ASTM Standard D2216)
- Collapse Potential (ASTM Standard D5333)
- Expansion Potential (ASTM Standard D4829)
- Soil Corrosivity Tests (California Test 6433, ASTM G57, and D516)
- R-Value (ASTM D2844)
- Percent Passing Sieve No. 200 (ASTM Standard D1140)
- Grain Size Distribution (ASTM Standard C136)
- Maximum Dry Density and Optimum Moisture Content Relationship (ASTM Standard D1557)
- Direct Shear Strength (ASTM Standard D3080)

For *in situ* moisture and density data, see the Logs of Borings in Appendix A, *Field Exploration*. For a description of the laboratory test methods and test results, see Appendix B, *Laboratory Testing Program*.

5.4 Analyses and Report

Data obtained from the exploratory field work and laboratory testing program, as well as the documents, reports, and maps presented in the Section 15.0, *References* were analyzed. This report was prepared to provide findings, conclusions and recommendations developed during our investigation.

6.0 GEOLOGIC SETTING

The regional and local geology are discussed in the following subsections.

6.1 Regional Geology

The project site is located within the Peninsular Ranges Geomorphic Province of Southern California.

The Peninsular Ranges Geomorphic Province consists of a series of northwest-trending mountain ranges and valleys bounded on the north by the San Bernardino and San Gabriel Mountains, on the west by the Los Angeles Basin, and on the southwest by the Pacific Ocean.

The province is a seismically active region characterized by a series of northwest-trending strike-slip faults. The most prominent of the nearby fault zones include the San Jacinto, Cucamonga, and San Andreas Fault Zones, all of which have been known to be active during Quaternary time.

Topography within the province is generally characterized by broad alluvial valleys separated by linear mountain ranges. This northwest-trending linear fabric is created by the regional faulting within the granitic basement rock of the Southern California Batholith. Broad, linear, alluvial valleys have been formed by erosion of these principally granitic mountain ranges.

6.2 Site Geology

The site is located on the northern margin of the west-trending Pauba Valley. The Pauba Valley is a broad alluvial valley eroded into the Pleistocene Pauba Formation by the Temecula Creek.

Regional mapping (Kennedy, 2000) indicates that, except for a small area in the northwestern corner, the site is underlain by Holocene alluvial deposits. The alluvium generally consists of unconsolidated to poorly consolidated sand and gravel deposits. The

surficial deposits at the site are underlain by the Pleistocene Pauba Formation, which is generally well-indurated sandstone and siltstone with occasional gravel, cobble, and boulder deposits. The mapping shows that the Pauba Formation is exposed in the northwestern corner of the site.

Previous grading, discussed in Section 4.0, *Previous Site Grading*, has placed fill soil over the site. Based on the previous geotechnical report (Converse, 1997), the fill soil was derived from alluvium, colluvium, older alluvium, or the Pauba Formation.

7.0 SITE CONDITIONS

A general description of the subsurface conditions and various materials encountered during our field exploration are presented in this section.

7.1 Subsurface Profile

The two northern, upper superpads are underlain by approximately 15 feet of fill soils on the east to approximately 35 feet of fill on the west. The fill soils generally consist of silty sand with occasional zones of clayey sand and sand with silt. The fill is generally dense; however, variations in the fill density were encountered. The fill soils are underlain by native alluvial soils. The alluvium primarily consists of silty sand, but includes layers various sand, silt, and clay mixtures. The alluvial soils are generally medium dense to dense.

The southern superpad is underlain by fill soil consisting of silty sand with various layers of sand, silt, and clay mixtures. The transition from fill soil to the underlying alluvial soils is not readily apparent in the borings. Visible organic content was noted at approximately 15 feet bgs in borings BH-8 and BH-11. Concentrations of organic matter are often, but not always, associated with shallow soils. The presence of organics at 15 feet bgs is consistent with the geotechnical report documenting the previous site grading (Converse, 1997), which indicates that 5 to 15 feet of previously existing fill soils were excavated and replaced with compacted fill. The berms surrounding the lower superpad are constructed of compacted fill.

For a detailed description of the subsurface materials encountered in the exploratory borings, see Drawing Nos. A-2 through A-7, *Logs of Borings,* in Appendix A, *Field Exploration.*

7.2 Groundwater

Groundwater was encountered during the field investigation at approximately 39.5 feet bgs in boring BH-11. Groundwater was not encountered in the other borings. During the previous site grading, small amounts of perched groundwater were encountered during alluvial removals in canyon areas to the west of the site (Converse, 1997).

Surface water was observed in the onsite drainage channel and pond during our field exploration. Vigorous vegetation growth along the channel currently and in the historical aerial photographs indicates that the area normally contains water. Surface water should be expected to infiltrate into the subsurface, resulting in locally saturated soil and perched groundwater.

Shallow perched groundwater may be encountered during construction in the channel and pond areas. Standing groundwater is not expected to be encountered. The depth to groundwater may vary due to seasonal precipitation, groundwater pumping activity, or other factors.

Regional groundwater data (USGS, 2012) was reviewed to evaluate the historical high groundwater level at the site. A well (USGS Well No. 332908117045501) is located at the southern perimeter of the site. The well was measured only one time, in 1967, and reported a groundwater elevation of 1,078 feet amsl, or approximately 14 feet below a reported ground surface elevation of 1,092 feet amsl. Although only one historical data point was available for the well, that point correlated well with the highest groundwater levels reported in other wells in the Pauba Valley.

Due to the lack of multiple data points in the historical groundwater elevation record, it is our opinion that a conservative approach to establishing the historical high groundwater level is warranted. The highest historical groundwater elevation reported was 14 feet bgs. The actual historical high groundwater level is not expected to have been higher than 10 feet below the original, pre-grading ground surface. Therefore, we have estimated a historical high groundwater level ranging from 1,080 feet amsl at the southwestern corner of the site to 1,100 feet amsl at the eastern site perimeter.

7.3 Subsurface Variations

Based on results of the subsurface exploration and our experience, some variations in the continuity and nature of subsurface conditions within the project site should be anticipated. Because of the uncertainties involved in the nature and depositional characteristics of the earth material at the site, care should be exercised in interpolating or extrapolating subsurface conditions presented in this report.

7.4 Excavatability

The surface and subsurface soil materials for the proposed development are expected to be excavatable by conventional heavy-duty earth moving equipment.

Although oversized materials were not encountered during drilling, we anticipate that scattered cobbles or small boulders may be encountered during excavation for the proposed developments.

The phrase "conventional heavy-duty excavation equipment" is intended to include commonly used equipment such as excavators, scrapers, and trenching machines. It does not include hydraulic hammers ("breakers"), jackhammers, blasting, or other specialized equipment and techniques used to excavate hard earth materials. Selection of an appropriate excavation equipment models should be done by an experienced earthwork contractor.

7.5 Flooding

The site is not located within a flood zone identified by Riverside County. A flood zone associated with the Temecula Creek is located approximately 500 feet south of the site. (Riverside County, 2012) Due to the elevation of the site, flooding at Temecula Creek is not anticipated to impact the site.

8.0 LABORATORY TEST RESULTS

8.1 Physical Testing

Results of the various laboratory tests are presented in Appendix B, *Laboratory Testing Program,* except for the results of *in situ* moisture and dry density tests which are presented on the Logs of Borings in Appendix A, *Field Exploration.* The results are also discussed below:

- *In situ* Moisture and Dry Density – *In situ* dry density and moisture content of the upper ten (10) feet of soils for the project site ranged between 98 and 126 pounds per cubic feet (pcf) and between 1 and 26 percent, respectively.

- Collapse Potential – The collapse potential of two (2) relatively undisturbed samples were tested under a vertical stress of 2.0 kips per square foot (ksf) in accordance with the ASTM Standard D2435/D5333 test method. The samples collected in the upper five (5) feet measured collapse of 0.4 to 1.6 percent, indicating 'Slight' collapse potential.

- Expansion Index – Two (2) representative soil samples were tested to evaluate Expansion Index (EI) in accordance with the ASTM Standard D4829. The measured EI values were 18 and 33, which correspond to 'very low' and 'low' expansion potential.

- R-Value – Three (3) representative soil samples from the upper five (5) feet of the project site soil were tested to evaluate the R-value in accordance with the ASTM Standard D2844. The result of the R-value test will be used for preliminary pavement section recommendations. The results indicated R-values ranging from 17 to 52.

- Percent Passing Sieve No. 200 – Two (2) representative soil samples were tested to determine the percent finer than sieve No. 200 to aid in the classification of the on-site soils in accordance to ASTM Standard D1140. Test results indicated the soils as Silty Sand.

- Gradation Analysis – Grain size analyses were performed on five (5) representative soil samples according to ASTM Standard D422 for particles larger than 75 micrometers. The results are presented in Drawings No. B-1a and B-1b, *Grain Size Distribution Results*, in Appendix B, *Laboratory Testing Program*.

- Maximum Dry Density and Optimum Moisture Content – Typical moisture-density relationship of three (3) representative soil samples were tested in accordance to ASTM Standard D1557. The maximum dry density of the tested soil ranged from 122.1 to 133.5 pounds per cubic foot (pcf) and optimum moisture content ranged from 4.5 to 8.5 percent. Test results are shown on Drawing No. B-2, *Moisture-Density Relationship Results*, in Appendix B, *Laboratory Testing Program*.

- Direct Shear - Direct shear tests were performed on three (3) relatively undisturbed ring samples in according to ASTM Standard D3080. Results of the direct shear tests are presented in Drawings No. B-3 through B-5, *Direct Shear Test Results,* in Appendix B, *Laboratory Testing Program*. Results of direct shear test indicate that the soil tested had moderate shear strength.

For additional information on the subsurface conditions, see the Logs of Borings in Appendix A, *Field Exploration*.

8.2 Chemical Testing - Corrosivity Evaluation

Two (2) representative soil samples were tested by HDR/Schiff for corrosivity evaluation with respect to common construction materials such as concrete and steel. Tests were performed in accordance with Caltrans Test Methods CT643, 422 and 417. The test results are discussed below and are presented in Appendix B, *Laboratory Testing Program.* The test includes pH, sulfate and chloride content, and saturated minimum electrical resistivity.

The sulfate contents of the sample tested were 26 and 229 mg/kg, which indicated that the concrete will have "negligible" exposure to external sulfate attack. Type I or Type II Portland Cement can be used for the construction of the concrete structures.

The pH values of the samples tested were 8.0 and 8.3. The chloride concentrations of the samples tested were 7 and 33 ppm. The measured values of the minimum electrical resistivity when saturated were 1,500 and 2,964 Ohm-cm. These values indicate that the site soils are "moderately corrosive" to "corrosive" to ferrous metals in contact with the soil.

In general, rebar can be protected from corrosion by providing epoxy coating and increased concrete cover. A corrosion engineer should be consulted for the corrosion mitigation measures for ferrous metals in contact with soil.

9.0 FAULTING AND SEISMICITY

9.1 Faulting

The site is not located within a currently designated Riverside County or State of California Earthquake Fault Zone. Based on a review of available geologic information no known active surface fault zone crosses or projects toward the site. (CGS, 2007; Riverside County, 2012)

The proposed site is situated in a seismically active region. As is the case for most areas of Southern California, ground shaking resulting from earthquakes associated with nearby and more distant faults may occur at the project site. During the life of the project, seismic activity associated with active faults can be expected to generate moderate to strong ground shaking at the site.

The following table contains a list of active and potentially active faults within 75 kilometers of the subject site.

Table No. 1, Seismic Characteristics of Nearby Active Faults

Fault Name	Approximate Distance (km)	Moment Magnitude (Mw)
Elsinore-Temecula	4.4	6.8
Elsinore-Julian	13.8	7.1
Elsinore-Glenn Ivy	30.2	6.8
San Jacinto-Anza	31.4	7.2
San Jacinto-San Jacinto Valley	32.0	6.9
Newport-Inglewood (Offshore)	48.1	6.9
Rose Canyon	50.9	6.9
San Jacinto – Coyote Creek	53.3	6.8
Earthquake Valley	57.5	6.5
Chino-Central Ave. (Elsinore)	58.9	6.7
San Jacinto-San Bernardino	60.7	6.7
San Andreas-Southern	60.9	7.4
San Andreas-San Bernardino	60.9	7.3
Whittier	65.7	6.8
Pinto Mountain	71.7	7.0

Table No. 1, Seismic Characteristics of Nearby Active Faults (Continued)

Fault Name	Approximate Distance (km)	Moment Magnitude (Mw)
San Andreas-Coachella	74.6	7.1
Coronado Bank	75.8	7.4
Newport-Inglewood (L.A. Basin)	79.3	6.9
Palos Verdes	82.7	7.1
Burnt Mountain	82.9	6.4
Cucamonga	84.1	7.0
North Frontal Fault Zone (West)	84.8	7.0
North Frontal Fault Zone (East)	86.6	6.7
Eureka Peak	87.5	6.4
Elysian Park Thrust	87.6	6.7
San Jacinto-Borrego	88.3	6.6
Elsinore-Coyote Mountain	88.5	6.8
Cleghorn	89.1	6.5
San Jose	89.6	6.5
Compton Thrust	90.2	6.8
Sierra Madre	93.4	7.0
Landers	97.3	7.3

9.2 CBC (2010) Seismic Design Coefficients

Seismic parameters based on 2010 California Building Code and site coordinates 33.4870° north latitude and 117.0820° west longitude are provided in the following table.

