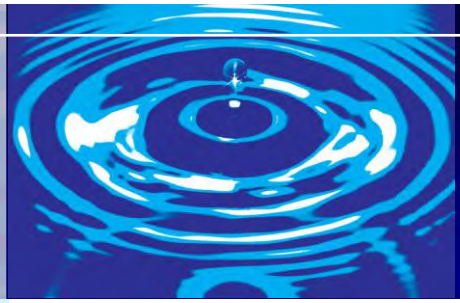

Preliminary CEQA Drainage Study

Sweetwater Place
San Diego, California

June 2014
January 2015
March 2015
July 2015
PDS2014-TM-5588 RPL-1; STP-14-015 RPL-1;
GPA-14-003; REZ-14-003; ER-14-19-005

Prepared for:

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Declaration of Responsible Charge

I, hereby declare that I am the Civil Engineer for this Drainage Study, that I have exercised responsible charge over this Drainage Study as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with current design. I attest to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based. The plans and specifications in this Drainage Study are not for construction purposes; the contractor shall refer to final approved construction documents for plans and specifications.

Jay Sullivan
RCE 77445

March 20, 2014

Table of Contents

List of Tables

Table of Appendices

Section 1. Project Location and Scope

1.1. Project Location

The Project site is located in the community of Spring Valley within the unincorporated area of southwestern San Diego County. The approximately 20-acre (gross)/17.1-acre (net) Project site is located at the northwestern corner of Sweetwater Springs Boulevard and Jamacha Boulevard. The site address is 2657 Sweetwater Springs Boulevard; the County Assessor Parcel Number (APN) is 505-231-36. A vicinity map is found Appendix A.

The site was originally designated as future right-of-way (ROW) for extension of State Highway 54 (SR 54). The California Department of Transportation (Caltrans) has since abandoned the SR 54 extension and sold the property at auction as excess right-of-way. The new (current) owner of the Project site is SAM Sweetwater, LLC. The Project site was previously utilized as a retail nursery (Evergreen Nursery), which has since ceased operation and vacated the site. The site is currently 100% disturbed due to the previous use.

Existing land uses in the Project area include undeveloped land to the west/southwest across Sweetwater Springs Boulevard, which is planned for a residential development known as "The Pointe;" however, a number of homes associated with this development have already been constructed. Other uses include a commercial strip mall and gas station to the southeast; a vegetated County detention basin further to the southeast; a self-storage facility, Mardi Gras Café and Market building, and Sweetwater Lodge mobile-home park to the south across Jamacha Boulevard; a vacant lot adjacent to northwest; and, a business park adjacent to the north. Single-family residential uses also exist further to the north and northeast/east.

1.2. Scope of Report

This report will deal specifically with proposed improvements associated with the Sweetwater Place residential development. This study develops 100-year storm peak flows and volumes for the pre and post development conditions to identify the hydrologic and hydraulic effect of the proposed project. The proposed BMPs (bioretention and permeable pavement) are discussed within this report in the context of 100-year peak flow attenuation.

This report does not discuss required water quality measures to be taken on an interim level during construction, or those necessary to be implemented on a permanent basis. That discussion can be found under separate cover in the project "Storm Water Management Plan" (SWMP). Additionally, this report does not discuss hydromodification mitigation requirements and/or exemptions. That discussion can be found in the SWMP as well.

Section 2. Study Objectives

The specific objectives of this study are as follows:

- Quantify the pre and post development 100-year peak flow rates and flow volumes for the project site,
- Quantify the 100-year peak flow rate for project site run-on from the northerly commercial development,
- Quantify the hydraulic capacity of all existing and proposed storm drain infrastructure, as it compares to the 100-year storm event,
- Quantify the proposed on-site peak flow attenuation provided by permeable pavement and bioretention areas for the project site,
- Address CEQA's guidelines for determining significance.

Section 3. Project Description

3.1. Project Site Information

The Project site is identified in the Spring Valley Community Plan as a "Special Study Area (SSA) – Sweetwater Springs Boulevard and Jamacha Boulevard." The SSA totals approximately 34 acres, extending northward of the Project site across Calavo Drive (two non-contiguous sites); however, the proposed Project site represents approximately 20.35 acres of the overall SSA. The remaining land within the SSA is not part of the proposed Project. The SSA designation requires that additional analysis be prepared to determine an appropriate land use. Additionally, the County provides specific goals and policies intended to guide future development of properties designated as SSA.

The existing County of San Diego General Plan land use designation is Public/Semi-Public with an underlying land use designation of RL-80 (Rural Lands). A General Plan Amendment is required to change the current General Plan designator from RL-80 to a Village Residential (VR-7.3) designator. The Regional Category of Village applies to the property; no change to the Regional Category is proposed with the Project. The Project site is currently zoned as S-90 (Holding Zone). A Rezone is requested to change the zone from S-90 to a RV-Variable Family Use Regulation to allow for the proposed condominium units.

Elevations on site range from approximately 492 feet above mean sea level (MSL) near the northeast property corner to 441 feet above MSL near the southwest property corner. Access to the site will be provided off Jamacha Boulevard, at Folex Way; and off Sweetwater Springs Boulevard. Refer to Appendix A for an aerial exhibit.

Based on the Natural Resources Conservation Service's (NRCS) Websoil Survey, the project site is comprised of approximately 90-percent Diablo clay (DaE), with slopes ranging from 15 to 30 percent (hydrologic soil type D); and approximately 10-percent Huerhuero loam (HrD2), with slopes ranging from nine to 15 percent (hydrologic soil type D).

The Federal Emergency Management Agency (FEMA) has not mapped any Special Flood Hazard Areas (SFHAs) for the project site. The entire project site lies within un-shaded Zone X, which correlates with areas determined to be outside the 500-year floodplain. An exhibit is provided in Appendix A of this report.

3.2. Pre Development Conditions

The 17.9-acre project site contains approximately 4.5 acres of impervious cover under existing conditions. This existing impervious area consists of several concrete pads and drive aisles. The site was previously used as a landscape and gardening nursery. No buildings or other vertical construction currently remains. Runoff drains southwesterly via a combination of sheet flow and open channel flow (rock-lined flood control channel).

3.2.1 Project Site Run-On

An existing commercial development is located immediately north of the project site. A 54-inch reinforced concrete pipe (RCP) storm drain discharges runoff from this commercial development onto the project site approximately midway along the northerly project boundary. Project site run-on from the 54-inch RCP is conveyed southwesterly across the project site via open channel flow (rock-lined flood control channel).

The northerly commercial area is topographically higher than the project site. As such, the project site receives sheet flow run-on from the vegetated slope separating the properties, in addition to the concentrated run-on from the 54-inch RCP.

A storm water field inspection was performed on October 11, 2013 to investigate the upstream tributary area. Refer to the Off-Site Hydrologic Work Map found in Appendix B for graphical representation of the upstream tributary area.

3.2.2 Discharge Locations

A majority of the site (15.6 acres, 77 percent) drains to the southwesterly corner of the project site, where a 60-inch reinforced concrete pipe (RCP) and headwall convey runoff off-site. A small portion of the site (2.3 acres, 13 percent) drains southwesterly to Sweetwater Springs Boulevard (westerly project boundary), where runoff discharges as sheet flow. See below for a discussion on the regional detention facility to which project site runoff drains into.

3.2.3 Storm Water Infrastructure

An existing 60-inch RCP with headwall is located in the southwesterly corner of the site. This pipe and headwall represent the project outfall location under pre and post development conditions. This 60-inch pipe transitions to dual 36-inch RCPs at the road right-of-way and conveys runoff southerly beneath Jamacha Boulevard, discharging to a regional detention facility located south of the Jamacha Boulevard. Refer to Section 3.3 for further discussion pertaining to the proposed improvements in this area.

An existing concrete lined channel is located on-site, along the easterly project boundary. This concrete channel conveys runoff southerly to an existing F-Type inlet, which discharges runoff to Jamacha Boulevard via a curb outlet. Alterations to this existing concrete channel or its tributary drainage area (northerly storage facility) are not proposed.

A regional detention facility is located immediately adjacent to the southeast corner of the Jamacha Boulevard, Sweetwater Springs Boulevard intersection. Storm water runoff from the project site drains to this detention facility via existing storm drain pipes beneath Jamacha Boulevard (dual 36-inch RCP) and via overland flow under pre and post development conditions. This regional detention facility receives runoff from approximately 590 acres, of which the 17.9-acre project site represents 3-percent.

3.3. Post Development Conditions

The Project proposes a 122-unit residential condominium development with exclusive backyards, attached two-car garages, 2.08-acre public community park, private and group useable open space, a riding and hiking trail, pedestrian pathways, and a series of greenbelt open areas. The units will be accessed by a series of 24-foot wide access drives within the interior of the property. Conceptual architectural design for the Project has been prepared, offering various housing styles and sizes. Additionally, ornamental landscaping will be provided within the onsite common areas, along Project roadways, and at the Project entryways to visually enhance the proposed development and blend the site into the existing surrounding setting. A Tentative Map/Condominium, Site Plan, and Grading Plan will be required to implement the proposed development.

Open Space: Integrated into the development will be private useable open space areas [minimum 350 square feet (s.f.) per unit] adjoining each unit, along with group useable open space areas located within the public park (minimum of 150 s.f. per unit). Each unit will have a fenced exclusive use backyard area.

Internal Drives: Private internal drives will be improved to 24 feet in width to enable circulation and fire protection service. The maximum length of the dead-end drives will be 150 feet; no cul-de-sacs are proposed at these locations. A five-foot wide sidewalk is proposed along one side of the main interior roadway, ultimately providing a pedestrian link between Jamacha and Sweetwater Springs Boulevards.

Parks and Trails: The Project proposes to dedicate, improve, and maintain a 2.08-acre public community park for use by both Sweetwater Place residents and the general public. The public park will be a major focal area for Community gathering. Access to the Public Park and 29- parking spaces is provided via a proposed public road extending easterly from Sweetwater Springs Boulevard. The public park will satisfy County Park Land Dedication Ordinance (PLDO) requirements of the project, plus the group useable open space acreage requirement per the site's zoning regulations. Private useable open space will also be provided within the exclusive back yard areas of the residents.

The Project proposes an 8-foot wide public riding and hiking trail (within a 12-foot wide graded easement) along the northern side of Jamacha Boulevard to enhance the existing public pedestrian network. A series of pedestrian pathways connect and circulate throughout the project site and Public Park. Access from the Jamacha Road public trail to the residential portion of the project and Public Park has been provided. A 10-foot wide existing (cleared) trail easement is also proposed along the eastern Project boundary for future construction of a public trail by others; no physical trail improvements are proposed with the Project along this easement.

Public Street Improvements: Main access will occur from Jamacha Boulevard at the intersection of Folex Way. The intersection will be signalized, and a project entrance will be constructed to extend into the site from the intersection with Jamacha Boulevard that will terminate in a cul-de-sac. An exclusive eastbound left-turn lane is proposed on

Jamacha Boulevard, and the existing exclusive northbound left-turn lane will be restriped to a shared thru/left-turn lane.