Table No. 2, CBC Seismic Parameters

Seismic Parameters	
Site Class	"D"
Mapped Short period (0.2-sec) Spectral Response Acceleration, S_s	1.557g
Mapped 1-second Spectral Response Acceleration, S_1	0.600g
Site Coefficient (from Table 1613.5.3(1)), F_a	1.0
Site Coefficient (from Table 1613.5.3(2)), F_v	1.5
MCE 0.2-sec period Spectral Response Acceleration, SM_s	1.557g
MCE 1-second period Spectral Response Acceleration, SM_1	0.900g
Design Spectral Response Acceleration for short period S_{ds}	1.038g
Design Spectral Response Acceleration for 1-second period, S_{d1}	0.600g

9.3 Secondary Effects of Seismic Activity

In general, secondary effects of seismic activity include surface fault rupture, soil liquefaction, landslides, lateral spreading, and differential settlement due to seismic shaking, tsunamis, seiches, and earthquake-induced flooding. The site-specific potential for each of these seismic hazards is discussed in the following sections.

Surface Fault Rupture: The project site is not located within a currently designated Riverside County or State of California Earthquake Fault Zone (CGS, 2007; Riverside County, 2012). Based on review of available geologic information, no major surface fault crosses through or extends towards the site. The potential for surface rupture resulting from the movement of nearby major faults, or currently unknown faults, is not known with certainty but is considered low.

Liquefaction: Liquefaction is defined as the phenomenon in which a cohesionless soil mass within the upper 50 feet of the ground surface, suffers a substantial reduction in its shear strength, due the development of excess pore pressures. During earthquakes, excess pore pressures in saturated soil deposits may develop as a result of induced cyclic shear stresses, resulting in liquefaction.

Soil liquefaction generally occurs in submerged granular soils and non-plastic silts during or after strong ground shaking. There are several general requirements for liquefaction to occur. They are as follows:

- Soils must be submerged
- Soils must be primarily granular
- Soils must be loose to medium-dense
- Ground motion must be intense
- Duration of shaking must be sufficient for the soils to lose shear resistance

Regional hazard maps (Riverside County, 2012) indicate that the northern portion of the site has a moderate susceptibility to liquefaction and the southern portion of the site has a very high susceptibility to liquefaction.

We have estimated a historical high groundwater level ranging from 1,080 feet amsl at the southwestern corner of the site to 1,100 feet amsl at the eastern site perimeter. Based on historical regional data, groundwater may be anticipated in the future at depths as shallow as approximately 15 feet bgs in boring BH-11, or an elevation of 1,087 feet amsl. Groundwater is currently present at approximately 39.5 feet below the lower superpad ground surface in boring BH-11.

Site-specific liquefaction analyses were performed using data obtained from borings BH-1 and BH-11. Groundwater depths at 40 feet bgs in boring BH-1, and 15 feet bgs in boring BH-11 have been used for the purpose of liquefaction analysis. A detailed

discussion of the analyses is presented in Appendix C, *Liquefaction and Settlement Analyses*.

The sediments encountered in BH-1 were not found to be susceptible to liquefaction. Boring BH-11, drilled in the lower superpad, encountered a medium dense sand layer between approximately 20 and 25 feet bgs in (1,073 to 1,078 feet amsl). This layer may be susceptible to liquefaction if subjected to ground shaking of sufficient intensity while saturated. Up to approximately 0.80 inches of liquefaction-induced settlement may occur.

Surface manifestations of liquefaction, such as sand boils, are not anticipated due to the greater thickness of the overlying non-liquefiable layer in comparison to the relatively thin liquefiable layer.

Landslides: Seismically induced landslides and other slope failures are common occurrences during or soon after earthquakes.

The site currently includes 2H:1V (horizontal:vertical) fill slopes up to approximately 25 feet in height. In general, properly constructed 2H:1V fill slopes less than 30 feet in height are considered to have a low susceptibility to earthquake-induced failure.

Lateral Spreading: Seismically induced lateral spreading involves primarily lateral movement of earth materials over underlying materials which are liquefied due to ground shaking. It differs from the slope failure in that complete ground failure involving large movement does not occur due to the relatively smaller gradient of the initial ground surface. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movement of the soil mass involved.

Due to the limited potential of the site for liquefaction, and the depth of the potentially liquefiable layer, the site is not considered to be at risk for lateral spreading.

Differential Settlement Due to Seismic Shaking: Differential settlement may occur when relatively low-density, medium- or coarse-grained sands are densified by intense seismic shaking. Based our site-specific analysis presented in Appendix C, *Liquefaction and Settlement Analyses*, seismic shaking may result in up to approximately 0.51 inches of settlement in the vicinity of BH-1 and the up to approximately 0.80 inches of settlement in the vicinity of BH-11. The potential for differential settlement may be estimated as up to half of the total settlement over a lateral distance of 50 feet.

Tsunamis: Tsunamis are large waves generated in open bodies of water by fault displacement or major ground movement. Due to the inland location of the site, tsunamis are not considered to be a risk.

Seiches: Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Due to the absence of significant bodies of water near the site, the potential for flooding due to seiching is considered low.

Earthquake-Induced Flooding: Dams or other water-retaining structures may fail as a result of large earthquakes. Due to the distance of the site from significant bodies of water, and the elevation of the site on the margin of the Pauba Valley, it is unlikely that the site would be impacted by flooding due to earthquake-induced failure of off-site facilities.

10.0 SITE GRADING/EARTHWORK RECOMMENDATIONS

10.1 General

This section contains our general recommendations regarding earthwork and grading recommendations for the proposed development. These recommendations are based on the results of our field exploration, laboratory testing, our experience with similar projects, and data evaluation as presented in the preceding sections. These recommendations may need to be modified based on observation of the actual field conditions during grading.

Prior to the start of any earthwork, the site should be cleared of all vegetation and debris. The materials resulting from clearing and grubbing operations should be removed from the site.

The final bottom surfaces of all excavations should be observed and approved by the project geotechnical consultant prior to placing any fill. Based on these observations, removal of localized areas deeper than those documented may be required during grading. Therefore, some variations in the depth and lateral extent of excavation recommended in this report should be anticipated.

10.2 Remedial Earthwork

The existing superpads have irregular surface, with numerous soil piles, are locally loose, dry, or disturbed. Such soils are not considered suitable for the support of additional fills or structures, and should be overexcavated and recompacted. The depth and limits of the overexcavation should be determined by the geotechnical consultant based on the field conditions encountered. In general, the existing grade should be overexcavated to expose a fill with a minimum density of 90 percent, or an alluvium with a minimum density of 85 percent of laboratory maximum density, or, to a depth of three feet below existing grade.

Excavated soils generated by the recommended remedial grading are generally considered suitable for re-use as compacted fill. Prior to re-use, excavated soils should be cleared of all debris, vegetation, rocks larger than 3 inches, and other deleterious materials.

10.3 Overexcavation

A tentative site layout exhibit (Cal-Paseo Del Sol, 2012b) indicates that the site will be reconfigured during the proposed development. The northern, upper superpads will be lowered by approximately 10 to 20 feet and the southern, lower superpad will be raised by approximately 5 to 15 feet.

Building footings and slabs-on-grade should be uniformly supported by compacted fill. If after the planned lowering of the northern upper superpads, uncompacted alluvium soil is encountered, such alluvium should be overexcavated and recompacted to a minimum depth of three feet below the bottom of the footing elevation. The overexcavation and recompaction should extend at least 5 feet beyond the building footprint.

For sub-grade below planned asphalt concrete or Portland concrete paving, including driveways, access roads, sidewalks, street areas, curbs and gutters or other flatwork, overexcavation and recompaction in alluvium soils should be to a depth of at least 2 feet, extending at least 2 feet beyond the pavement or flatwork.

Excavations should be in accordance to Section D1.5 *Excavations* in Appendix D, *Recommended Earthwork Specifications*.

10.4 Sub-grade Preparation

The sub-grade in all areas should be observed and approved by qualified geotechnical consultant.

All areas to receive fill should be overexcavated to the depth where the existing soils have a relative compaction of at least 90 percent of the laboratory maximum dry density, or to a depth of three feet bgs. Any loose, soft, and unsuitable materials encountered during overexcavation should be removed from the site. The depth of such removal should be determined during the grading by the geotechnical consultant.

After the required overexcavation as recommended in this report, or as recommended by the geotechnical consultant during remedial grading is performed, all surfaces to receive fill should be scarified to an additional depth of six inches. The sub-grade soils should be moisture conditioned to within 3 percent of optimum moisture content for granular soils and up to 2 percent above optimum moisture content for fine-grained soils. The soils should be re-compacted to at least 90 percent of the laboratory maximum dry density to produce a firm and unyielding surface.

10.5 Compacted Fill

Excavated soils are generally considered suitable for re-use as compacted fill. Prior to re-use, excavated soils should be cleared of all debris, vegetation, rocks larger than 3 inches, and other deleterious materials. Rocks larger than 1 inch in the largest dimension

should not be placed within the upper 12 inches of fill beneath footings and slabs or the upper 18 inches of fill under paved areas. Imported fill soils, if any, should meet the criteria presented in Section 11.5, *Imported Fill Materials* and should be approved by the geotechnical consultant prior to importation to the site.

Fill soils should be compacted as presented in Section D1.7 *Placement and Compaction of Structural Fill* in Appendix D, *Recommended Earthwork Specifications*.

10.6 Shrinkage and Subsidence

The existing site soils will undergo a change in volume when excavated and recompacted in accordance with the recommendations presented in this report. This volume change should be considered for earthwork calculations.

Based on our review of the *in situ* densities and an average anticipated compaction of 92 percent, we anticipate that the loose, near-surface soils excavated during remedial and design earthwork will shrink by up to approximately 10 percent, while shrinkage of the previously compacted fill is anticipated to be negligible. For earthwork volume calculations, an average of 5 percent shrinkage may be used for the upper 5 feet of excavation and 0 percent for deeper excavations. The actual shrinkage will depend on, among other factors, the depth of cut and/or fill, the grading method, and the equipment utilized.

Subsidence refers to general settlement of the site due to densification of the deeper underlying soils while the shallower soils are being compacted by earthmoving equipment. Due to the previous site grading, ground subsidence is expected to be negligible.

Although these values are only approximate, they represent our best estimates of the factors to be used to calculate lost volume that may occur during grading. If more accurate shrinkage and subsidence factors are needed, it is recommended that field-testing using the actual equipment and grading techniques be conducted.

11.0 UTILITY TRENCH BACKFILL

The following sections present earthwork for utility trench backfill. The earthwork for utility trenches includes sub-grade preparation, pipe bedding, and trench zone backfill.

Open cuts adjacent to existing roadways and/or adjacent structures are not recommended within a 1H:1V (horizontal:vertical) plane extending beyond and down from the roadway or structure perimeter.

Spoils from the trench excavation should not be stockpiled more than six (6) feet in or within a distance H (ft) from the top of trench edge, where H is the depth of the trench in feet. Spoils, if any, should not be stockpiled behind the shoring within a horizontal distance equal to the depth of the trench, unless the shoring has been designed for such loads.

11.1 Pipeline Sub-grade Preparation

The final sub-grade surface should be level, firm, uniform, and free of loose materials and properly graded to provide uniform bearing and support to the entire section of the pipe placed on bedding material. Protruding oversize particles larger than two (2) inches in dimension, if any, should be removed from the trench bottom and replaced with compacted on-site materials.

Any loose, soft and/or unsuitable materials encountered at the pipe sub-grade should be removed and replaced with an adequate bedding material. During the digging of depressions for proper sealing of the pipe joints, the pipe should rest on a prepared bottom for as near its full length as is practicable.

11.2 Pipe Bedding

Bedding is defined as the material supporting and surrounding the pipe, to 12 inches above the pipe. To provide uniform and firm support for the pipeline, free-draining granular soil should be used as pipe bedding material. For flexible pipes, excavated sandy materials may be used as bedding material. Crushed rock or gravel may be used for rigid pipes. Bedding material for the pipes should be free from oversized particles greater than one (1) inch in maximum dimension.

Pipe design generally requires sand equivalent of 30 or greater for bedding materials. Specifications for bedding materials including required backfill requirements surrounding the pipe should be specified by the design engineer in accordance with the pipe manufacturer's guideline.

11.3 Trench Zone Backfill

The trench zone is defined as the portion of the trench above the pipe bedding extending up to the final grade level of the trench surface. The detailed trench backfill recommendations are presented in Section D1.8, *Trench Backfill,* in Appendix D, *Earthwork Specifications*.

11.4 Temporary Excavations

Based on the materials encountered in the borings, sloped temporary excavations may be constructed according to the slope ratios presented in Table No. 3, *Slope Ratios for Temporary Excavation*. Any loose utility trench backfill or other fill encountered in excavations will be less stable than the native soils. Temporary cuts encountering loose fill or loose, dry sand may have to be constructed at a flatter gradient than presented in the following table.

Table No. 3, Slope Ratios for Temporary Excavation

Maximum Depth of Cut (feet)	Maximum Slope Ratio* (horizontal: vertical)
0-4	1:1
4-10	1.5:1
10-20	2:1

*Slope ratio assumed to be uniform from top to toe of slope.

Surfaces exposed in slope excavations should be kept moist but not saturated to retard raveling and sloughing during construction. Adequate provisions should be made to protect the slopes from erosion during periods of rainfall. Surcharge loads, including construction, should not be placed within five (5) feet of the unsupported trench edge. The above maximum slopes are based on a maximum height of six (6) feet of stockpiled soils placed at least five (5) feet from the trench edge.

All applicable requirements of the California Construction and General Industry Safety Orders and the Occupational Safety and Health Act, current amendments, should be met. The soils exposed in cuts should be observed during excavation by the project's geotechnical consultant. If potentially unstable soil conditions are encountered, modifications of slope ratios for temporary cuts may be required.

11.5 Imported Fill Materials

Imported soils, if any, used as compacted trench backfill should be predominantly granular and meet the following criteria:

- Expansion Index less than 20
- Free of all deleterious materials
- Contain no particles larger than 3 inches in the largest dimension
- Contain less than 30 percent by weight retained on ¾-inch sieve
- Contain at least 15 percent fines (passing #200 sieve)
- Plasticity Index of 10 or less
- Corrosion potential similar or better than onsite soils

Any import fill should be tested and approved by the owner's representative prior to delivery to the site.

12.0 DESIGN RECOMMENDATIONS

Recommendations for the design and construction of the proposed development are presented in the following sections. The recommendations provided are based on the assumption that, in preparing the site, the above earthwork recommendations will be implemented.

12.1 Shallow Foundation Design Parameters

The proposed commercial and multifamily developments may be supported on continuous (strip) and/or isolated spread footings. Continuous and isolated spread footings should be at least 18 inches wide. The depth of embedment below lowest adjacent soil grade of interior and exterior footings should be at least 18 inches. Such footings can be designed based on an allowable net bearing capacity of 2,500 pounds per square foot (psf), plus 300 psf for each additional foot of depth and 150 psf for each foot of width. The maximum allowable bearing capacity should be limited to 3,000 psf.

The allowable net bearing capacity is defined as the maximum allowable net bearing pressure on the ground. It is obtained by dividing the net ultimate bearing capacity by a safety factor. The ultimate bearing capacity is the bearing stress at which ground fails by shear or experiences a limiting amount of settlement at the foundation. The net ultimate bearing capacity is obtained by subtracting the total overburden pressure on a horizontal plane at the foundation level from the ultimate bearing capacity.

The net allowable bearing values indicated above are for the dead load and frequently applied live loads and are obtained by applying a factor of safety of 3.0 to the net ultimate bearing capacity. If normal code requirements are applied for design, the above vertical bearing value may be increased by 33 percent for short duration loading, which will include loading induced by wind or seismic forces.

12.1.1 Active Earth Pressures

The active earth pressure behind any buried wall depends primarily on the allowable wall movement, type of backfill materials, backfill slopes, wall inclination, surcharges, and any hydrostatic pressures. Equivalent fluid pressures are recommended in Table No. 5, *Lateral Earth Pressure*. These pressures assume a level ground surface behind the walls for a distance greater than the wall height, no surcharge, and no hydrostatic pressure.

Table No. 4, Lateral Earth Pressure

Lateral Earth Pressure, Equivalent Fluid Pressure (pcf)	
Active earth conditions (wall is free to deflect)	35
At-rest (wall is restrained)	55
Seismic pressure on unrestrained walls (at the top of reverse triangle where H is the height of the wall)	18H

If water pressure is allowed to build up behind the walls, the active pressures should be reduced by 50 percent and added to a full hydrostatic pressure to compute the design pressures against the walls.

12.1.2 Passive Earth Pressure

Resistance to lateral loads can be assumed to be provided by combination of friction acting at the base of foundations and by passive earth pressure. A coefficient of friction of 0.35 between concrete and soil and of 0.25 between soil and steel may be used with the dead load forces. Passive earth pressure of 270 psf per foot of depth may be used for the sides of footings poured against recompacted native soils. A factor of safety of 1.5 was applied in calculating passive earth pressure. The maximum value of the passive earth pressure should be limited to 2,500 psf. These lateral resistances may be increased by 33 percent for seismic forces. Due to the low overburden stress of the soil at shallow depth, the upper one foot of passive resistance should be neglected unless the soil is confined by pavement or slab.

Vertical and lateral bearing values indicated above are for the total dead loads and frequently applied live loads. If normal code requirements are applied for design, the above vertical bearing and lateral resistance values may be increased by 33 percent for short duration loading, which will include the effect of wind or seismic forces.

12.2 Settlement

The geotechnical report of the previous site grading (Converse, 1997) stated that ongoing monitoring of settlement monuments within or near the site indicated that the site was undergoing a significant rate of ground settlement at the time of the report. The site has remained in its current configuration for approximately 15 years, and we anticipate that the ground settlement is currently negligible.

The proposed site grading (Cal-Paseo, 2012) will remove approximately 10 to 20 feet of fill from the northern half of the site and add approximately 5 to 15 feet of fill to the southern half of the site. The geotechnical consultant should evaluate the final site configuration and conditions encountered during grading to determine whether post-grading settlement monitoring should be conducted.

The following estimates are provided for preliminary design purposes, and should be evaluated by the geotechnical consultant based on the final site configuration and conditions encountered during grading. The total settlement of shallow footings, designed as recommended above, from static structural loads and short-term settlement of properly compacted fill is anticipated to be 0.5 inch or less. Dynamic settlement under seismic conditions is estimated to be up to 0.8 inches based on the analysis presented in Appendix C, *Liquefaction and Settlement Analyses*.

The static and dynamic differential settlements can be taken as equal to one-half of the corresponding total settlement over a lateral distance of 50 feet.

12.3 Slabs-on-Grade

The design of the slab-on-grade will depend on, among other factors, the expansive potential of the pad soils. Based on expansion index testing performed during this investigation, the expansive potential of the soil tested is very low to low. Due to mixing and movement of soil during grading, the expansion potential the final sub-grade soil may be different than this result. The final expansion potential should be verified at the completion of sub-grade preparation. We recommend performing additional expansion index tests at the completion of sub-grade preparation, to locate any areas where mitigation is required.

Thickness of slabs-on-grade should be determined by the structural engineer. The sub-grade for slabs-on-grade should be firm and uniform. All loose or disturbed soils including under-slab utility trench backfill should be recompacted.

If moisture-sensitive flooring or environments are planned, slabs-on-grade should be protected by 10-mil-thick polyethylene vapor barriers. The sub-grade surface should be free of all exposed rocks or other sharp objects prior to placement of the barrier. The barrier should be overlain by two (2) inches of sand, to minimize punctures and to aid in the concrete curing. At discretion of the structure engineer, the sand layer may be eliminated.

In hot weather, the contractor should take appropriate curing precautions after placement of concrete to minimize cracking or curling of the slabs. The potential for slab cracking may be lessened by the addition of fiber mesh to the concrete and/or control of the water/cement ratio.

Concrete should be cured by protecting it against loss of moisture and rapid temperature change for at least seven (7) days after placement. Moist curing, waterproof paper, white polyethylene sheeting, white liquid membrane compound, or a combination thereof may be used after finishing operations have been completed. The edges of concrete slabs exposed after removal of forms should be immediately protected to provide continuous curing.

12.4 Preliminary Pavement Design Recommendations

Three representative samples of the site soils were tested to evaluate the Resistance (R) value in accordance with the ASTM Standard D2844. The test is designed to provide a relative measure of soil strength for use in pavement design. The tests indicated R-value of 17, 18, and 52. Due to mixing and movement during grading, the R-values of the final sub-grade soil are likely to be different than tested. We recommend performing additional R-value tests at the completion of the sub-grade preparation, which could change/increase the proposed preliminary pavement sections.

Asphalt concrete pavement sections corresponding to Traffic Indices (TIs) ranging from 5.0 to 8.0 for an R-value of 17 are presented for preliminary design in the following table.

Table No. 5, Recommended Preliminary Pavement Sections

R-value	Traffic Index (TI)	Asphalt Concrete Thickness (inches)	Aggregate Base Thickness (inches)
17	5.0	4.0	6.0
	6.0	4.0	9.0
	7.0	6.0	9.0
	8.0	6.5	12.0

Base materials should conform to Section 200-2.2, "Crushed Aggregate Base" of the current Standard Specifications for Public Works Construction ("Greenbook") (Public Works Standards, 2012), and should be placed in accordance with Section 301-2 of the Greenbook.

Asphalt concrete materials should conform to Section 203 of the Greenbook and should be placed in accordance with Section 302.5 of the Greenbook.

Pavement sub-grade should be prepared in accordance with Section 301 of the Greenbook. The upper 12 inches of sub-grade should be compacted to a relative compaction of at least 95 percent as per ASTM Standard D1557 test method.

Positive drainage should be provided away from all pavement areas to prevent seepage of surface and/or subsurface water into the pavement base and/or sub-grade.

12.5 Site Drainage

Adequate positive drainage should be provided away from the structures to prevent ponding and to reduce percolation of water into structural backfill. A desirable slope for surface drainage is two (2) percent in landscaped areas and one (1) percent in paved areas. Planters and landscaped areas adjacent to the building perimeter should be designed to minimize water infiltration into the sub-grade soils. Gutters and downspouts

should be installed on the roof, and runoff should be directed to the storm drain through non-erosive devices.

13.0 PLAN REVIEW AND CONSTRUCTION INSPECTION SERVICES

Project grading plans were not available for review at the time of this report. This report has been prepared to aid in the evaluation of the site, to prepare preliminary site grading recommendations, and to assist the engineer with the design of the proposed apartment building(s). It is recommended that this office should also be given the opportunity to review the future site plans and specifications to verify whether the recommendations presented herein are appropriate for the planned site development.

Recommendations presented herein are based upon the assumptions that earthwork monitoring will be provided by a qualified geotechnical consultant. All excavation bottoms should be observed and tested by a representative of the geotechnical consultant prior to fill placement. Structural fill and backfill should be placed and compacted during continuous observation and testing. It is recommended that footing excavations should be observed by a geotechnical consultant representative prior to placement of steel and concrete, so that footings are founded on satisfactory materials and excavations are free of loose and disturbed materials. All base course and subbase materials used for pavement structures should be tested and approved by the soils engineer.

14.0 CLOSURE

The findings and recommendations of this report were prepared in accordance with generally accepted professional engineering and engineering geologic principles and practice. We make no other warranty, either expressed or implied. Our conclusions and recommendations are based on the results of the field and laboratory investigations, combined with an interpolation and extrapolation of soil conditions between and beyond boring locations. If conditions encountered during construction appear to be different from those shown by the borings, this office should be notified.

As the project evolves, a continued consultation and construction monitoring by a qualified geotechnical consultant should be considered an extension of geotechnical investigation services performed to date. The geotechnical consultant should review plans and specifications to verify that the recommendations presented herein have been appropriately interpreted, and that the design assumptions used in this report are valid. Where significant design changes occur, Converse may be required to augment or modify the recommendations presented herein. Subsurface conditions may differ in some locations from those encountered in the explorations, and may require additional analyses and, possibly, modified recommendations.

Design recommendations given in this report are based on the assumption that the recommendations contained in this report are implemented. Additional consultation may be prudent to interpret Converse's findings for contractors, or to possibly refine these recommendations based upon the review of the actual site conditions encountered during construction. If the scope of the project changes, if project completion is to be delayed, or if the report is to be used for another purpose, this office should be consulted.

This report was prepared for Cal-Paseo Del Sol, LLC for the subject project described herein. We are not responsible for technical interpretations made by others of our exploratory information. Specific questions or interpretations concerning our findings and conclusions may require a written clarification to avoid future misunderstandings.

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APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

Our field investigation included a site reconnaissance and a subsurface exploration program consisting of drilling borings. During the site reconnaissance, the surface conditions were noted, and the approximate location of the test borings were established using existing boundary features. The boring locations should be considered accurate only to the degree implied by the method used to establish them. Discussion of the field investigation methods is presented below.