Secondary access is proposed off of Sweetwater Springs Boulevard via extension of an onsite public roadway terminating in a cul-de-sac. This road will provide access to the proposed public park and associated parking area (29 spaces total). Improvements to Sweetwater Springs Boulevard will include construction of a southbound left-turn pocket, median, and installation of stop signs at the intersection to facilitate ingress to and egress from the site. Additionally, the Project proposes to improve Jamacha Boulevard and Sweetwater Springs Boulevard to a 55-foot half-width with curb, gutter, and sidewalks, and a bike lane.

Fire, Water, Sewer, Storm Drain: The site will be served by the San Miguel Fire Protection District for fire service. The site will be served by the Otay Water District for public water service and the San Diego County (Spring Valley) Sanitation District will provide public sewer service. The Project proposes improvements to capture storm water flows from offsite properties that currently flow aboveground across the site within a proposed underground 54-inch pipe for outflow to an existing storm drain at the southwest corner of the site near Jamacha Boulevard. Onsite stormwater flows will discharge from the Project site in two locations. The majority of the site will discharge to the existing storm drain system within Jamacha Boulevard, consistent with pre-development conditions. The westerly portion of the site will discharge to Sweetwater Springs Boulevard, and flows will continue southwesterly via curb and gutter, consistent with pre-development conditions.

3.3.1 Project Site Run-On

The existing off-site 54-inch RCP will be extended through the project site and connected to the 60-inch RCP located in the southwesterly corner. A proposed concrete ditch will intercept slope run-on from the area immediately north of the project site and convey this off-site flow to Sweetwater Springs Road.

3.3.2 Discharge Locations

Under post development conditions, runoff will discharge from the site as pipe flow in the southwesterly corner and as overland flow to Sweetwater Springs Boulevard (westerly project boundary), consistent with pre development conditions. Peak flow attenuation will be provided via proposed bioretention areas and permeable pavement sections. Under proposed conditions, discharge from the project site will not be increased at either location, as compared to existing conditions.

3.3.3 Storm Water Infrastructure

The rock-lined flood control channel conveying runoff southwesterly across the project site will be replaced with a pipe to accommodate proposed improvements. The existing off-site 54-inch RCP storm drain that discharges into the rock-lined channel will be extended through the site such that off-site runoff is not co-mingled with on-site runoff. The new, on-site 54-inch RCP will directly connect to the existing 60-inch RCP located

in the southwesterly corner of the site. A 36-inch RCP with headwall will be installed immediately adjacent to this connection such that overland release is provided for project site runoff draining to the bioretention areas located in the southwest corner (adjacent to Jamacha Boulevard.

An on-site storm drain system consisting of inlets and pipes is proposed to convey project site runoff into the proposed bioretention areas. Refer to the Proposed Hydrologic Work Map found in Appendix C. Sub-drains will be included in the bioretention areas and permeable pavement sections. These perforated sub-drains will connect directly, via hard-lined pipes, to the project outfall at Jamacha Boulevard. The proposed bioretention area adjacent to Sweetwater Springs Boulevard will be fitted with a sub-drain that discharges to the street curb and gutter, consistent with pre development conditions (in terms of discharge location).

A proposed 24-inch RCP culvert will be extended beneath the project site entrance off Jamacha Boulevard. This culvert is sized and located (diameter and invert elevation) for 100-year conditions. The intent of this culvert is to provide flood control conveyance of flow from the easterly bioretention areas to the westerly bioretention areas (adjacent to Jamacha Boulevard) and on to the southwesterly project outfall (the primary conveyance mechanism is the bioretention sub-drains).

As mentioned in Section 3.2.3, no alterations to the concrete channel or area contributing flow to the concrete channel along the easterly project boundary are proposed. Under post development conditions, this existing concrete channel will continue to convey off-site runoff to Jamacha Boulevard, consistent with pre development conditions.

The proposed project will continue to discharge runoff to the regional detention facility located at the southeast corner of the Jamacha Boulevard, Sweetwater Springs Boulevard intersection, consistent with pre development conditions. Post development project site flows will be attenuated to pre development levels so as not to disrupt the current functionality of this regional detention facility.

Section 4. Methodology

4.1. Hydrology

Advanced Engineering Solutions (AES – HydroWIN 2013) was used to model the hydrologic characteristics of the project site under pre and post development conditions. This software utilizes the Rational Method and conforms to the hydrologic methodologies outlined in the San Diego County Hydrology Manual (SDCHM, June 2003). The Rational Method is a physically-based model that calculates peak flow rates (Q) as a function of runoff coefficients (c), rainfall intensities (I), and drainage areas (A):

$$Q = c * I * A$$

Runoff coefficients (c) where established based upon Table 3-1 from the SDCHM (page 3-6). Given the amount of imperious cover under existing conditions, weighted runoff coefficient calculations were developed and are included in Appendix B. Under proposed conditions, Table 3-1 from the SDCHM has been referenced using 10.9 dwelling units per acre (DU/ac) and hydrologic soil type D. This represents a conservative approach, as the proposed development includes 122 units on 15.4 acres (7.9 DU/ac.).

Time of concentration and rainfall intensities were developed internally within the AES software. The 'San Diego' AES module was used for this analysis and conforms to the methodologies described in the SDCHM. Refer to Appendices B and C for existing and proposed condition calculations, respectively.

Area delineations were developed using project specific 1-foot contour topography. Off-site delineations were developed using a combination of field survey and USGS topography. Refer to the hydrologic work maps found in Appendices B and C.

4.2. Runoff Volume

Pre and post development runoff volumes have been calculated using the standard volume equation:

$$VOL = (P_6)_{100} * C * A$$

The difference between pre and post development runoff volume has been compared to the provided storage volume under post development conditions.

4.3. Hydraulics

Hydraulic modeling has been performed in accordance with the San Diego County Drainage Design Manual (July 2005).

Bentley's Culvert Master has been used for design of the proposed headwalls located at Nodes 203 and 205. Culvert Master solves for inlet and outlet control using built in FHWA Hydraulic Design of Highway Culverts (HDS-5) methodology.

The Manning's equation has been used to size the proposed RCP storm drain conveying off-site flow through the project site, as well as on-site storm drain conveying project runoff to the proposed bioretention areas. Allowances have been made in the permitted depth of flow within the proposed pipes to account for junction losses.

Section 5. Results and Conclusions

5.1. Hydrologic Results

The tables below summarize the hydrologic results under existing and proposed conditions for the project site's contribution to the watershed. The storage volume associated with the proposed bioretention areas and permeable pavement sections far exceeds the delta runoff volume between existing and proposed conditions. Calculations are included in Appendices B and C.

Table 5-1 Summary of Pre vs. Post Development Peak Flow Rates: Project Site

Discharge Location	C	I	A	Q_{100}	Mitigated Q_{100}	Velocity
-	-	(in/hr)	(ac)	(cfs)	(cfs)	(ft/sec)
Pre Development Condition						
Sweetwater Springs Blvd. Node 103	0.64	3.51	2.3	5.1	-	1.7
Jamacha Blvd. Node 204	0.47	3.52	15.6	25.6	-	13.2
Total	-	-	**17.9**	**30.7**	-	-
Post Development Condition						
Sweetwater Springs Blvd. Node 103	0.60	3.61	2.9	6.5*	5.1	1.7
Jamacha Blvd. Node 130	0.60	3.70	15.0	40.0*	25.6	13.2
Total	-	-	**17.9**	**46.5***	**30.7**	-

**Un-mitigated peak flow rate*
Discharge velocities will not be impacted by the proposed development. At Jamacha, discharge is via the 60" pipe and post development peak flows are not increased. At Sweetwater Springs, discharge will occur was weir flow (from the bioretention basins) in the event the sub-drains clog. Under normal operation, runoff will discharge from the bioretention sub-drain to the curb and gutter of Sweetwater Springs Boulevard, consistent with pre development conditions.

The un-mitigated values above do not account for the storage volume provided by the proposed bioretention and permeable pavement. Refer to Table 5-2 for a comparison of pre development, post development, and proposed storage volumes.

Table 5-2 Summary of Pre vs. Post Development Runoff Volume

	100-year Runoff Volume (ft^3)
Pre Development Condition	95,876
Post Development Condition	116,959
Delta Runoff Volume	**18,083**
Proposed Storage via Bioretention and Permeable Pavement	**57,377**

The pre and post development runoff values tabulated above were determined using a weighted runoff coefficient, the 100-year, 6-hour rainfall depth (3 inches), and the project site area. Table 5-2 above shows the extensive storage volume provided by the proposed BMPs, relative to difference in runoff volume between pre and post development conditions.

As shown in the project specific Hydromodification Mitigation report, found under separate cover, the proposed BMP's dramatically reduce the peak flow discharge from the site during the 2-, 5-, 10-, and 25-year storm events (on the order of 90-percent).

The continuous simulation results show that peak flow discharge for the 25-year event is reduced almost 90-percent when compared to pre development conditions. The provided storage volume on-site under post development conditions is approximately three times the delta runoff volume under pre and post development conditions. Based on these results and design, the assertion that 100-year peak flow rates have been mitigated to pre development conditions is valid and warranted.

5.2. Hydraulic Results

The table below summarizes the hydraulic results. Proposed storm drains have been sized to avoid pressure flow during 100-year, peak flow conditions. The two proposed headwalls have been sized to convey post development 100-year peak flow rate without overtopping.

Table 5-3 Hydraulic Summary

Location	Facility	HW/D (ft)	Q100 (cfs)	Velocity (ft/sec)
Pre Development Condition				
S.W. Corner	60" RCP w/HDWL	1.31	172.8	13.2
Post Development Condition				
Culvert Beneath Access Road off Jamacha Blvd.	24" RCP w/HDWL	1.17	16.9	11.8
On-site Storm Drains	24" RCP	1.5*	20.6 [1]	8.2 [1]
S.W. Corner (adjacent to 60" RCP)	36" RCP w/HDWL	0.79	24.9	8.6
Northerly Project Boundary	V-Ditch	0.62*	3.2	4.2**
Southwesterly through the site	54" RCP	2.93*	149.3	13.6

**Normal depth in v-ditch or pipe*

***Discharges to Sweetwater Springs Blvd. via an under sidewalk drain (no diversion of flow as compared to pre development conditions).*

[1] Conservative Q100 & V: detailed HGL calculations will be developed during final engineering

The proposed 54-inch RCP conveying off-site flow through the project site has been sized using Manning's equation. Hydraulic results indicate this pipe is approximately 65-percent full, prior to accounting for junction losses. Based on a proposed alignment that includes only three 90-degree bends, junction losses are not anticipated to warrant a larger pipe such that pressure flow is avoided. A hydraulic analysis that accounts for junction losses, per Table 3-7 of the San Diego County Drainage Design Manual, will be

provided during final engineering. Riprap energy dissipaters will be located downstream of all proposed on-site storm drain outfalls.