Twelve (12) exploratory borings (BH-1 through BH-12) were drilled within the project site on May 30, 2012. Borings BH-2 through BH-10 and BH-12 were drilled to the planned depth of at least 16.5 feet bgs. Borings BH-1 and BH-11 were drilled to the planned maximum depth of 51.5 feet bgs. The borings were advanced using a truck-mounted drill rig equipped with eight-inch diameter hollow-stem augers equipped with split-spoon drive samplers for soil sampling. Encountered earth materials were continuously logged by a Converse geologist and classified in the field by visual examination in accordance with the Unified Soil Classification System. Where appropriate, field descriptions and classifications have been modified to reflect laboratory test results.

Relatively undisturbed samples were obtained using a California Modified Sampler (2.4-inch inside diameter and 3.0-inch outside diameter) lined with thin sample rings. The sampler was driven into the bottom of the borehole with successive drops of a 140-pound driving weight falling 30 inches. Blow counts at each sample interval are presented on the boring logs. Samples were retained in brass rings (2.4-inch inside diameter and 1.0-inch height) and carefully sealed in waterproof plastic containers for shipment to the Converse laboratory. Bulk samples of representative soils were also collected.

Standard penetration tests (SPT) were performed in Borings BH-1 and BH-11 below 20 feet bgs at 10-foot intervals using a split-barrel sampler (1.4-inch inside diameter and 2.0-inch outside diameter) in accordance with the ASTM Standard D1586 test method. The mechanically driven hammer for the SPT sampler was 140 pounds, falling 30 inches for each blow. The recorded blow counts for every six (6) inches for a total of 1.5 feet of sampler penetration are shown on the boring logs.

It should be noted that the exact depths at which material changes occur cannot always be established accurately. Unless a more precise depth can be established by other means, changes in material conditions that occur between driven samples are indicated in the log at the top of the next drive sample.

A key to soil symbols and terminology used in the boring logs is included as Drawing No. A-1, *Unified Soil Classification and Key to Boring Log Symbols*. For Logs of Borings, see Drawings No. A-2 through A-13, *Logs of Borings.*

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BORING LOG SYMBOLS

SAMPLE TYPE

STANDARD PENETRATION TEST
Split barrel sampler in accordance with ASTM D-1586-84 Standard Test Method

DRIVE SAMPLE 2.42" I.D. sampler (CMS).

DRIVE SAMPLE No recovery

BULK SAMPLE

GROUNDWATER WHILE DRILLING

GROUNDWATER AFTER DRILLING

LABORATORY TESTING ABBREVIATIONS			
TEST TYPE (Results shown in Appendix B)		STRENGTH	
		Pocket Penetrometer	p
		Direct Shear	ds
		Direct Shear (single point)	ds*
		Unconfined Compression	uc
CLASSIFICATION		Triaxial Compression	tx
Plasticity	pi	Vane Shear	vs
Grain Size Analysis	ma	Consolidation	c
Passing No. 200 Sieve	wa	Collapse Test	col
Sand Equivalent	se	Resistance (R) Value	r
Expansion Index	ei	Chemical Analysis	ca
Compaction Curve	max	Electrical Resistivity	er
Hydrometer	h	Permeability	perm
Disturb	Dist.	Soil Cement	sc

Apparant Density	Very Loose	Loose	Medium	Dense	Very Dense
SPT (N)	< 4	4 - 11	11 - 30	31 - 50	> 50
CA Sampler	< 5	5 - 12	13 - 35	36 - 60	> 60
Relative Density (%)	< 20	20 - 40	40 - 60	60 - 80	> 80

Consistency	Very Soft	Soft	Medium	Stiff	Very Stiff	Hard
SPT (N)	< 2	2-4	5-8	9-15	16-30	> 30
CA Sampler	< 3	3-6	7-12	13-25	26-50	> 50

UNIFIED SOIL CLASSIFICATION AND KEY TO BORING LOG SYMBOLS

Log of Boring No. BH- 1

Dates Drilled: 5/30/2012 Logged by: CG Checked By: SM

Equipment: CME 75/ 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1142 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE	DRY UNIT WT. (pcf)	OTHER
		FILL: **SILTY SAND (SM):** fine to coarse-grained, brown.						
		- concrete fragments	■		13/9/8	7	126	ma,max r
5		**CLAYEY SAND (SC):** fine to coarse-grained, yellow-brown.	■		6/9/15	15	123	
10			■		5/6/4	10	111	
15		**SILTY SAND (SM):** fine to coarse-grained, brown.	■		6/10/14	8	120	
20			☒		4/7/7			
25		- trace clay	■		5/14/20	14	115	
30			☒		8/11/14			

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Drawing No. A-2a

Log of Boring No. BH- 1

Dates Drilled: 5/30/2012 Logged by: CG Checked By: SM

Equipment: CME 75/ 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1142 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE	DRY UNIT WT. (pcf)	OTHER
		ALLUVIUM (Qal): **SILTY SAND (SM):** fine to coarse-grained, brown.	■		9/14/20	6	122	
40			☒		8/11/12			
45			■		10/15/23	9	117	
50			☒		6/9/8			
		End of boring at 51.5 feet. No groundwater encountered. Borehole backfilled loose with soil cuttings on 5/30/12.						

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Drawing No. A-2b

Log of Boring No. BH- 2

Dates Drilled: 5/30/2012 Logged by: CG Checked By: SM

Equipment: CME 75/ 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1127 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE	DRY UNIT WT. (pcf)	OTHER
		FILL: **SILTY SAND (SM):** fine to coarse-grained, yellow-brown.	■		12/12/16	5	115	
5			■		9/8/9	8	115	
10			■		6/7/9	11	116	
15			■		12/10/13	10	119	
		End of boring at 16.5 feet. No groundwater encountered. Borehole backfilled loose with soil cuttings on 5/30/12.						

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Drawing No. A-3

Log of Boring No. BH- 3

Dates Drilled: 5/30/2012 Logged by: CG Checked By: SM

Equipment: CME 75/ 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1129 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE	DRY UNIT WT. (pcf)	OTHER
		FILL: **SILTY SAND (SM):** fine to coarse-grained, asphalt and concrete fragments, brown.	■		11/9/7	7	121	
5			■		3/3/6	11	114	ds,col
10		-fine to medium-grained	■		5/6/7	13	110	
15		- fine to coarse-grained	■		8/8/14	8	125	
		End of boring at 16.5 feet. No groundwater encountered. Borehole backfilled loose with soil cuttings on 5/30/12.						

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Drawing No. A-4

Log of Boring No. BH- 4

Dates Drilled: 5/30/2012 Logged by: CG Checked By: SM

Equipment: CME 75/ 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1125 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE	DRY UNIT WT. (pcf)	OTHER
		FILL: **SILTY SAND (SM):** fine to coarse-grained, asphalt and concrete fragments at 2' bgs, brown.	■		6/9/26	13	110	
5			■	▨	11/11/15	6	114	ma.ei
10		**SANDY SILT (ML):** fine-grained sand, brown.	■		5/7/7	14	111	
15			■		3/4/7	10	123	
		End of boring at 16.5 feet. No groundwater encountered. Borehole backfilled loose with soil cuttings on 5/30/12.						

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Drawing No. A-5

Log of Boring No. BH- 5

Dates Drilled: 5/30/2012 Logged by: CG Checked By: SM

Equipment: CME 75/ 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1130 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE	DRY UNIT WT. (pcf)	OTHER
		FILL: **SILTY SAND (SM):** fine to coarse-grained, yellow-brown.	■		10/16/7	6	113	ca,er r
5			■		10/7/6	9	119	
10		**SANDY SILT (ML):** fine-grained sand, dark brown.	■		7/9/15	12	120	
15			■		8/11/16	12	116	
		End of boring at 16.5 feet. No groundwater encountered. Borehole backfilled loose with soil cuttings on 5/30/12.						

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Drawing No. A-6

Log of Boring No. BH- 6

Dates Drilled: 5/30/2012 Logged by: CG Checked By: SM

Equipment: CME 75/ 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1127 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE	DRY UNIT WT. (pcf)	OTHER
		FILL: **SILTY SAND (SM):** fine to coarse-grained, brown.						
		- trace clay, trace gravel up to 1/2" in largest dimension	■		9/9/15	6	120	
5		**SAND WITH SILT (SP-SM):** fine to medium-grained, brown.	■		9/13/14	1	124	
10		**SILTY SAND (SM):** fine to coarse-grained, brown.	■		5/6/12	12	114	
15		**SANDY SILT (ML):** fine to medium-grained sand, organics, black.	■		6/10/14	19	105	
		End of boring at 16.5 feet. No groundwater encountered. Borehole backfilled loose with soil cuttings on 5/30/12.						

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Drawing No. A-7

Log of Boring No. BH- 7

Dates Drilled: 5/30/2012 Logged by: CG Checked By: SM

Equipment: CME 75/ 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1125 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE	DRY UNIT WT. (pcf)	OTHER
		FILL: **SILTY SAND (SM):** fine to medium-grained, dark brown.	■		9/19/27	9	122	
5			■		9/12/19	12	111	ds
10			■		10/21/35	10	122	
15		**ALLUVIUM (Qal):** **SILTY SAND (SM):** fine to medium-grained, brown.	■		15/19/27	12	108	
		End of boring at 16.5 feet. No groundwater encountered. Borehole backfilled loose with soil cuttings on 5/30/12.						

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Drawing No. A-8

Log of Boring No. BH- 8

Dates Drilled: 5/30/2012 Logged by: CG Checked By: SM

Equipment: CME 75/ 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1124 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE	DRY UNIT WT. (pcf)	OTHER
		FILL: **SILTY SAND (SM):** fine to coarse-grained, few silt, brown.	■		15/17/21	5	111	
5		**CLAYEY SAND (SC):** fine-grained, dark brown.	■	▨	5/9/20	19	103	ma,max ei
10			■		6/8/11	15	102	
15		**ALLUVIUM (Qal):** **CLAYEY SAND (SC):** fine-grained, some organics, dark brown.	■		9/13/19	18	111	
		End of boring at 16.5 feet. No groundwater encountered. Borehole backfilled loose with soil cuttings on 5/30/12.						

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Drawing No. A-9

Log of Boring No. BH- 9

Dates Drilled: 5/30/2012 Logged by: CG Checked By: SM

Equipment: CME 75/ 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1093 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE	DRY UNIT WT. (pcf)	OTHER
		FILL: **SILTY SAND (SM):** fine to coarse-grained, brown.	■		8/12/35	11	112	ca,er ma,r
5			■		10/18/20	10	116	
10		**ALLUVIUM:** **SANDY SILT (ML):** fine-grained sand, dark brown.	■		5/7/19	22	103	
15		**SAND (SP):** fine to coarse-grained, brown.	■		6/8/6	6	95	
		End of boring at 16.5 feet. No groundwater encountered. Borehole backfilled loose with soil cuttings on 5/30/12.						

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Drawing No. A-10

Log of Boring No. BH-10

Dates Drilled: 5/30/2012 Logged by: CG Checked By: SM

Equipment: CME 75/ 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1096 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE	DRY UNIT WT. (pcf)	OTHER
		FILL: **SILTY SAND (SM):** fine to coarse-grained, brown.						
		SANDY SILT (ML): fine-grained sand, light brown.	■		7/7/10	26	98	
5			■		5/10/12	11	113	col
10		**ALLUVIUM:** **SILTY SAND (SM):** fine to coarse-grained, dark brown.	■		11/10/11	6	113	ds
15		**SANDY SILT (ML):** fine-grained sand, dark brown.	■		5/4/9	21	98	
		End of boring at 16.5 feet. No groundwater encountered. Borehole backfilled loose with soil cuttings on 5/30/12.						

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Drawing No. A-11

Log of Boring No. BH-11

Dates Drilled: 5/30/2012 Logged by: CG Checked By: SM

Equipment: CME 75/ 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1098 Depth to Water (ft): 39.5

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE	DRY UNIT WT. (pcf)	OTHER
		FILL: **SILTY SAND (SM):** fine to coarse-grained, light brown.	■		10/14/19	6	121	
5			■		10/12/17	8	118	
10		**ALLUVIUM:** **SILTY SAND (SM):** fine to coarse-grained, light brown.	■	▨	12/17/11	3	102	ma,max
15		**SANDY SILT (ML):** fine-grained sand, organics, dark brown.	■		4/6/13	24	83	
20		**SILTY SAND (SM):** fine to coarse-grained, brown.	☒		4/8/9			wa
25		**SANDY CLAY (CL):** fine-grained sand, dark brown.	■		5/6/9	22	100	
30		**SILTY SAND (SM):** fine to coarse-grained, dark brown.	☒		4/8/12			wa

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Drawing No. A-12a

Log of Boring No. BH-11

Dates Drilled: 5/30/2012 Logged by: CG Checked By: SM

Equipment: CME 75/ 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1098 Depth to Water (ft): 39.5

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE	DRY UNIT WT. (pcf)	OTHER
		SILTY SAND (SM): fine to coarse-grained, some clay, dark brown.	■		3/9/31	18	114	
40		**CLAYEY SAND (SC):** fine to coarse-grained, brown.	☒		22/32/35			
45			■		13/15/26	22	106	
50			☒		20/30/36			
		End of boring at 51.5 feet. Groundwater encountered at approximately 39.5 feet. Borehole backfilled loose with soil cuttings on 5/30/12.						

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Drawing No. A-12b

Log of Boring No. BH-12

Dates Drilled: 5/30/2012 Logged by: CG Checked By: SM

Equipment: CME 75/ 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1094 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE	DRY UNIT WT. (pcf)	OTHER
		FILL: **SILTY SAND (SM):** fine to coarse-grained, brown.	■		7/12/17	13	112	
5		**ALLUVIUM:** **SANDY SILT (ML):** fine to medium-grained sand, dark brown.	■		6/10/15	17	114	
10		**SAND (SP):** fine to coarse-grained, gray.	■		8/11/11	3	105	
15			■		5/8/9	3	104	
		End of boring at 16.5 feet. No groundwater encountered. Borehole backfilled loose with soil cuttings on 5/30/12.						

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Project No. 12-81-173-01

Drawing No. A-13

APPENDIX B

LABORATORY TESTING PROGRAM

APPENDIX B

LABORATORY TESTING PROGRAM

Tests were conducted in our laboratory on representative soil samples for the purpose of classification and evaluation of their relevant physical characteristics and engineering properties. The amount and selection of tests were based on the geotechnical requirements of the project. Summaries of the various laboratory tests conducted are presented below.

Moisture Content and Dry Density

Results of moisture content and dry density tests performed on relatively undisturbed ring samples in accordance to ASTM Standard D2216 were used to aid in the classification of the soils and to provide quantitative measurement of the *in situ* dry density. Data obtained from this test provides qualitative information on strength and compressibility characteristics of site soils. For test results, see the Logs of Borings in Appendix A, *Field Exploration*.

Collapse Test

To evaluate the moisture sensitivity (collapse potential) of the encountered soils, two (2) representative ring samples were loaded to approximately 2 kips, allowed to stabilize under load, and then submerged. The test was performed in accordance to ASTM Standard D5333. The test result is presented in the following table.

Table No. B-1, Summary of Collapse Test Results

Boring No.	Depth (feet)	Soil Description	Percent Collapse (-) Swell (+)
BH-3	5-6.5	Silty Sand (SM), brown	- 1.6
BH-10	5-6.5	Sandy Silt (ML), brown	-0.4

Expansion Index Test

Two (2) representative bulk samples were tested to evaluate the expansion potential of material encountered at the site. The test was conducted in accordance with ASTM Standard D4829. Test results are presented in the following table.

Table No. B-2, Summary of Expansion Index Test Result

Boring No.	Depth (feet)	Soil Description	Expansion Index	Expansion Potential
BH-4	5-10	Silty Sand (SM)	18	Very Low
BH-8	5-10	Clayey Sand (SC), dark brown	33	Low

Soil Corrosivity Tests

Two (2) representative soil samples were tested to determine minimum electrical resistivity, pH, and chemical content, including soluble sulfate and chloride concentrations. The purpose of these tests was to determine the corrosion potential of site soils when placed in contact with common construction materials. These tests were performed by HDR/Schiff in accordance to Caltrans Test Methods CT643, 422 and 417. Test results are presented in the table below and included at the end of this appendix.

Table No. B-3, Summary of Soil Corrosivity Test Results

Boring No.	Depth (feet)	pH	Chloride (ppm)	Sulfate (ppm)	Minimum Electrical Resistivity (ohm-cm)
BH-5	0-5	8.0	7	26	2,964
BH-9	0-5	8.3	33	299	1,500

R-value Tests

R-value tests are performed to provide a relative measure of the soil strength for use in calculating the thickness of the pavement structural sections. Three (3) representative bulk samples were tested to determine the R-value of the near surface soil materials. The test was performed in accordance with ASTM Standard D2844. The test result is presented in the following table.

Table No. B-4, Summary of R-value Test Results

Boring No.	Depth(feet)	Soil Description	R-value
BH-1	0-5	Silty Sand (SM)	17
BH-5	0-5	Silty Sand (SM)	18
BH-9	0-5	Silty Sand (SM)	52

Percent Finer than Sieve No. 200

The percent finer than sieve No. 200 test was performed on two (2) representative soil samples to aid in the classification of the on-site soils and to estimate other engineering parameters. Testing was performed in general accordance with the ASTM Standard D1140 test method. The test results are presented in the following table.

Table No. B-5, Percent Passing Sieve #200 Results

Boring No.	Depth (feet)	Soil Classification	Percent Passing Sieve No. 200
BH-11	20.21.5	Silty Sand (SM), brown	31.7
BH-11	30-31.5	Silty Sand (SM), brown	38.7

Grain-Size Analyses

To aid in classification of the soils, mechanical grain-size analyses was performed on five (5) representative soil samples. Testing was performed in accordance with the ASTM Standard C136 test method. For test results, see Drawing No. B-1, Gra*in Size Distribution Results*.

Laboratory Maximum Density Test

Laboratory maximum dry density-optimum moisture content relationships test were performed on three (3) representative bulk samples. The test was conducted in accordance with the ASTM Standard D15570 test method. The test results are presented in Drawing No. B-2, *Moisture-Density Relationship Results,* and are summarized in the following table.

Table No B-6, Summary of Moisture-Density Relationship Results

Boring No.	Depth (feet)	Soil Description	Optimum Moisture (%)	Maximum Density (lb/cft)
BH-1	0-5	Silty Sand (SM), brown	7.0	133.5
BH-8	5-10	Clayey Sand (SC), dark brown	8.5	125.5
BH-11	10-15	Silty Sand (SM), brown	4.5	122.1

Direct Shear Test

Three (3) direct shear tests were performed on representative undisturbed soil samples. For each test, three ring samples were used and all samples were tested at soaked moisture conditions. The samples were placed, one at a time, directly into the test apparatus and subjected to a range of normal loads appropriate for the anticipated conditions. Each sample was then sheared at a constant strain rate of 0.01 inch/minute.

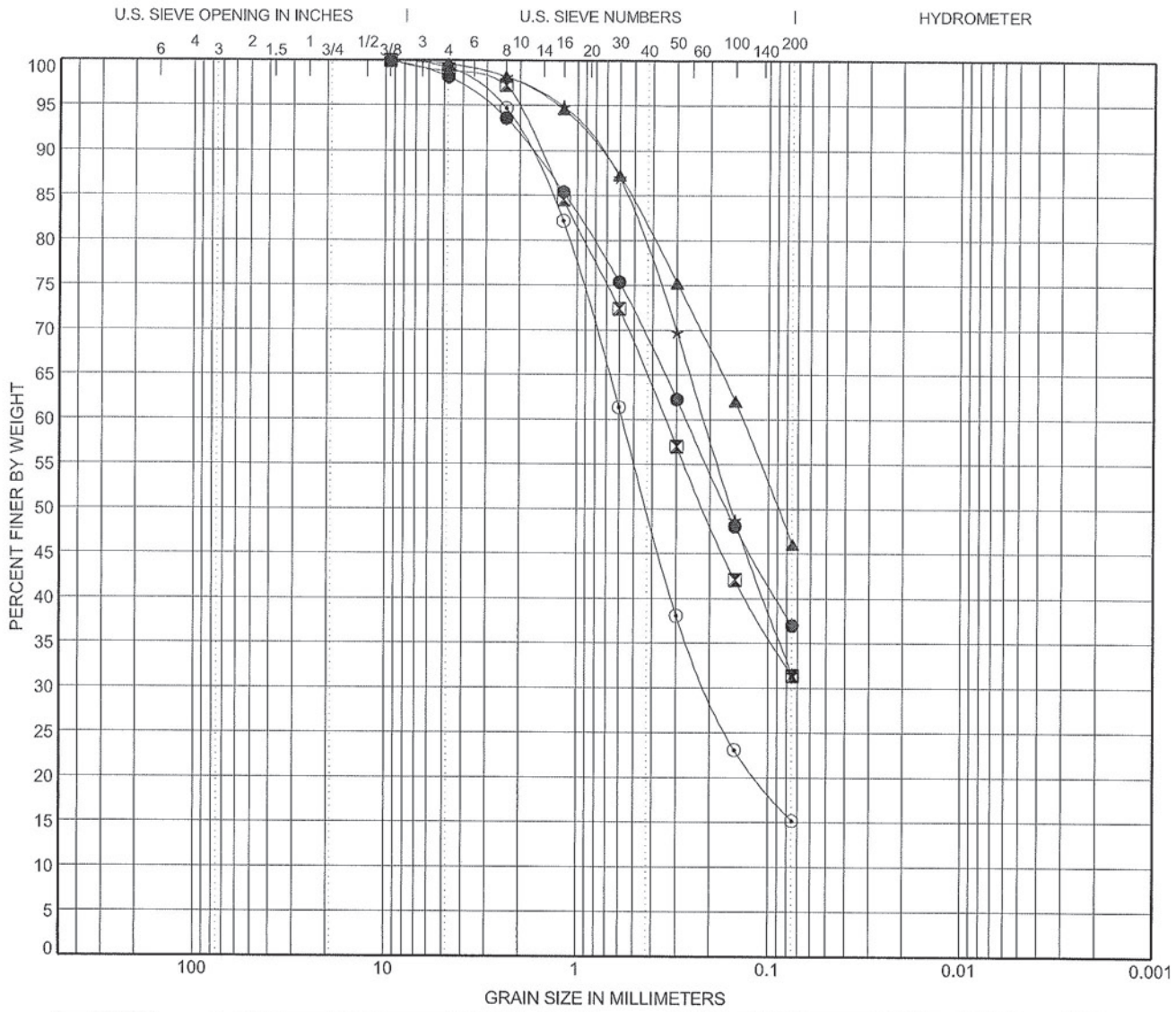
Shear deformation was recorded until a maximum of about 0.25-inch shear displacement was achieved. Ultimate strength was selected from the shear-stress vs. deformation data and plotted to determine the shear strength parameters. For test data, including sample density and moisture content, see Drawings No. B-3 through B-5, *Direct Shear Test Results,* and are summarized in the table below.

Table No. B-7, Summary of Direct Shear Test Result

Boring No.	Depth (feet)	Soil Description	Peak Strength Parameters	
			Friction Angle (degrees)	Cohesion (psf)
BH-3	5.0-6.5	Silty Sand (SM)	30	100
BH-7	5.0-6.5	Silty Sand (SM)	31	150
BH-10	10.0-11.5	Silty Sand (SM)	30	100

Sample Storage

Soil samples presently stored in our laboratory will be discarded 30 days after the date of this report, unless this office receives a specific request to retain the samples for a longer period.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Description	LL	PL	PI	Cc	Cu
●	BH- 1	0-5	SILTY SAND (SM)					
⊠	BH- 4	5-10	SILTY SAND (SM)					
▲	BH- 8	5-10	CLAYEY SAND (SC)					
★	BH- 9	0-5	SILTY SAND (SM)					
⊙	BH-11	10-15	SILTY SAND (SM)					

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BH- 1	0-5	9.5	0.268			1.8	61.2	37.0	
⊠	BH- 4	5-10	9.5	0.343			1.1	67.5	31.4	
▲	BH- 8	5-10	9.5	0.136			0.4	53.5	46.1	
★	BH- 9	0-5	9.5	0.216			0.4	68.0	31.6	
⊙	BH-11	10-15	9.5	0.576	0.206		0.8	84.0	15.2	