5.3. Conclusions

Through the installation of bioretention areas and permeable pavement; the proposed project will mitigate any potential adverse impact associated with hydrology and hydraulics.

The proposed project will not substantially alter the existing drainage pattern of the site, nor will it have any adverse impact on the potential for erosion. Proposed conditions will reduce the amount of concentrated flow throughout the site through the strategic placement of permeable pavement and bioretention areas, as compared to predevelopment conditions. Along Jamacha Boulevard, the proposed bioretention areas are tiered such that weir flow is achieved as runoff conveys westerly overland. Riprap (or similar) energy dissipaters will be utilized along the weirs to prevent scour. Riprap energy dissipaters, or similar, will be included downstream of all proposed on-site storm drain outfalls to protect against scour and erosion.

Under post development conditions, runoff will discharge from the site as pipe flow in two locations. (1) In the southwesterly corner, adjacent to Jamacha Boulevard, on-site runoff will discharge to the existing storm drain system (dual 36-inch RCP) conveying flow southerly beneath Jamacha Boulevard to the regional detention facility. (2) Along the westerly project boundary, on-site runoff will discharge to the curb and gutter of Sweetwater Springs Boulevard via the proposed bioretention area sub-drain. As such, discharge from the project site is not anticipated to have any adverse impact on the potential for erosion.

A proposed 54-inch RCP will be installed to convey off-site flow to the existing 60-inch RCP located in the southwest corner of the site. This does not result in the diversion of flow as compared to pre development conditions. The proposed 54-inch RCP will prevent the comingling of off-site runoff with on-site runoff. At the point of connection with the existing 60-inch RCP (southwest corner), a proposed 36-inch RCP lateral with headwall will be included for secondary project site discharge (primary discharge being the perforated sub-drains associated with the bioretention area).

The regional detention facility located across Jamacha Boulevard from the project site will not be adversely impacted as a result of the proposed development.

Minor surface improvements are proposed along Jamacha Boulevard and Sweetwater Springs Boulevard. The proposed on-site bioretention areas have been sized to treat the equivalent area of off-site improvements. Refer to the project specific Storm Water Management Plan (SWMP), found under separate cover, for detailed calculations.

Section 6. CEQA Guidelines for Determining Significance

1. **Will the project 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?**

   The project will not alter the existing drainage pattern across the site. Upon completion of the project, runoff will continue to flow southwesterly towards Sweetwater Springs Boulevard and Jamacha Boulevard. Runoff will discharge from the project site as either pipe flow directly connected to existing storm drains (at Jamacha Boulevard) or as pipe flow directly to the curb and gutter (Sweetwater Springs Boulevard).

2. **Will the project increase water surface elevation in a watercourse within a watershed equal to or greater than 1 square mile, by 1 foot or more in height and in the case of the San Luis Rey River, San Dieguito River, San Diego River, Sweetwater River and Otay River, 2/10 of a foot or more?**

   The project will not increase water surface elevations across the site or downstream. Proposed improvements will not alter the existing hydrologic and hydraulic properties of the site. No increase in peak flow discharge is anticipated as a result of the proposed project.

3. **Will the project result in increased velocities and peak flow rates exiting the project site that could cause flooding downstream or exceed the storm water drainage system capacity serving the site?**

   The project will not increase runoff velocities or peak flow rates leaving the site. Runoff will continue to flow as it does under existing conditions. The project will not cause flooding downstream, nor will it hydraulically impact on-site or downstream storm water infrastructure.

4. **Will the project result in placing housing, habitable structures, or unanchored impediments to flow in a 100-year floodplain area or other special flood hazard area, as shown on a FIRM, a County Flood Plain Map or County Alluvial Fan Map, which would subsequently endanger health, safety and property due to flooding?**

   The project will not result in placing housing within a 100-year floodplain or other special flood hazard area.

5. **Will the project place structures within a 100-year flood hazard or alter the floodway in a manner that would redirect or impede flow resulting in any of the following:**

   a) **Alter the line of inundation resulting in the placement of other housing in a 100 year flood hazard**

b) Increase water surface elevation in a watercourse with a watershed equal to or greater than 1 square mile by 1 foot or more in height and in the case of the San Luis Rey River, San Dieguito River, San Diego River, Sweetwater River and Otay River, 2/10 of a foot or more?

No, the project will not place housing within a 100-year floodplain. Nor will the project increase water surface elevations downstream.

Section 7. References

County of San Diego, 2003. County of San Diego. (June 2003). Hydrology Manual

County of San Diego, 2005. County of San Diego. (July 2005). Drainage Design Manual.

FEMA, 1997. FEMA. (June 17, 1997). Flood Insurance Study, San Diego County.

Appendix A: Project Information

Vicinity Map

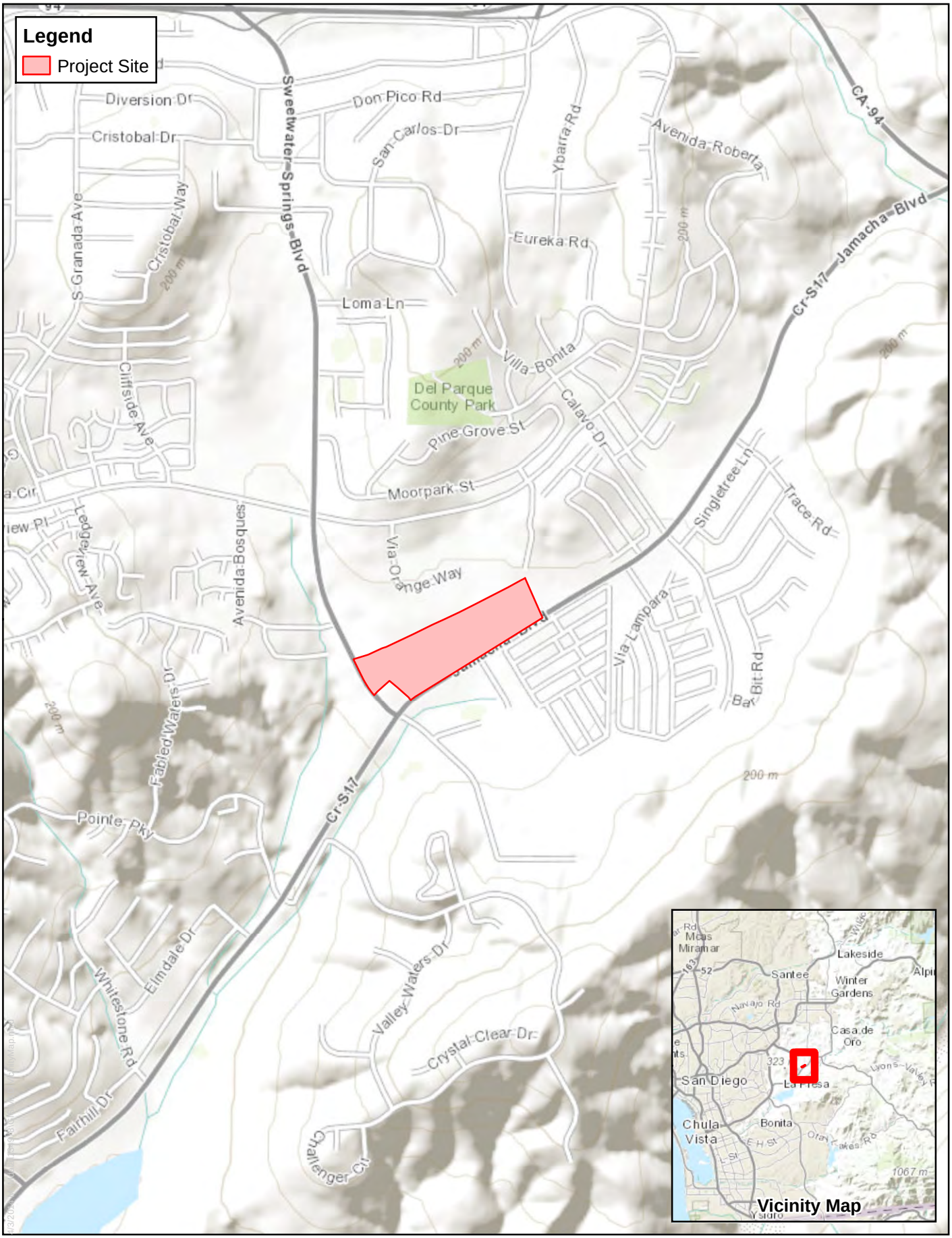
Rainfall Isopluvials

Runoff Coefficients for Urban Areas: Table 3-1 in SDCHM

Intensity-Duration Design Chart: Figure 3-1 in SDCHM

NRCS Soils Information

FEMA Information



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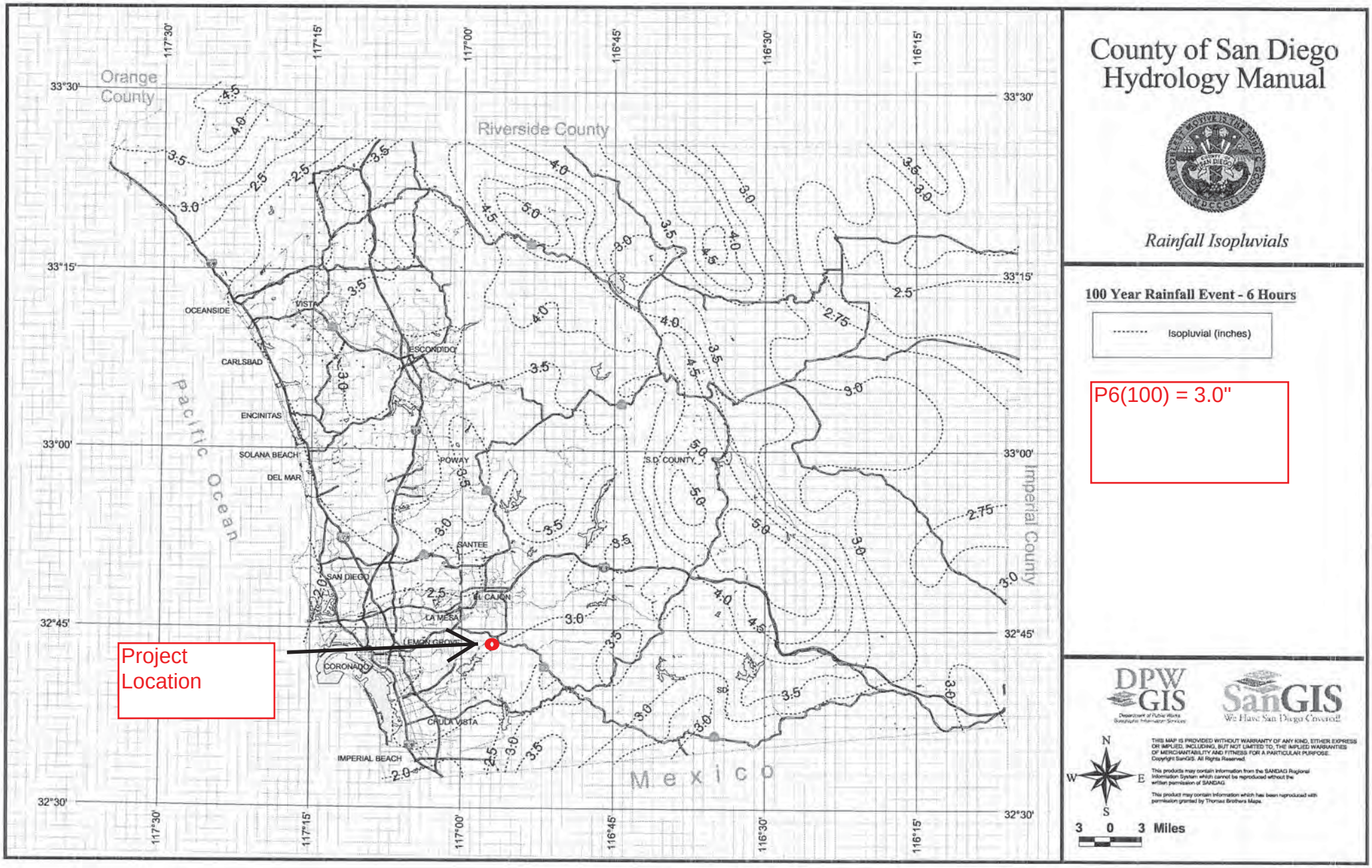
Source: ESRI, RBF

Spring Valley, California

Sweetwater Village



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

P6(100) = 3.0"

DPW GIS
Department of Public Works Geographic Information Services

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N W E S

3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

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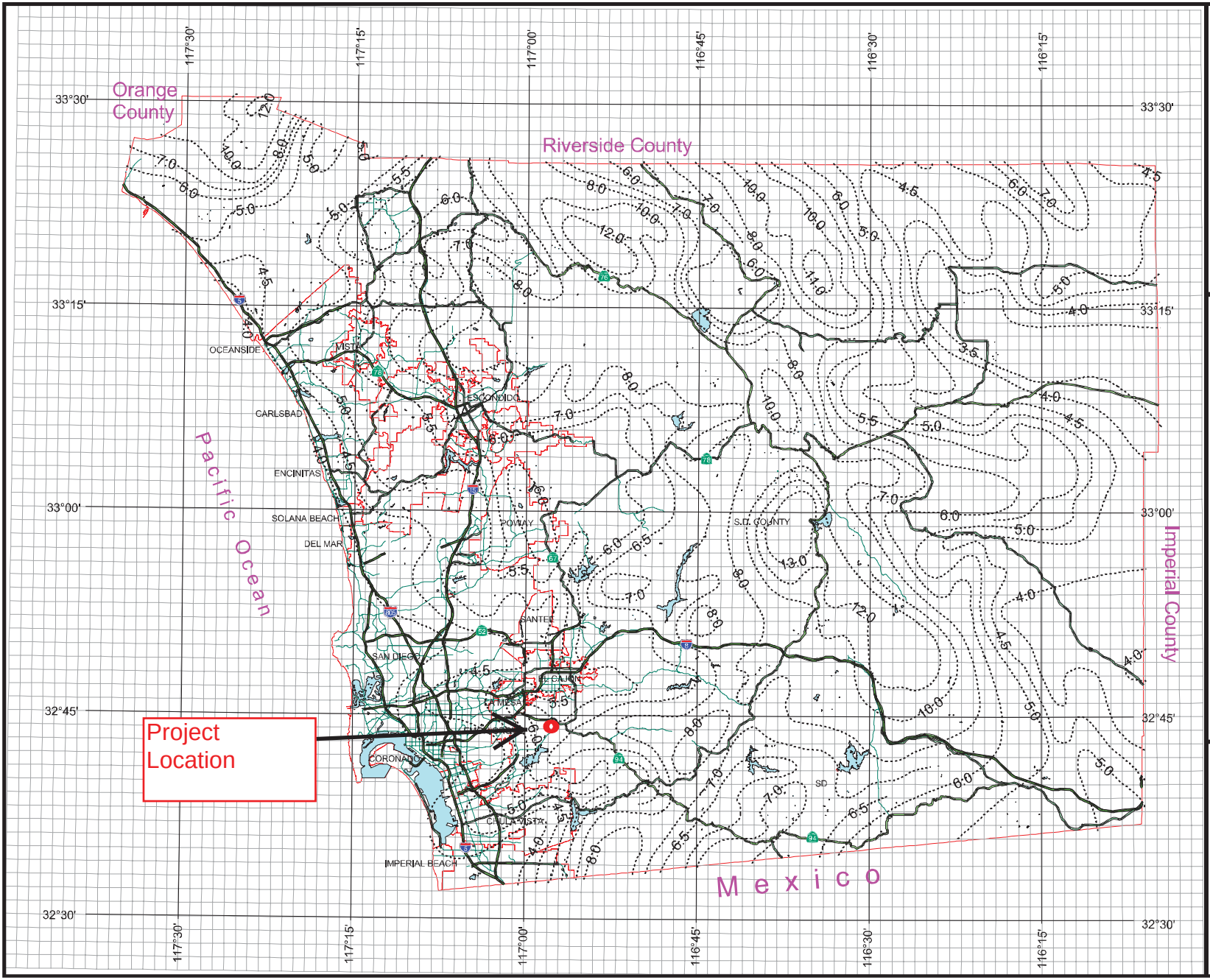

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N
W E
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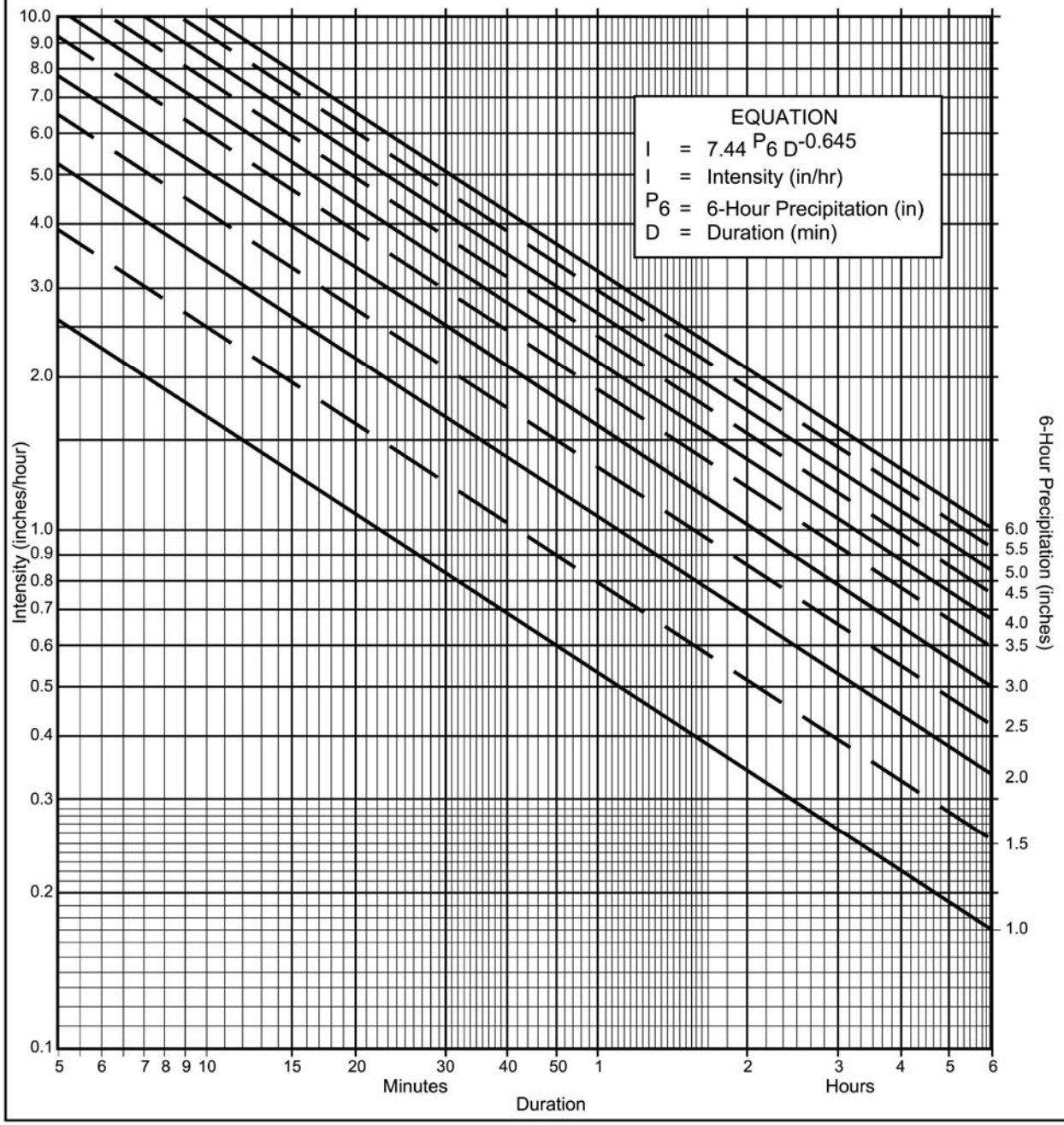
Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 3 in., P_{24} = 6, $\frac{P_6}{P_{24}}$ = 50 %(2)

(c) Adjusted P_6(2) = N/A in.

(d) t_x = SEE AES OUTPUT min.