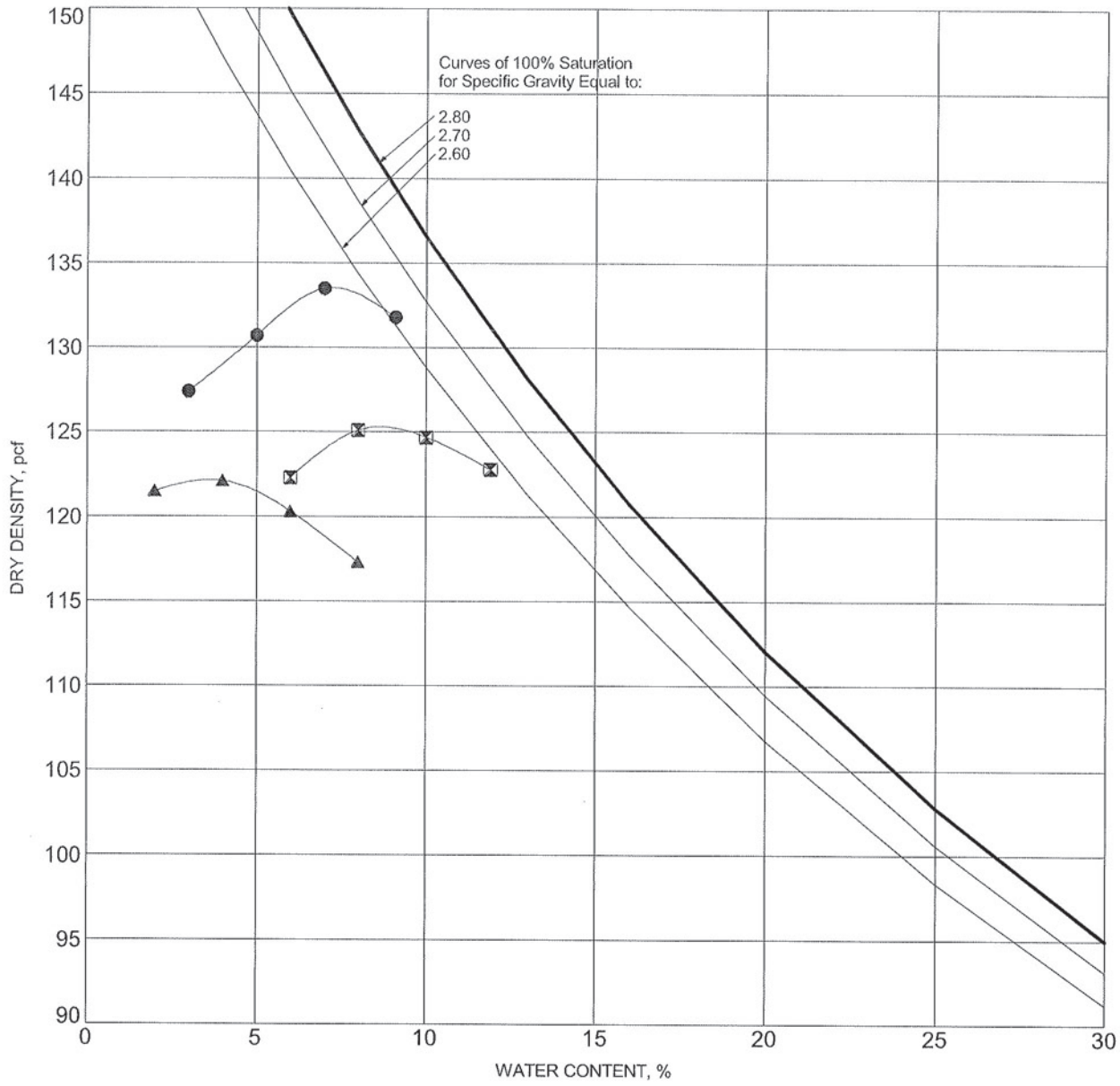
GRAIN SIZE DISTRIBUTION RESULTS

Converse Consultants

Commercial And Multi-Family Development
Planning Area 4; Approximately 43 Acre Site
City of Temecula, Riverside County, California
For: Cal-Paseo Del Sol, LLC

Project No. 12-81-173-01

Drawing No. B-1



SYMBOL	BORING NO.	DEPTH (ft)	DESCRIPTION	ASTM TEST METHOD	OPTIMUM WATER, %	MAXIMUM DRY DENSITY, pcf
●	BH- 1	0-5	SILTY SAND (SM), brown	D1557 - A	7	133.5
⊠	BH- 8	5-10	CLAYEY SAND (SC), dark brown	D1557 - A	8.5	125.5
▲	BH-11	10-15	SILTY SAND (SM), brown	D1557 - A	4.5	122.1

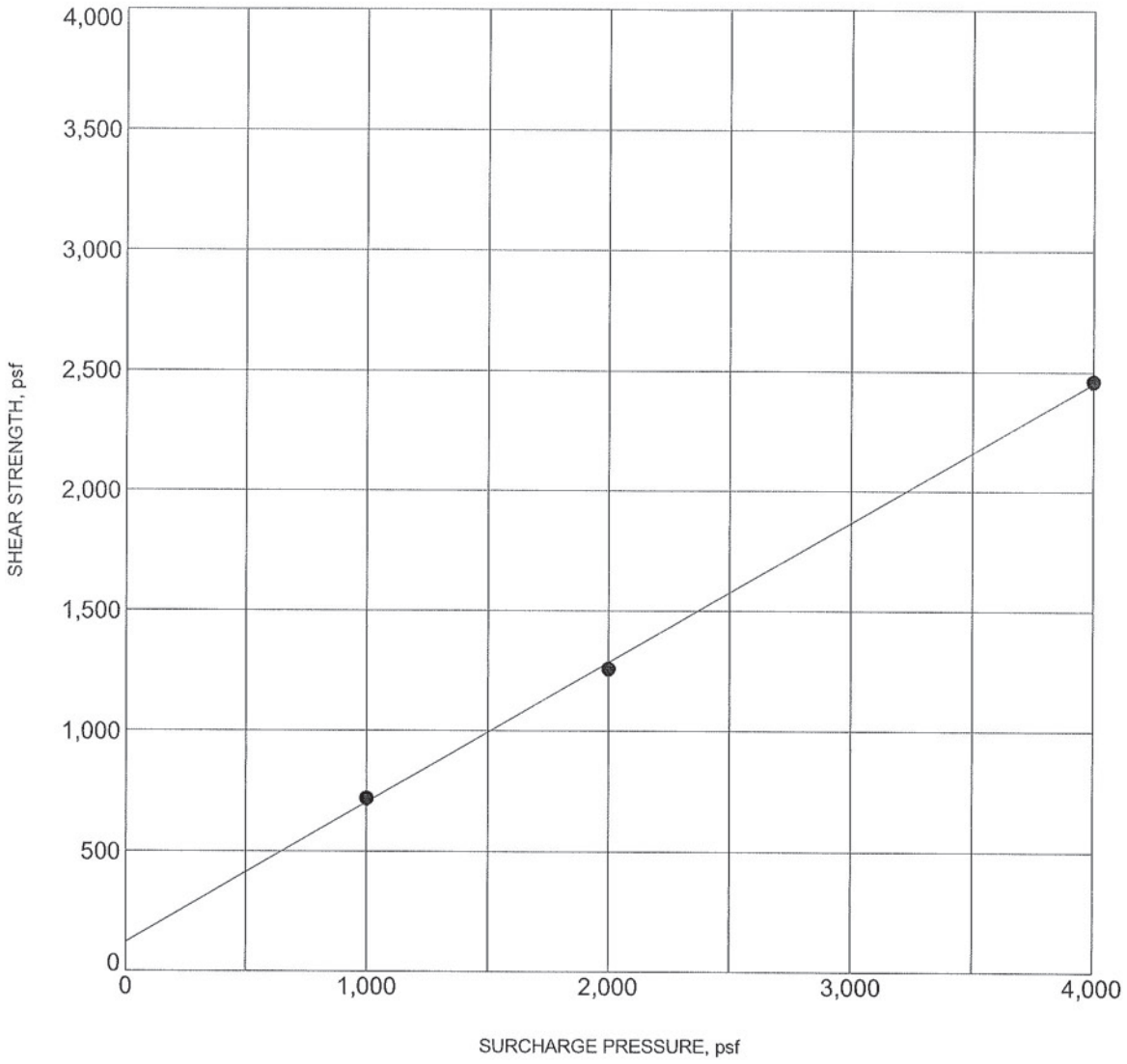
MOISTURE-DENSITY RELATIONSHIP RESULTS

Converse Consultants

Commercial And Multi-Family Development
Planning Area 4; Approximately 43 Acre Site
City of Temecula, Riverside County, California
For: Cal-Paseo Del Sol, LLC

Project No. 12-81-173-01

Drawing No. B-2



BORING NO.	:	**BH- 3**	DEPTH (ft)	:	**5.0-6.5**
DESCRIPTION	:	**SILTY SAND (SM)**			
COHESION (psf)	:	**100**	FRICTION ANGLE (degrees)	:	**30**
MOISTURE CONTENT (%)	:	**11.0**	DRY DENSITY (pcf)	:	**114.0**

NOTE: Ultimate Strength.

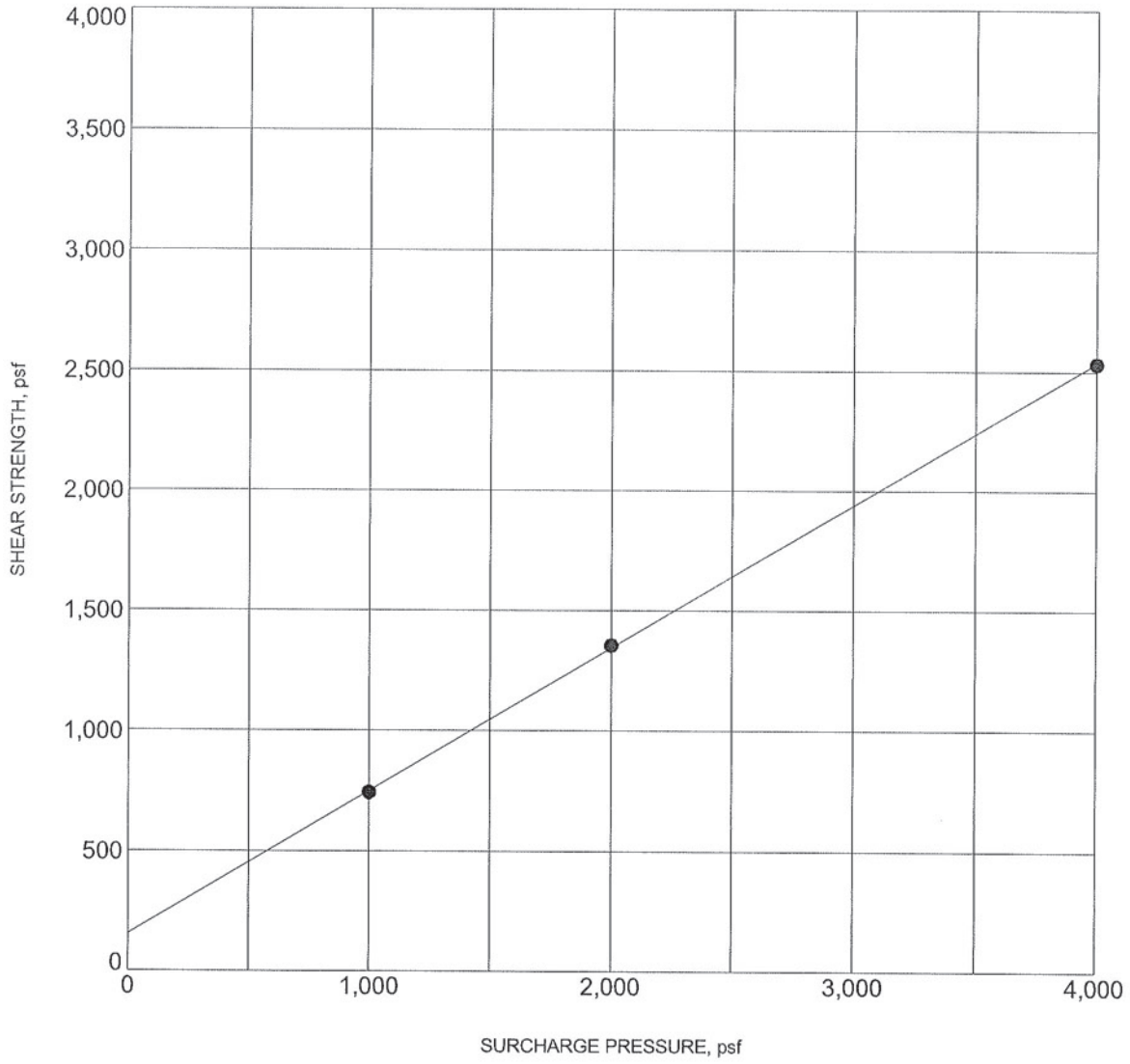
DIRECT SHEAR TEST RESULTS

Converse Consultants

Commercial And Multi-Family Development
Planning Area 4; Approximately 43 Acre Site
City of Temecula, Riverside County, California
For: Cal-Paseo Del Sol, LLC

Project No. **12-81-173-01**

Drawing No. **B-3**



BORING NO.	:	**BH- 7**	DEPTH (ft)	:	**5.0-6.5**
DESCRIPTION	:	**SILTY SAND (SM)**			
COHESION (psf)	:	**150**	FRICTION ANGLE (degrees)	:	**31**
MOISTURE CONTENT (%)	:	**11.7**	DRY DENSITY (pcf)	:	**111.5**

NOTE: Ultimate Strength.