(e) I = SEE AES OUTPUT in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1

Map Scale: 1:2,940 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 40 80 160 240

Feet: 0 100 200 400 600

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 1:24,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: 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: San Diego County Area, California
Survey Area Data: Version 7, Nov 15, 2013

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

Date(s) aerial images were photographed: May 2, 2010—May 6, 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 — San Diego County Area, California (CA638)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
DaE	Diablo clay, 15 to 30 percent slopes	D	16.0	90.4%
HrD2	Huerhuero loam, 9 to 15 percent slopes, eroded	D	1.7	9.6%
Totals for Area of Interest			**17.7**	**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:

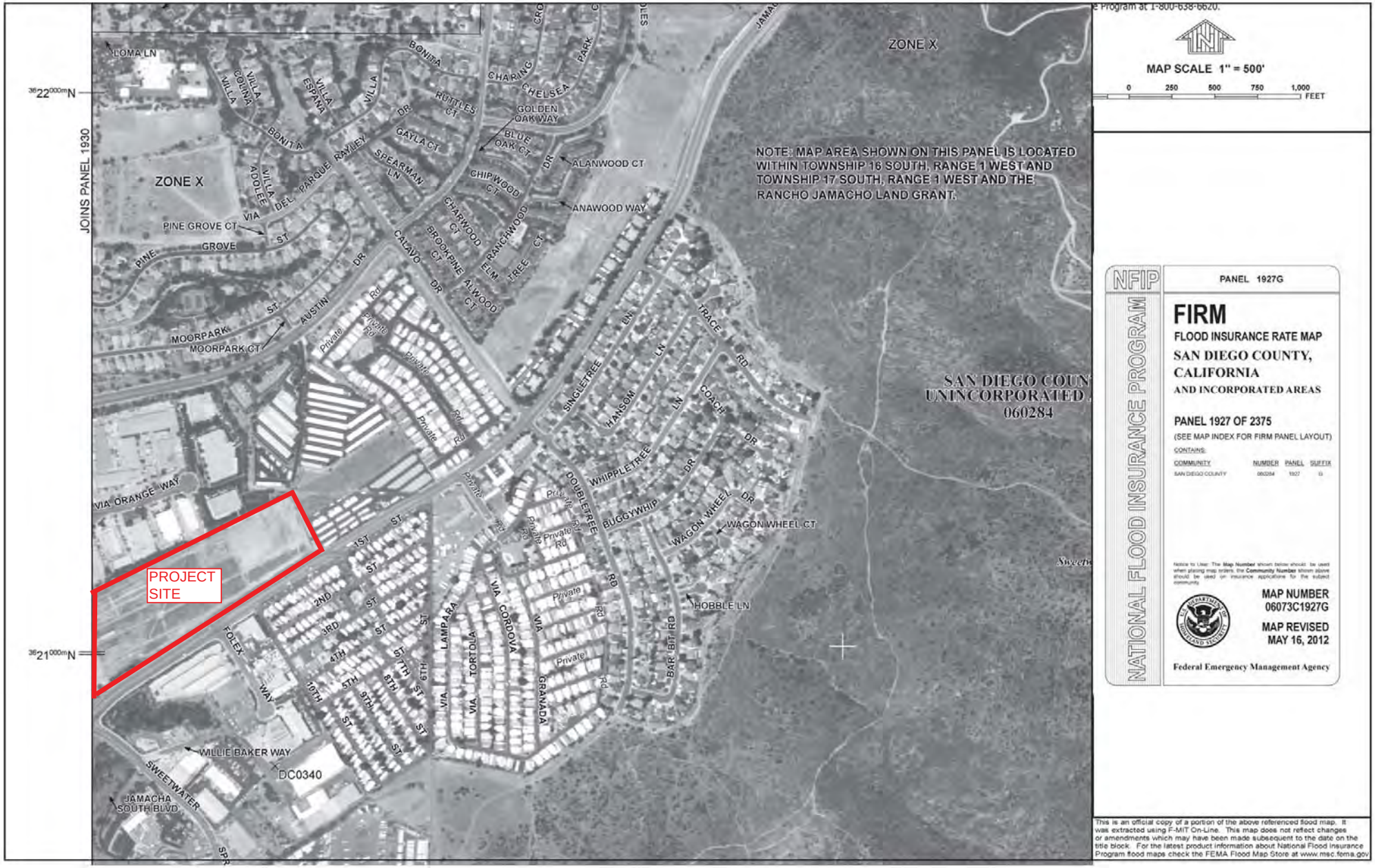
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

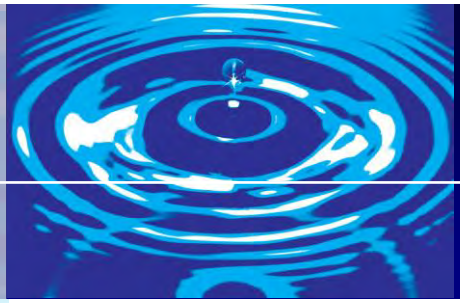
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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.


PROJECT SITE
ZONE X
ZONE X
NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 16 SOUTH, RANGE 1 WEST AND TOWNSHIP 17 SOUTH, RANGE 1 WEST AND THE RANCHO JAMACHO LAND GRANT.
SAN DIEGO COUN
UNINCORPORATED
060284
JOINS PANEL 1930
3622000mN
3621000mN
LOMA LN
BONITA
VILLA CORUNA VILLA
VILLA ESPANA
VILLA
RUTTLES CT
CHARING
CHELSEA
PARK
GOLDEN OAK WAY
BLUE OAK CT
DR
ALANWOOD CT
ANAWOOD WAY
GAYLA CT
RAYLEY
SPEARMAN LN
CHIPWOOD CT
VILLA DEL PARQUE
VILLA ADOLEE
PINE GROVE CT
VIA
ST
PINE GROVE
CHARWOOD CT
BROOKPINE CT
RANCHWOOD CT
ELM TREE CT
ALWOOD CT
CALAVO DR
AUSTIN DR
MOORPARK ST
MOORPARK CT
Private Rd
SINGLETREE LN
HANSOM LN
TRACE RD
COACH DR
WHIPPLETREE DR
DOUBLETREE
BUGGYWHIP
WAGON WHEEL DR
WAGON WHEEL CT
HOBBLE LN
BAR 8IT RD
VIA ORANGE WAY
1ST ST
2ND ST
3RD ST
4TH ST
5TH ST
6TH ST
7TH ST
8TH ST
9TH ST
10TH ST
FOLEX WAY
LAMPARA
TORTOLA
VIA CORDOVA
GRANADA
WILLIE BAKER WAY
DC0340
SWEETWATER
JAMACHA SOUTH BLVD
MAP SCALE 1" = 500'
0 250 500 750 1,000 FEET
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 1927G
FIRM
FLOOD INSURANCE RATE MAP
SAN DIEGO COUNTY, CALIFORNIA
AND INCORPORATED AREAS
PANEL 1927 OF 2375
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
SAN DIEGO COUNTY 060284 1927 G
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.
MAP NUMBER
06073C1927G
MAP REVISED
MAY 16, 2012
Federal Emergency Management Agency
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



Appendix B: Existing Hydrology

Off-Site Hydrologic Work Map

Existing Condition On-Site Hydrologic Work Map

Existing Condition AES (Off-Site Flow Included)

Weighted Runoff Coefficients

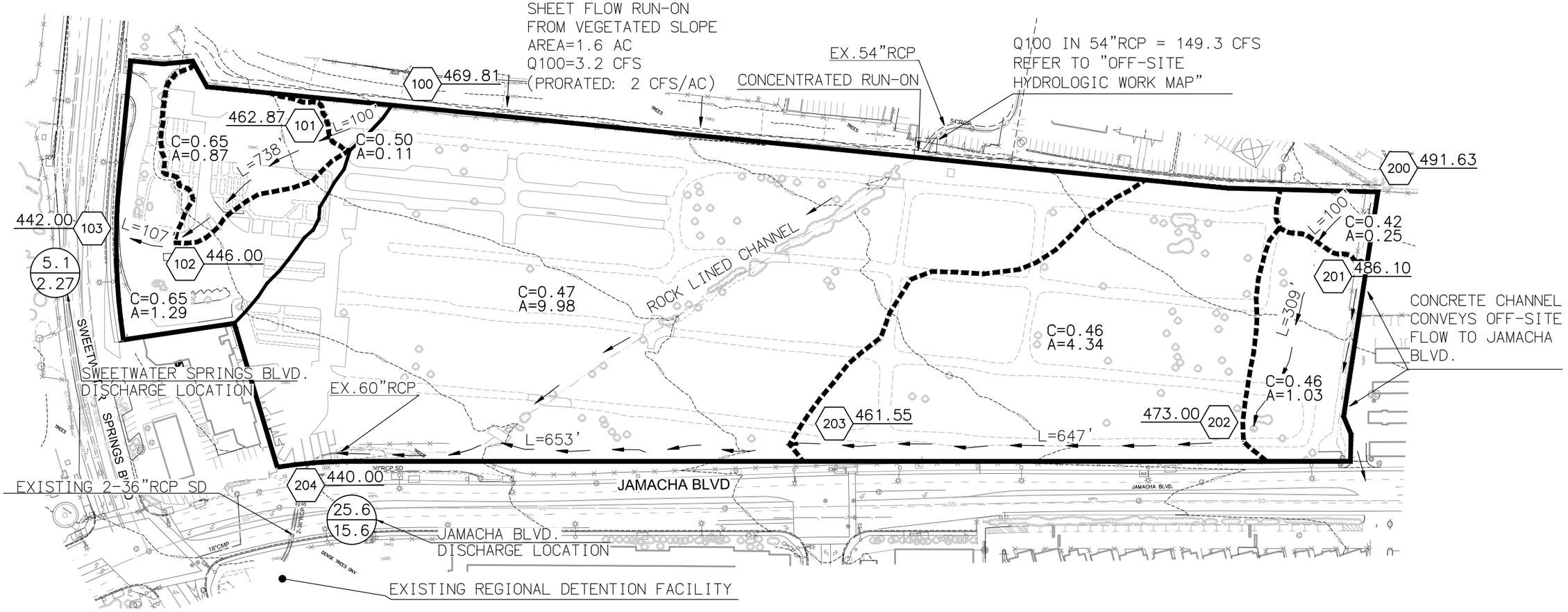
RBF CONSULTING A Baker Company

GIS

N

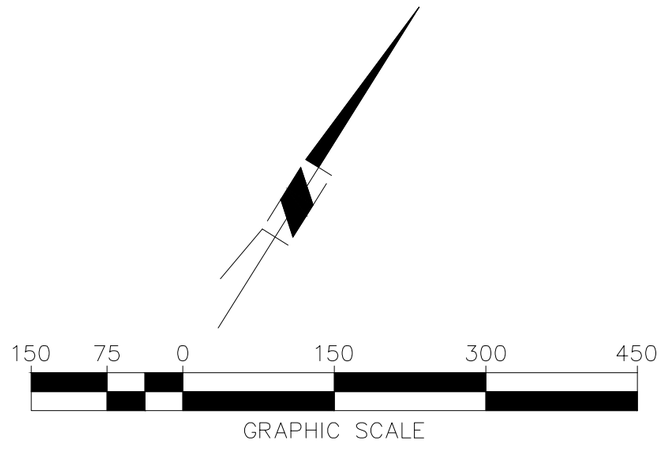
0 250 500 1,000 Feet

Sweetwater Town Center Off-Site Hydology Exhibit



LEGEND

- DRAINAGE BOUNDARY
- SUBAREA BOUNDARY
- FLOW PATH
- 0.00 / 0.00 — PROJECT OUTFALL: Q100 (CFS) / TOTAL AREA (ACRES)
- C=0.00 A=0.00 — RUN-OFF COEFFICIENT / AREA (ACRES)
- 100 — HYDROLOGY NODE
- 442 — NODE ELEVATION



SWEETWATER VILLAGE
EXISTING CONDITION
HYDROLOGY EXHIBIT

RBF CONSULTING
A Baker Company
5050 AVENIDA ENCINAS, SUITE 260
CARLSBAD, CALIFORNIA 92008-4386
760.476.9193 ▪ FAX 760.476.9198 ▪ www.RBF.com

H:\PDATA\134978\CADD\Strmwater\134978_Ex_Hydor_Exhibit.dwg 01/14/15 - 5:15pm eric.edge

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                       2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2013 Advanced Engineering Software (aes)
             Ver. 20.0 Release Date: 06/01/2013  License ID 1264

                        Analysis prepared by:

                            RBF Consulting
                          14257 Alton Parkway
                               Irvine, CA
                                92618

 ************************* DESCRIPTION OF STUDY *************************
* Existing Condition 100 Year                                           *
* Sweetwater Town Center                                                *
* 134978                                                               *
 ************************************************************************

  FILE NAME: EX100SW.DAT
  TIME/DATE OF STUDY: 12:10 06/05/2014
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.000
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.01
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: CONSIDER ALL CONFLUENCE STREAM COMBINATIONS
        FOR ALL DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

+--------------------------------------------------------------------------+
| Begin Basin 100                                                          |
| Northwesterly portion of project site                                    |
| Discharges to Sweeatwater Springs Road                                   |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    469.81
  DOWNSTREAM ELEVATION(FEET) =    462.87
  ELEVATION DIFFERENCE(FEET) =      6.94
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.662
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.295
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.40

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    462.87  DOWNSTREAM(FEET) =    446.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   738.00   CHANNEL SLOPE =  0.0229
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.660
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.50
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.14
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =  10.83
  Tc(MIN.) =   16.49
  SUBAREA AREA(ACRES) =     0.87       SUBAREA RUNOFF(CFS) =    2.07
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.633
  TOTAL AREA(ACRES) =        1.0         PEAK FLOW RATE(CFS) =       2.27

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =   1.35
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     838.00 FEET.
```



```
****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    446.00  DOWNSTREAM(FEET) =    442.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   107.00   CHANNEL SLOPE =  0.0374
  CHANNEL BASE(FEET) =   30.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.514
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.74
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.66
  AVERAGE FLOW DEPTH(FEET) =   0.07   TRAVEL TIME(MIN.) =   1.07
  Tc(MIN.) =   17.57
  SUBAREA AREA(ACRES) =     1.29       SUBAREA RUNOFF(CFS) =    2.95
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.643
  TOTAL AREA(ACRES) =        2.3         PEAK FLOW RATE(CFS) =       5.13

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.09   FLOW VELOCITY(FEET/SEC.) =   1.87
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     945.00 FEET.

+--------------------------------------------------------------------------+
| Begin Basin 200                                                          |
| Majority of the project site                                             |
| Discharges to EX. 60" RCP located in SW corner of the site               |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .4200
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    491.63
  DOWNSTREAM ELEVATION(FEET) =    486.10
  ELEVATION DIFFERENCE(FEET) =      5.53
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.922
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.408
  SUBAREA RUNOFF(CFS) =      0.67
  TOTAL AREA(ACRES) =      0.25   TOTAL RUNOFF(CFS) =      0.67

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    486.10  DOWNSTREAM(FEET) =    473.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   309.00   CHANNEL SLOPE =  0.0424
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.975
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.85
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.55
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   3.33
  Tc(MIN.) =   10.25
  SUBAREA AREA(ACRES) =     1.03       SUBAREA RUNOFF(CFS) =    2.36
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.452
  TOTAL AREA(ACRES) =        1.3         PEAK FLOW RATE(CFS) =       2.88

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =   1.75
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     409.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    473.00  DOWNSTREAM(FEET) =    461.55
  CHANNEL LENGTH THRU SUBAREA(FEET) =   647.00   CHANNEL SLOPE =  0.0177
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.904
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.82
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.30
  AVERAGE FLOW DEPTH(FEET) =   0.25   TRAVEL TIME(MIN.) =   4.68
  Tc(MIN.) =   14.93
  SUBAREA AREA(ACRES) =     4.34       SUBAREA RUNOFF(CFS) =    7.79
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.458
  TOTAL AREA(ACRES) =        5.6         PEAK FLOW RATE(CFS) =      10.05

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.31   FLOW VELOCITY(FEET/SEC.) =   2.62
```

```
 LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    1056.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    461.55  DOWNSTREAM(FEET) =    440.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   653.00   CHANNEL SLOPE =  0.0330
 CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.520
 *USER SPECIFIED(SUBAREA):
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .4700
 S.C.S. CURVE NUMBER (AMC II) =  94
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      18.32
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.19
 AVERAGE FLOW DEPTH(FEET) =   0.37   TRAVEL TIME(MIN.) =   2.60
 Tc(MIN.) =   17.53
 SUBAREA AREA(ACRES) =     9.98       SUBAREA RUNOFF(CFS) =   16.51
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.466
 TOTAL AREA(ACRES) =       15.6          PEAK FLOW RATE(CFS) =      25.57

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.45   FLOW VELOCITY(FEET/SEC.) =   4.67
 LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =    1709.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| Off-Site Flow                                                            |
| Run-on Location: Midway along northerly boundary                         |
| 54" RCP discharges onto the project site                                 |
+--------------------------------------------------------------------------+

****************************************************************************
 FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
 UPSTREAM ELEVATION(FEET) =    670.00
 DOWNSTREAM ELEVATION(FEET) =    662.00
 ELEVATION DIFFERENCE(FEET) =      8.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.605
 WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.343
 SUBAREA RUNOFF(CFS) =      0.26
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.26

****************************************************************************
 FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    662.00  DOWNSTREAM(FEET) =    590.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   640.00   CHANNEL SLOPE =  0.1125
 CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.682
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.92
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.90
 AVERAGE FLOW DEPTH(FEET) =   0.12   TRAVEL TIME(MIN.) =   2.74
 Tc(MIN.) =    8.34
 SUBAREA AREA(ACRES) =     4.60       SUBAREA RUNOFF(CFS) =    9.15
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
 TOTAL AREA(ACRES) =        4.7          PEAK FLOW RATE(CFS) =       9.35

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.17   FLOW VELOCITY(FEET/SEC.) =   4.98
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     720.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   590.00  DOWNSTREAM(FEET) =   511.00
 FLOW LENGTH(FEET) =   779.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  15.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.21
 GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       9.35
 PIPE TRAVEL TIME(MIN.) =   4.05    Tc(MIN.) =   12.39
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =    1499.00 FEET.
```



```
****************************************************************************
 FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.402
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.5141
 SUBAREA AREA(ACRES) =   13.80   SUBAREA RUNOFF(CFS) =   34.62
 TOTAL AREA(ACRES) =       18.5   TOTAL RUNOFF(CFS) =      41.87
 TC(MIN.) =   12.39

****************************************************************************
 FLOW PROCESS FROM NODE    303.00 TO NODE    304.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   511.00  DOWNSTREAM(FEET) =   482.00
 FLOW LENGTH(FEET) =   926.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   2.63
 PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
 GIVEN PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      41.87
 PIPE TRAVEL TIME(MIN.) =   5.86    Tc(MIN.) =   18.25
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    304.00 =    2425.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    304.00 TO NODE    304.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.429
 GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  95
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7257
 SUBAREA AREA(ACRES) =   41.50   SUBAREA RUNOFF(CFS) =  116.67
 TOTAL AREA(ACRES) =       60.0   TOTAL RUNOFF(CFS) =     149.28
 TC(MIN.) =   18.25

****************************************************************************
 FLOW PROCESS FROM NODE    304.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    482.00  DOWNSTREAM(FEET) =    440.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   945.00   CHANNEL SLOPE =  0.0444
 CHANNEL BASE(FEET) =   15.00   "Z" FACTOR =   3.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.231
 URBAN NEWLY GRADED AREAS RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  94
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     149.29
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   8.96
 AVERAGE FLOW DEPTH(FEET) =   0.94   TRAVEL TIME(MIN.) =   1.76
 Tc(MIN.) =   20.01
 SUBAREA AREA(ACRES) =     0.01       SUBAREA RUNOFF(CFS) =    0.02
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.726
 TOTAL AREA(ACRES) =       60.0          PEAK FLOW RATE(CFS) =     149.28

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.94   FLOW VELOCITY(FEET/SEC.) =   8.96
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    204.00 =    3370.00 FEET.

+--------------------------------------------------------------------------+
| Total Q100 at Node 204                                                   |
| Includes Off-site Area                                                   |
| Discharge from site in a 60" RCP                                         |
+--------------------------------------------------------------------------+

****************************************************************************
 FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF       Tc       INTENSITY     AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)   (ACRE)
     1      149.28    20.01       3.231        60.01
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    204.00 =    3370.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF       Tc       INTENSITY     AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)   (ACRE)
     1       25.57    17.53       3.520        15.60
 LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =    1709.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc       INTENSITY
 NUMBER     (CFS)      (MIN.)   (INCH/HOUR)
     1     156.31      17.53        3.520
     2     172.76      20.01        3.231
```