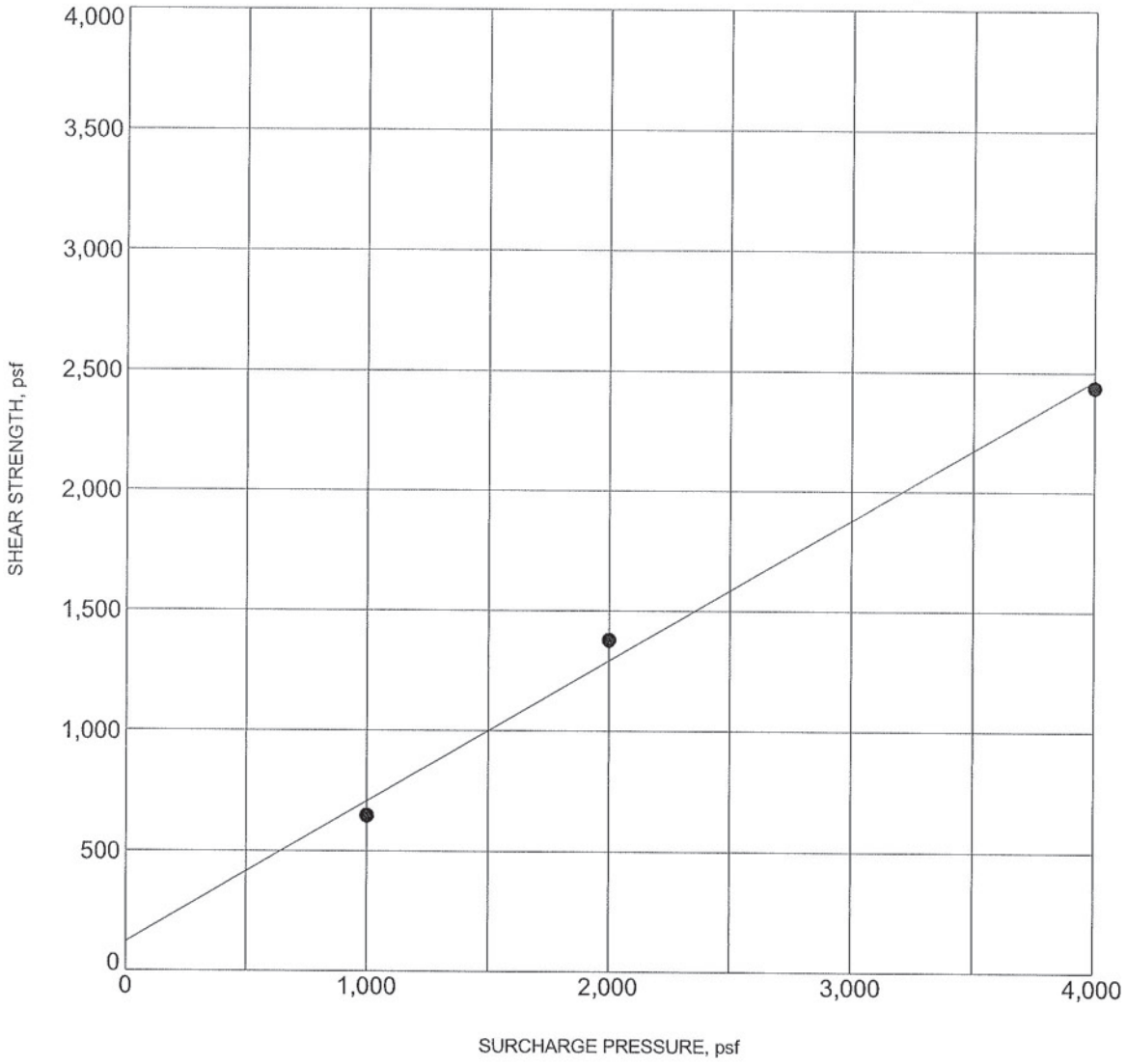
DIRECT SHEAR TEST RESULTS

Converse Consultants

Commercial And Multi-Family Development
Planning Area 4; Approximately 43 Acre Site
City of Temecula, Riverside County, California
For: Cal-Paseo Del Sol, LLC

Project No. **12-81-173-01**

Drawing No. **B-4**



BORING NO.	:	**BH-10**	DEPTH (ft)	:	**10.0-11.5**
DESCRIPTION	:	**SILTY SAND (SM)**			
COHESION (psf)	:	**100**	FRICTION ANGLE (degrees)	:	**30**
MOISTURE CONTENT (%)	:	**10.6**	DRY DENSITY (pcf)	:	**108.8**

NOTE: Ultimate Strength.

DIRECT SHEAR TEST RESULTS

Converse Consultants

Commercial And Multi-Family Development
Planning Area 4; Approximately 43 Acre Site
City of Temecula, Riverside County, California
For: Cal-Paseo Del Sol, LLC

Project No. **12-81-173-01**

Drawing No. **B-5**

APPENDIX C

LIQUEFACTION AND SETTLEMENT ANALYSES

APPENDIX C

LIQUEFACTION AND SETTLEMENT ANALYSES

The subsurface data obtained from exploratory borings were used to evaluate the liquefaction potential of the subject site. The boring logs are presented in Appendix A, *Field Exploration.*

Liquefaction analyses were performed using the SPT data collected from hollow stem auger borings (BH-1 and BH-11) in accordance with the method suggested in Special Publication No. 117A (CGS, 2008) and methods published by Southern California Earthquake Center (SCEC, 1999). Recorded non-standard penetration resistance from California sampler were converted to SPT blow counts by applying a conversion factor of 0.6 as suggested in Foundation Engineering Handbook (Fang, 1991). A disaggregated mean earthquake magnitude of M7.1 and peak ground acceleration (PGA) of 0.415g, where g is the acceleration due to gravity, was selected for this analysis. PGA was calculated equal to $S_{ds}/2.5$ per ASCE Standard 7-05 (ASCE, 2006) and the California Building Code (CBC, 2010).

Analysis for seismically induced settlement for the proposed site was performed utilizing SPT data in the LiquefyPro computer program (CivilTech, 2011). The results of our analyses are summarized in the following table.

Boring Number	Total Depth Explored (feet)	Approximate Depth of Major Liquefaction (feet)	Dynamic Settlement (inches)
BH-1	51.5	Below 45	0.52
BH-11	51.5	20 to 25	0.80

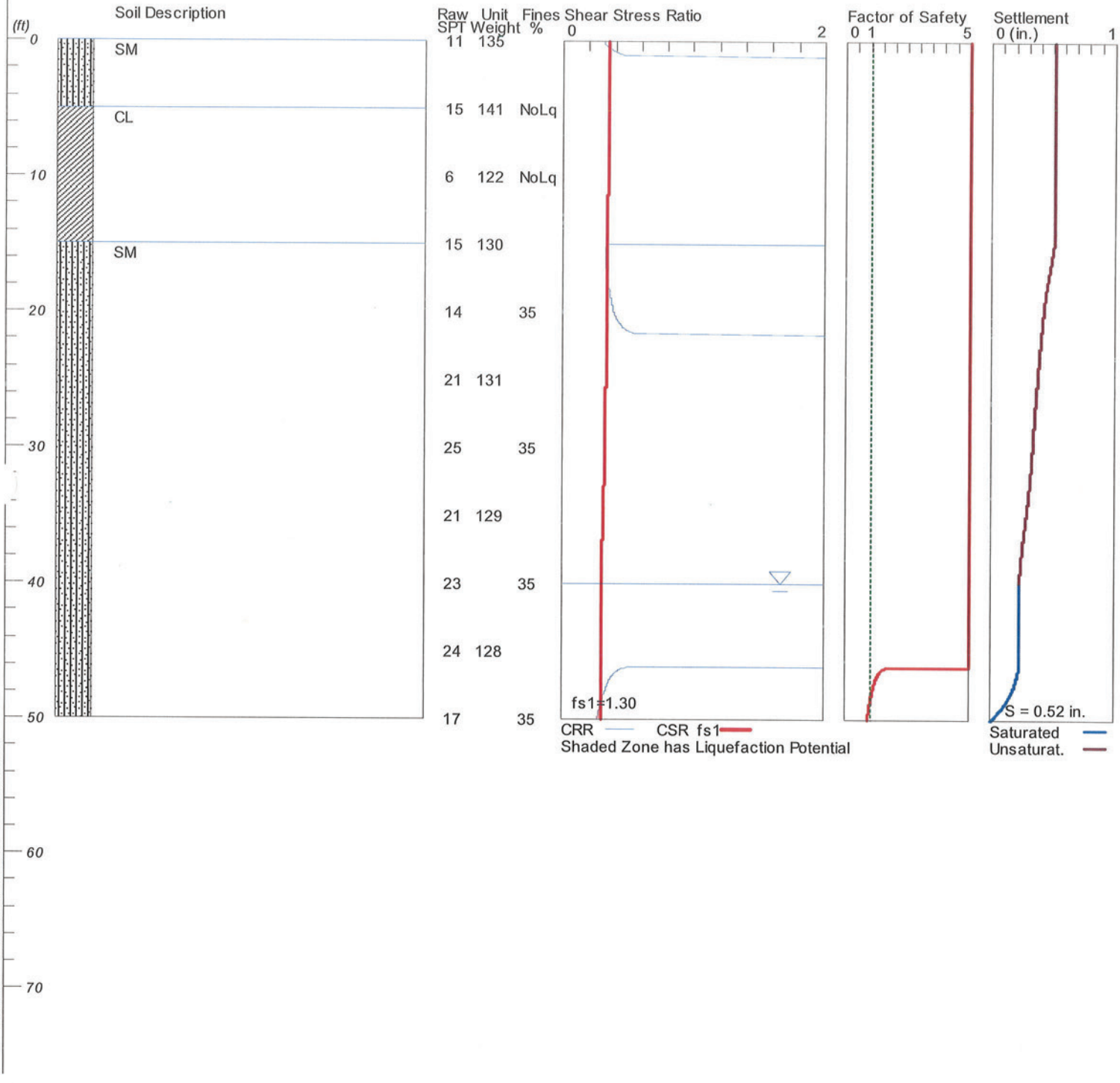
In general, the analysis indicates that liquefaction may occur within the proposed site at the depth shown on the above table. Settlement due to liquefaction is expected during a sufficiently large seismic event. The estimated dry settlement is negligible and the post-liquefaction settlement is in the range of 0.51 to 0.80 inches. Differential settlement can be estimated to be one half of the total settlement. Plate C-1 and C-2 shows the results of the liquefaction analysis.