```
 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =     172.76   Tc(MIN.) =   20.01
 TOTAL AREA(ACRES) =       75.6
================================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       75.6  TC(MIN.) =     20.01
 PEAK FLOW RATE(CFS)   =     172.76
 *** PEAK FLOW RATE TABLE ***
        Q(CFS)   Tc(MIN.)
 1      156.31      17.53
 2      172.76      20.01
================================================================================
================================================================================
 END OF RATIONAL METHOD ANALYSIS
```

ON-SITE Runoff Coefficients

EXISTING Condition

Land Use	Area A1	
	Area	C
Type D Natural	0.08	0.35
EX. Impervious	0.03	0.90
Total	**0.11**	

Weighted C = 0.50

Land Use	Area A2	
	Area	C
Type D Natural	0.39	0.35
EX. Impervious (pavement)	0.48	0.90
Total	**0.87**	

Weighted C = 0.65

Land Use	Area A3	
	Area	C
Type D Natural	0.58	0.35
EX. Impervious (pavement)	0.70	0.90
Total	**1.29**	

Weighted C = 0.65

Land Use	Area B1	
	Area	C
Type D Natural	0.22	0.35
EX. Impervious (pavement)	0.03	0.90
Total	**0.25**	

Weighted C = 0.42

Land Use	Area B2	
	Area	C
Type D Natural	0.83	0.35
EX. Impervious (pavement)	0.20	0.90
Total	**1.03**	

Weighted C = 0.46

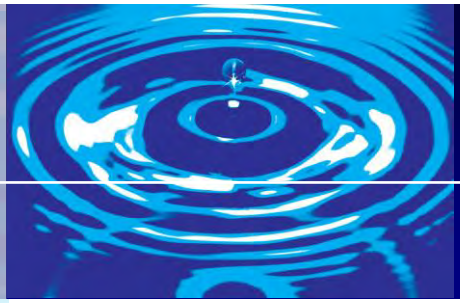
Land Use	Area B3	
	Area	C
Type D Natural	3.47	0.35
EX. Impervious (pavement)	0.87	0.90
Total	**4.34**	

Weighted C = 0.46

Land Use	Area B4	
	Area	C
Type D Natural	7.79	0.35
EX. Impervious (pavement)	2.19	0.90
Total	**9.98**	

Weighted C = 0.47

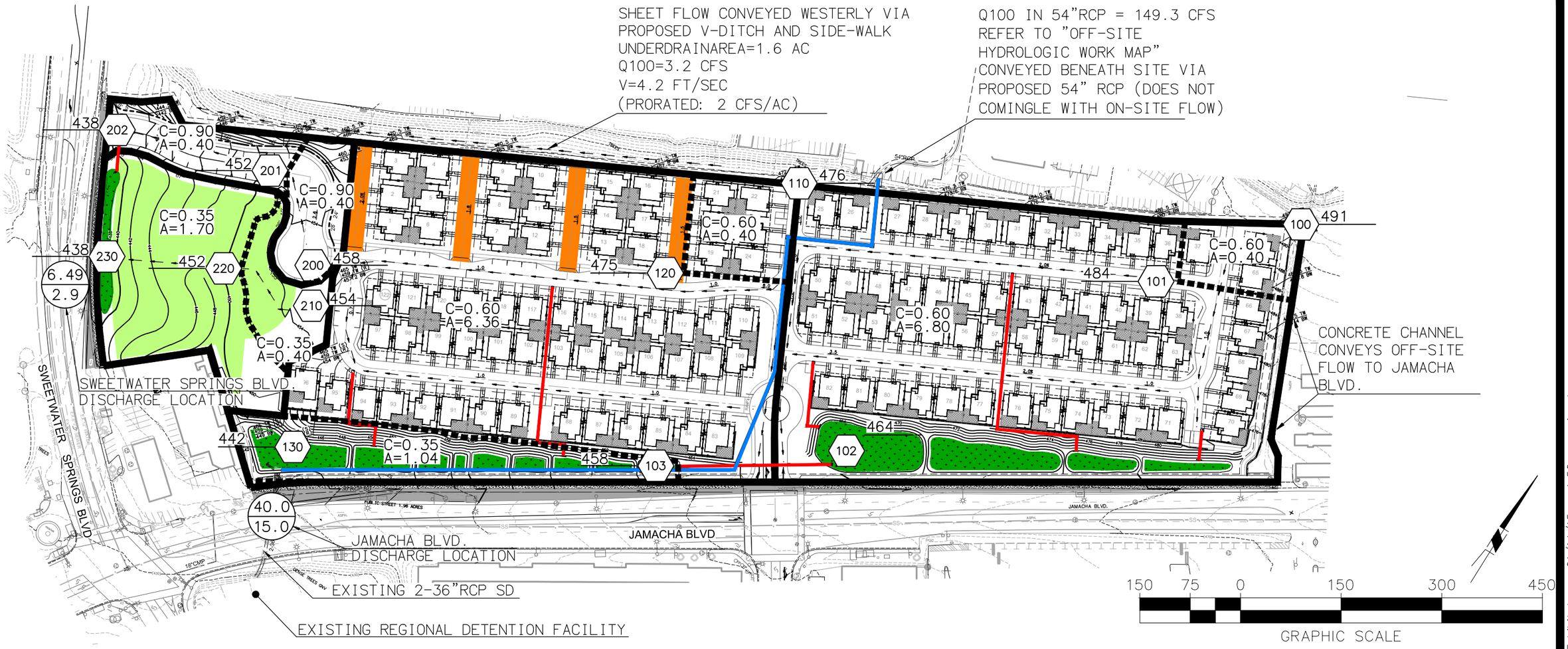
Total Area =	**17.87**	**ac**
Total Impervious =	**4.50**	**ac**



Appendix C: Proposed Hydrology

Proposed Condition On-Site Hydrologic Work Map

Proposed Condition AES (Off-Site Flow Included)



LEGEND

- DRAINAGE BOUNDARY
- SUBAREA BOUNDARY
- FLOW PATH
- 0.00 / 0.00 — PROJECT OUTFALL: UNMITIGATED Q100 (CFS) / TOTAL OUFALL AREA (ACRES)
- C=0.00 A=0.00 — RUN-OFF COEFFICIENT AREA (ACRES)
- 100 — HYDROLOGY NODE
- 442 — NODE ELEVATION
- PERVIOUS PAVEMENT
- BIORETENTION
- PUBLIC PARK
- PUBLIC IMPROVEMENT PAVEMENT
- PUBLIC IMPROVEMENT SIDEWALK
- 24" ON-SITE STORM DRAIN
- 54" RCP (OFF-SITE FLOW)

PUBLIC IMPROVEMENTS:

	SWEETWATER SPRINGS BLVD	JAMACHA BLVD.	TOTAL
NEW PAVEMENT	0.06 AC	0.33 AC	0.39 AC
NEW SIDEWALK	0.04 AC	0.19 AC	0.23 AC
	0.10 AC	0.52 AC	0.62 AC

PROJECT OUTFALL DESCRIPTION:

1) SWEETWATER SPRINGS BLVD - BIORETENTION SUB-DRAIN DISCHARGE TO CURB AND GUTTER

2) JAMACHA BLVD - EXISTING DUAL 36-INCH RCP DISCHARGE TO REGIONAL DETENTION FACILITY

SWEETWATER VILLAGE PROPOSED CONDITION HYDROLOGY EXHIBIT

RBF CONSULTING
A Baker Company
5050 AVENIDA ENCINAS, SUITE 260
CARLSBAD, CALIFORNIA 92008-4386
760.476.9193 ▪ FAX 760.476.9198 ▪ www.RBF.com

H:\PDATA\134978\CADD\Strmwater\134978 Prop_Hydro Exhibit.dwg 01/14/15 - 4:50pm eric.edge

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****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2013 Advanced Engineering Software (aes)
              Ver. 20.0 Release Date: 06/01/2013  License ID 1264

                              Analysis prepared by:

                                 RBF Consulting
                                14257 Alton Parkway
                                     Irvine, CA
                                       92618

 ************************** DESCRIPTION OF STUDY **************************
* UN-MITIGATED PROPOSED CONDITION:100-YEAR                                *
* SWEETWATER VILLAGE                                                      *
* 134978                                                                  *
 ****************************************************************************

  FILE NAME: SWTPR100.DAT
  TIME/DATE OF STUDY: 16:31 01/14/2015
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.000
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.01
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: CONSIDER ALL CONFLUENCE STREAM COMBINATIONS
        FOR ALL DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  ========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

+--------------------------------------------------------------------------+
| BEGIN BASIN 100                                                          |
| CONFLUENCES WITH BASIN 110                                               |
| DISCHARGES TO EXISTING DUAL 36" RCP                                      |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   192.00
  UPSTREAM ELEVATION(FEET) =    491.00
  DOWNSTREAM ELEVATION(FEET) =    486.00
  ELEVATION DIFFERENCE(FEET) =      5.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.068
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    86.04
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.976
  SUBAREA RUNOFF(CFS) =      1.67
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.67

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  486.00  DOWNSTREAM ELEVATION(FEET) =  464.00
  STREET LENGTH(FEET) =   840.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   7.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      12.53
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   11.96
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.05
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.48
  STREET FLOW TRAVEL TIME(MIN.) =   3.46   Tc(MIN.) =    9.53
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.215
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.600
  SUBAREA AREA(ACRES) =    6.80      SUBAREA RUNOFF(CFS) =   21.28
  TOTAL AREA(ACRES) =        7.2        PEAK FLOW RATE(CFS) =      22.53

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.42   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  5.06   DEPTH*VELOCITY(FT*FT/SEC.) =   2.14
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =    1032.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  41
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   464.00  DOWNSTREAM(FEET) =   458.00
  FLOW LENGTH(FEET) =   231.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.17
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      22.53
  PIPE TRAVEL TIME(MIN.) =   0.54    Tc(MIN.) =   10.07
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    1263.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    130.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    458.00  DOWNSTREAM(FEET) =    442.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   565.00   CHANNEL SLOPE =  0.0283
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.311
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =  88
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      23.31
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.45
  AVERAGE FLOW DEPTH(FEET) =   0.29   TRAVEL TIME(MIN.) =   2.73
  Tc(MIN.) =   12.80
  SUBAREA AREA(ACRES) =     1.04       SUBAREA RUNOFF(CFS) =    1.57
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.568
  TOTAL AREA(ACRES) =        8.2         PEAK FLOW RATE(CFS) =      22.53

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.29   FLOW VELOCITY(FEET/SEC.) =   3.36
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    130.00 =    1828.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| BEGIN BASIN 110                                                          |
| CONFLUENCES WITH BASIN 100                                               |
| DISCHARGES TO EXISTING DUAL 36" RCP                                      |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
```

```
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   208.00
  UPSTREAM ELEVATION(FEET) =    476.00
  DOWNSTREAM ELEVATION(FEET) =    475.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.018
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    50.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.829
  SUBAREA RUNOFF(CFS) =      1.40
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.40

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  475.00  DOWNSTREAM ELEVATION(FEET) =  442.00
  STREET LENGTH(FEET) =   660.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   7.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.95
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.91
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.98
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.61
  STREET FLOW TRAVEL TIME(MIN.) =   2.21   Tc(MIN.) =   10.23
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.982
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.600
  SUBAREA AREA(ACRES) =    6.36      SUBAREA RUNOFF(CFS) =   19.01
  TOTAL AREA(ACRES) =        6.8        PEAK FLOW RATE(CFS) =      20.21

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  5.90   DEPTH*VELOCITY(FT*FT/SEC.) =   2.24
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    130.00 =     868.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================
```

```
  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER       (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       20.21    10.23       4.982        6.76
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    130.00 =     868.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER       (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       22.53    12.80       4.311        8.24
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    130.00 =    1828.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      38.21      10.23        4.982
      2      40.01      12.80        4.311

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      40.01   Tc(MIN.) =   12.80
  TOTAL AREA(ACRES) =       15.0

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| BEGIN BASIN 200                                                          |
| CONFLUENCES WITH BASIN 210                                               |
| DISCHARGES TO CURB AND GUTTER ALONG SWEETWATER SPRINGS BLVD              |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   150.00
  UPSTREAM ELEVATION(FEET) =    458.00
  DOWNSTREAM ELEVATION(FEET) =    452.00
  ELEVATION DIFFERENCE(FEET) =      6.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.211
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    95.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.904
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      2.85
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      2.85

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  61
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  452.00  DOWNSTREAM ELEVATION(FEET) =  438.00
  STREET LENGTH(FEET) =   262.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   7.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.27
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    6.30
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.14
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.05
  STREET FLOW TRAVEL TIME(MIN.) =   1.05   Tc(MIN.) =    3.26
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.904
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.900
  SUBAREA AREA(ACRES) =    0.40      SUBAREA RUNOFF(CFS) =    2.85
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       5.69

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   7.20
  FLOW VELOCITY(FEET/SEC.) =  4.47   DEPTH*VELOCITY(FT*FT/SEC.) =   1.21
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     412.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    230.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   438.00  DOWNSTREAM(FEET) =   437.00
  FLOW LENGTH(FEET) =    62.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   1.81
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.69
  PIPE TRAVEL TIME(MIN.) =   0.57    Tc(MIN.) =    3.83