LIQUEFACTION ANALYSIS

Liquefaction Analysis

Hole No.=BH-11 Water Depth=40 ft Surface Elev.=1102

Magnitude=7.1
Acceleration=0.415g

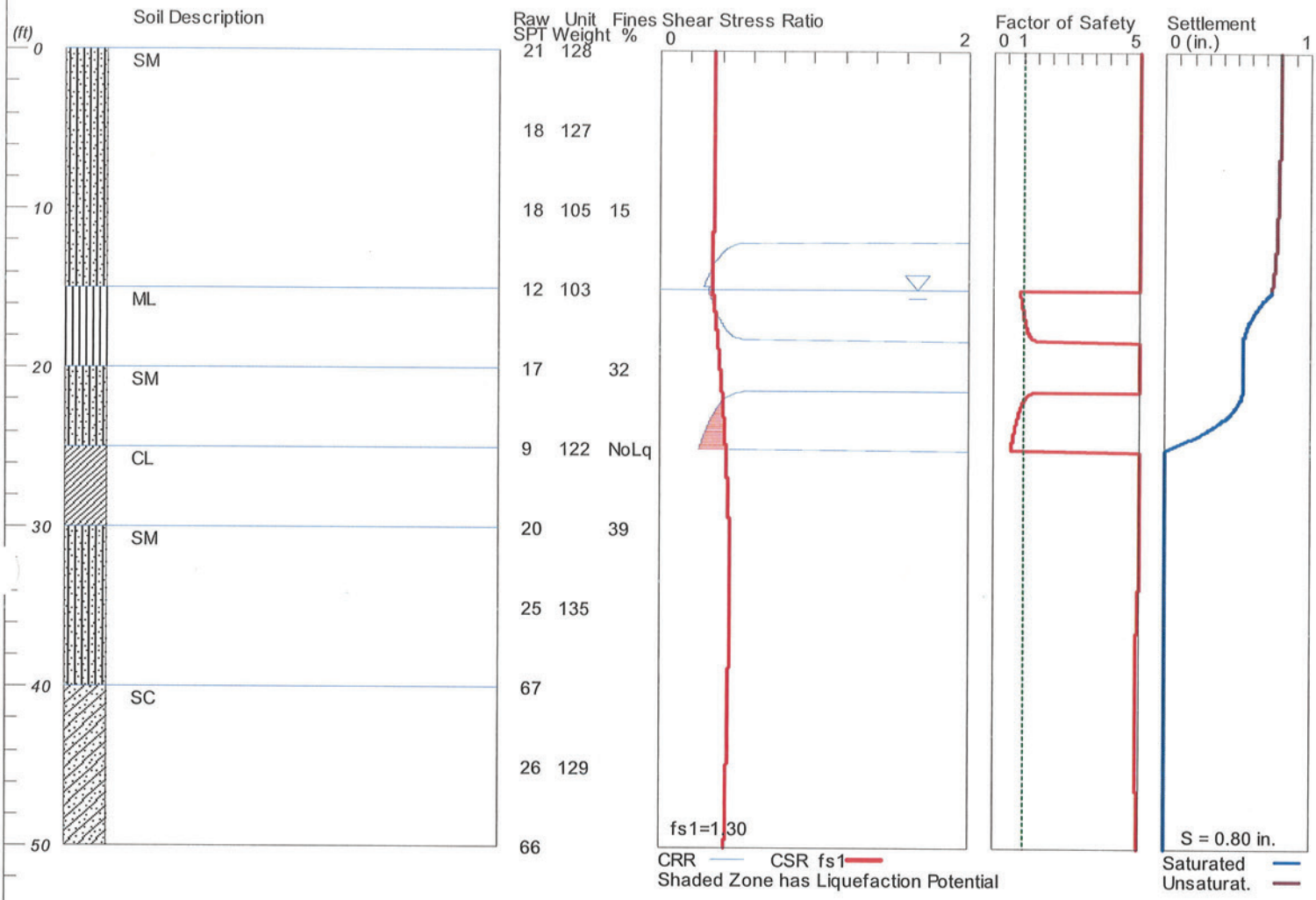


LIQUEFACTION ANALYSIS

Liquefaction Analysis

Hole No.=BH-11 Water Depth=15 ft Surface Elev.=1102

Magnitude=7.1
Acceleration=0.415g



LiquefyPro CivilTech Software USA www.civiltech.com

APPENDIX D

RECOMMENDED EARTHWORK SPECIFICATIONS

APPENDIX D

RECOMMENDED EARTHWORK SPECIFICATIONS

We recommend that the following be incorporated into the project earthwork specifications.

D1.1 Scope of Work

The work includes all labor, supplies and equipment required to construct the proposed pipeline residential development in a good, workman-like manner, as shown on the drawings and herein specified. The major items of work covered in this section include the following:

- Site Inspection
- Authority of Geotechnical Engineer
- Site Clearing
- Excavations
- Preparation of Fill Areas
- Placement and Compaction of Structural Fill
- Trench Backfill
- Observation and Testing

D1.2 Site Inspection

1. The Contractor shall carefully examine the site and make all inspections necessary, in order to determine the full extent of the work required to make the completed work conform to the drawings and specifications. The Contractor shall satisfy himself as to the nature and location of the work, ground surface and the characteristics of equipment and facilities needed prior to and during prosecution of the work. The Contractor shall satisfy himself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered. Any inaccuracies or discrepancies between the actual field conditions and the drawings, or between the drawings and specifications must be brought to the Owner's attention in order to clarify the exact nature of the work to be performed.

2. This *Geotechnical Investigation Report* may be used as a reference to the surface and subsurface conditions on this project. The information presented in this report is intended for use in design and is subject to confirmation of the conditions

encountered during construction. The exploration logs and related information depict subsurface conditions only at the particular time and location designated on the borings. Subsurface conditions at other locations may differ from conditions encountered at the exploration locations. In addition, the passage of time may result in a change in subsurface conditions at the exploration locations. Any review of this information shall not relieve the Contractor from performing such independent investigation and evaluation to satisfy himself as to the nature of the surface and subsurface conditions to be encountered and the procedures to be used in performing his work.

D1.3 Authority of the Geotechnical Engineer

1. The Geotechnical Engineer will observe the placement of compacted fill and will take sufficient tests to evaluate the uniformity and degree of compaction of filled ground.
2. As the Owner's representative, the Geotechnical Engineer will (a) have the authority to cause the removal and replacement of loose, soft, disturbed and other unsatisfactory soils and uncontrolled fill; (b) have the authority to approve the preparation of native ground to receive fill material.
3. The Civil Engineer and/or Owner will decide all questions regarding (a) the interpretation of the drawings and specifications, (b) the acceptable fulfillment of the contract on the part of the Contractor and (c) the matters of compensation.

D1.4 Site Clearing

1. Clearing and grubbing shall consist of the removal from structure areas to be graded of all existing utilities and vegetation.
2. Organic materials resulting from the clearing and grubbing operations shall be hauled away from the areas to be graded.

D1.5 Excavations

1. Based on the results of our field exploration, surface and subsurface soil materials for the proposed development are expected to be excavatable by conventional heavy-duty earth moving equipment. Although oversized materials were not encountered during drilling, scattered cobbles and possible boulders may be encountered during grading.

2. All undocumented fill soils shall be excavated to expose dense, undisturbed, previously documented, compacted fill or native alluvium.

3. The surface of the compacted fill, where not overlain by undocumented fill, may be locally loose, dry, or disturbed. Such areas shall be excavated to expose dense, undisturbed fill.

4. Any loose sediment deposited in the bottom of the retention basin and drainage channel shall be excavated to expose dense, undisturbed alluvium. The depth and limits of the overexcavation should be determined by the geotechnical consultant based on the field conditions encountered.

5. Any surface with an existing slope steeper than 5:1 (horizontal:vertical), which is to receive additional fills, should be benched to expose dense compacted fill and to create a horizontal surface for fill placement. The lowest bench should be at least 15 feet in width and tilted at least 2 percent into the slope. Subsequent benches should not exceed 4 feet in height. Benches should be widened as needed to maintain a fill width equal to or greater than the width of the compaction equipment in use in order to facilitate compaction of all portions of the fill.

6. If loose, dry, or otherwise unsuitable materials within the fill or alluvium are exposed by the remedial grading, those materials shall be excavated. The depth and limits of the overexcavation shall be determined by the geotechnical consultant based on the field conditions encountered.

7. If required by the design grades, the soils underlying building footings shall be overexcavated to provide a compacted fill thickness of at least 3 feet and the soils underlying slabs-on-grade shall be overexcavated to provide a compacted fill thickness of at least 1 foot. Over-excavations shall extend at least five (5) feet outside building footprints or a distance equal to the actual depth of removal, whichever is greater.

8. If required by the design grades, the soils underlying asphalt concrete or Portland concrete paving, including driveways, access roads, sidewalks, street areas, curbs and gutters and other flatwork shall be overexcavated to provide a compacted fill thickness of at least 2 feet. Such over-excavation shall extend at least two (2) feet beyond the pavement edges.

D1.6 Preparation of Fill Areas

1. The sub-grade in all areas to receive fill should be observed and approved by qualified geotechnical consultant. If any loose, soft, and unsuitable materials encountered during grading should be removed from the site.

2. The sub-grade in all areas to receive fill shall be scarified to a minimum depth of twelve (12) inches, the soil moisture adjusted to within three (3) percent of

optimum moisture content for granular soils and up to two (2) percent above optimum moisture content for fine-grained soils, then compacted to at least 90 percent of the laboratory maximum dry density as determined by ASTM Standard D1557 test method.

3. For shallow foundations and slab-on-grade, the upper 24 inches of the sub-grade soils should be non-expansive (expansion index less than 20).

D1.7 Placement and Compaction of Structural Fill

1. Compacted fill placed for the support of footings and slabs-on-grade will be considered structural fill. Structural fill may consist of approved on-site soils or imported fill that meets the criteria indicated below.

2. Fill consisting of selected on-site earth materials or imported soils approved by the Geotechnical Engineer shall be placed in layers on approved earth materials. Soils used as compacted structural fill shall have the following characteristics:

   a. All fill soil particles shall not exceed three (3) inches in nominal size, and shall be free of organic matter and miscellaneous inorganic debris and inert rubble.

   b. Gravel larger than 1-inch should not be placed within the top one (1) foot of compacted fill below footings and slab-on-grade.

   c. Rocks larger than one (1) inches in the largest dimension should not be placed within the upper 18 inches of sub-grade soil under asphalt concrete paved area.

   d. Imported fill materials shall have an Expansion Index (EI) less than 20. All imported fill should be compacted to at least 90 percent of the laboratory maximum dry density (ASTM Standard D1557) and moisture conditioned to within three (3) percent of optimum moisture content for granular soils and up to two (2) percent above optimum moisture content for fine-grained soils.

3. Fill soils shall be evenly spread in maximum 8-inch lifts, moisture conditioned as necessary, mixed and compacted to at least the density specified below. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Engineer.

4. All fill placed at the site shall be compacted to at least 90 percent of the laboratory maximum dry density as determined by ASTM Standard D1557 test method. Coarse-grained soils shall be moisture conditioned to within three (3) percent of the optimum moisture content and up to two (2) percent above optimum moisture content for fine-grained soils. At least the upper 12 inches of sub-grade soils

underneath the concrete apron and asphalt concrete should be compacted to at least 95 percent of the laboratory maximum dry density.

5. The upper 12 inches of soil below footing should be compacted to at least 95 percent of laboratory maximum dry density.

6. Slopes shall be constructed with fill placed in horizontal lifts, and compacted to the slope face. Finished slopes shall be compacted by appropriate means to achieve at least 90 percent compaction at the slope face.

7. Representative samples of materials being used, as compacted fill will be analyzed in the laboratory by the Geotechnical Engineer to obtain information on their physical properties. Maximum laboratory density of each soil type used in the compacted fill will be determined by the ASTM Standard D1557 test method.

8. Fill materials shall not be placed, spread or compacted during unfavorable weather conditions. When site grading is interrupted by heavy rain, filling operations shall not resume until the Geotechnical Engineer approves the moisture and density conditions of the previously placed fill.

D1.8 Trench Backfill

The following specifications are recommended to provide a basis for quality control during the placement of trench backfill.

1. Trench excavations to receive backfill shall be free of trash, debris or other unsatisfactory materials at the time of backfill placement.

2. The final sub-grade surface should be level, firm, uniform, and free of loose materials and properly graded to provide uniform bearing and support to the entire section of the pipe placed on bedding material. Protruding oversize particles larger than two (2) inches in dimension, if any, should be removed from the trench bottom and replaced with compacted on-site materials.

3. Pipe design generally requires sand equivalent of 30 or greater for bedding materials. Specifications for bedding materials including required backfill requirements surrounding the pipe should be specified by the design engineer in accordance with the pipe manufacturer guideline.

4. Excavated site soils free of oversize particles greater than 3 inches and deleterious materials may be used to backfill the trench zone up to the sub-grade level.

5. Rocks larger than one (1) inch should not be placed within 12 inches of the top of

the pipeline or within the upper 12 inches of pavement or structure sub-grade. No more than 30 percent of the backfill volume shall be larger than 3/4-inch in largest dimension diameter and rocks shall be well mixed with finer soil.

6. Trench backfill shall be compacted to a minimum of 90 percent of the laboratory maximum dry density as per ASTM Standard D1557 test method.

7. At least the upper one (1) foot of trench backfill underlying pavement should be compacted to at least 95 percent of the laboratory maximum dry density as per ASTM D1557 test method.

8. Trench backfill shall be compacted by mechanical methods, such as sheepsfoot, vibrating or pneumatic rollers, or mechanical tampers, to achieve the density specified herein. The backfill materials shall be brought to within three (3) percent of optimum moisture content for coarse-grained soils and up to two (2) percent optimum moisture content for fine-grained soils, then placed in horizontal layers. The thickness of uncompacted layers should not exceed eight (8) inches. Each layer shall be evenly spread, moistened or dried as necessary, and then tamped or rolled until the specified density has been achieved.

9. The Contractor shall select the equipment and processes to be used to achieve the specified density without damage to adjacent ground and completed work.

10. The field density of the compacted soil shall be measured by the ASTM Standard D1556 or ASTM Standard D2922 test methods or equivalent.

11. Observation and field tests should be performed by Converse during construction to confirm that the required degree of compaction has been obtained. Where compaction is less than that specified, additional compactive effort shall be made with adjustment of the moisture content as necessary, until the specified compaction is obtained.

12. It should be the responsibility of the Contractor to maintain safe conditions during cut and/or fill operations.

13. Trench backfill shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests by the project's geotechnical consultant indicate that the moisture content and density of the fill are as previously specified.

D1.9 Observation and Testing

1. During the progress of earthwork for construction of the project, the Geotechnical Engineer will provide observation of the fill placement operations.

2. Field density tests will be made during earthwork operations to provide an opinion on the degree of compaction being obtained by the Contractor. Where compaction of less than specified herein is indicated, additional compactive effort with adjustment of the moisture content shall be made as necessary, until the required degree of compaction is obtained.

3. A sufficient number of field density tests will be performed to provide an opinion to the degree of compaction achieved. In general, density tests will be performed on each one-foot lift of fill, but not less than one for each 500 cubic yards of fill placed.