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    230.00 =     474.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    220.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   150.00
  UPSTREAM ELEVATION(FEET) =    454.00
  DOWNSTREAM ELEVATION(FEET) =    452.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.622
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    75.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.862
  SUBAREA RUNOFF(CFS) =      0.68
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      0.68

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    230.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    452.00  DOWNSTREAM(FEET) =    438.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   203.00   CHANNEL SLOPE =  0.0690
  CHANNEL BASE(FEET) =  100.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.031
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.90
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.95
  AVERAGE FLOW DEPTH(FEET) =   0.02   TRAVEL TIME(MIN.) =   3.58
  Tc(MIN.) =   14.20
  SUBAREA AREA(ACRES) =     1.70       SUBAREA RUNOFF(CFS) =    2.40
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        2.1         PEAK FLOW RATE(CFS) =       2.96

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.03   FLOW VELOCITY(FEET/SEC.) =   1.14
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    230.00 =     353.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER       (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1         2.96    14.20       4.031        2.10
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    230.00 =     353.00 FEET.
```

```
  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        5.69     3.83       7.904        0.80
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    230.00 =     474.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1       6.49       3.83        7.904
      2       5.87      14.20        4.031

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       6.49   Tc(MIN.) =    3.83
  TOTAL AREA(ACRES) =        2.9

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| Off-Site Flow                                                            |
| Run-on Location: Midway along northerly boundary                         |
| 54" RCP discharges onto the project site                                 |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    670.00
  DOWNSTREAM ELEVATION(FEET) =    662.00
  ELEVATION DIFFERENCE(FEET) =      8.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.605
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.343
  SUBAREA RUNOFF(CFS) =      0.26
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.26

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    662.00  DOWNSTREAM(FEET) =    590.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   640.00   CHANNEL SLOPE =  0.1125
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.682
```

```
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.92
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.90
  AVERAGE FLOW DEPTH(FEET) =   0.12   TRAVEL TIME(MIN.) =   2.74
  Tc(MIN.) =    8.34
  SUBAREA AREA(ACRES) =     4.60       SUBAREA RUNOFF(CFS) =    9.15
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        4.7         PEAK FLOW RATE(CFS) =       9.35

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.17   FLOW VELOCITY(FEET/SEC.) =   4.98
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   590.00  DOWNSTREAM(FEET) =   511.00
  FLOW LENGTH(FEET) =   779.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  15.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.21
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.35
  PIPE TRAVEL TIME(MIN.) =   4.05    Tc(MIN.) =   12.39
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =    1499.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.402
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  87
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5141
  SUBAREA AREA(ACRES) =   13.80   SUBAREA RUNOFF(CFS) =   34.62
  TOTAL AREA(ACRES) =       18.5   TOTAL RUNOFF(CFS) =      41.87
  TC(MIN.) =   12.39

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    304.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   511.00  DOWNSTREAM(FEET) =   482.00
  FLOW LENGTH(FEET) =   926.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.63
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      41.87
  PIPE TRAVEL TIME(MIN.) =   5.86    Tc(MIN.) =   18.25
```

```
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    304.00 =    2425.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    304.00 TO NODE    304.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.429
 GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  95
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7257
 SUBAREA AREA(ACRES) =   41.50   SUBAREA RUNOFF(CFS) =  116.67
 TOTAL AREA(ACRES) =       60.0   TOTAL RUNOFF(CFS) =     149.28
 TC(MIN.) =   18.25

+----------------------------------------------------------------------------+
| Total Q100 at Node 205                                                     |
| Un-Mitigated Condition: Includes Off-Site Area                             |
| Discharge from site in a 60" RCP                                           |
+----------------------------------------------------------------------------+
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       60.0  TC(MIN.) =     18.25
 PEAK FLOW RATE(CFS)   =     149.28
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

Appendix D: Hydraulics

Existing 60” RCP On-site Storm Drain (EX. Outfall in S.W. Corner)

Proposed On-site Storm Drain (Off-site Flow Conveyance)

Proposed On-Site Culvert (Access off Jamacha Blvd.)

Proposed On-Site Culvert (PR. Outfall in S.W. Corner)

Proposed Concrete Ditch (Northerly Project Boundary)

Proposed 24” RCP – On-site Storm Drains

Culvert Designer/Analyzer Report
EX 60" RCP

Analysis Component			
Storm Event	Design	Discharge	172.80 cfs

Peak Discharge Method: User-Specified			
Design Discharge	172.80 cfs	Check Discharge	0.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-60 inch Circular	172.80 cfs	452.53 ft	13.23 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
EX 60" RCP

Component:Culvert-1

Culvert Summary					
Computed Headwater Elev	452.53	ft	Discharge	172.80	cfs
Inlet Control HW Elev.	452.41	ft	Tailwater Elevation	N/A	ft
Outlet Control HW Elev.	452.53	ft	Control Type	Entrance Control	
Headwater Depth/Height	1.31				

Grades					
Upstream Invert	446.00	ft	Downstream Invert	445.00	ft
Length	100.00	ft	Constructed Slope	0.010000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	3.16	ft
Slope Type	Steep		Normal Depth	2.98	ft
Flow Regime	Supercritical		Critical Depth	3.77	ft
Velocity Downstream	13.23	ft/s	Critical Slope	0.005238	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	5.00	ft
Section Size	60 inch		Rise	5.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	452.53	ft	Upstream Velocity Head	1.84	ft
Ke	0.50		Entrance Loss	0.92	ft

Inlet Control Properties					
Inlet Control HW Elev.	452.41	ft	Flow Control	Transition	
Inlet Type	Square edge w/headwall		Area Full	19.6	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Proposed 54" RCP (to convey off-site flow)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	4.50	ft
Discharge	149.30	ft^3/s

Results

Normal Depth	2.93	ft
Flow Area	10.98	ft^2
Wetted Perimeter	8.46	ft
Hydraulic Radius	1.30	ft
Top Width	4.29	ft
Critical Depth	3.59	ft
Percent Full	65.2	%
Critical Slope	0.00608	ft/ft
Velocity	13.60	ft/s
Velocity Head	2.88	ft
Specific Energy	5.81	ft
Froude Number	1.50	
Maximum Discharge	211.53	ft^3/s
Discharge Full	196.64	ft^3/s
Slope Full	0.00576	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	65.17	%
Downstream Velocity	Infinity	ft/s

Proposed 54" RCP (to convey off-site flow)

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.93	ft
Critical Depth	3.59	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00608	ft/ft

Culvert Designer/Analyzer Report
PR 24" RCP

Analysis Component			
Storm Event	Design	Discharge	16.90 cfs

Peak Discharge Method: User-Specified			
Design Discharge	16.90 cfs	Check Discharge	0.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-24 inch Circular	16.90 cfs	468.34 ft	11.67 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
PR 24" RCP

Component:Culvert-1

Culvert Summary					
Computed Headwater Elev	468.34	ft	Discharge	16.90	cfs
Inlet Control HW Elev.	468.30	ft	Tailwater Elevation	N/A	ft
Outlet Control HW Elev.	468.34	ft	Control Type	Entrance Control	
Headwater Depth/Height	1.17				

Grades					
Upstream Invert	466.00	ft	Downstream Invert	458.00	ft
Length	288.00	ft	Constructed Slope	0.027778	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.94	ft
Slope Type	Steep		Normal Depth	0.94	ft
Flow Regime	Supercritical		Critical Depth	1.48	ft
Velocity Downstream	11.67	ft/s	Critical Slope	0.006907	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	468.34	ft	Upstream Velocity Head	0.71	ft
Ke	0.20		Entrance Loss	0.14	ft

Inlet Control Properties					
Inlet Control HW Elev.	468.30	ft	Flow Control	Transition	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	3.1	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Designer/Analyzer Report
PR 36" RCP SW Corner

Analysis Component			
Storm Event	Design	Discharge	24.90 cfs

Peak Discharge Method: User-Specified			
Design Discharge	24.90 cfs	Check Discharge	0.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	24.90 cfs	442.38 ft	8.61 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
PR 36" RCP SW Corner

Component:Culvert-1

Culvert Summary					
Computed Headwater Elev	442.38	ft	Discharge	24.90	cfs
Inlet Control HW Elev.	442.27	ft	Tailwater Elevation	N/A	ft
Outlet Control HW Elev.	442.38	ft	Control Type	Entrance Control	
Headwater Depth/Height	0.79				

Grades					
Upstream Invert	440.00	ft	Downstream Invert	439.00	ft
Length	100.00	ft	Constructed Slope	0.010000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.28	ft
Slope Type	Steep		Normal Depth	1.27	ft
Flow Regime	Supercritical		Critical Depth	1.61	ft
Velocity Downstream	8.61	ft/s	Critical Slope	0.004405	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	442.38	ft	Upstream Velocity Head	0.65	ft
Ke	0.20		Entrance Loss	0.13	ft

Inlet Control Properties					
Inlet Control HW Elev.	442.27	ft	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	7.1	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

PR V-Ditch Along Northerly Boundary

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.01000	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Discharge	3.20	ft^3/s

Results

Normal Depth	0.62	ft
Flow Area	0.76	ft^2
Wetted Perimeter	2.76	ft
Hydraulic Radius	0.28	ft
Top Width	2.47	ft
Critical Depth	0.69	ft
Critical Slope	0.00542	ft/ft
Velocity	4.20	ft/s
Velocity Head	0.27	ft
Specific Energy	0.89	ft
Froude Number	1.33	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.62	ft
Critical Depth	0.69	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00542	ft/ft

Proposed 24" RCP - On-Site Storm Drains

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Normal Depth	1.50	ft
Diameter	2.00	ft

Results

Discharge	20.63	ft^3/s
Flow Area	2.53	ft^2
Wetted Perimeter	4.19	ft
Hydraulic Radius	0.60	ft
Top Width	1.73	ft
Critical Depth	1.63	ft
Percent Full	75.0	%
Critical Slope	0.00841	ft/ft
Velocity	8.16	ft/s
Velocity Head	1.04	ft
Specific Energy	2.54	ft
Froude Number	1.19	
Maximum Discharge	24.33	ft^3/s
Discharge Full	22.62	ft^3/s
Slope Full	0.00832	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	75.00	%
Downstream Velocity	Infinity	ft/s

Proposed 24" RCP - On-Site Storm Drains

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.50	ft
Critical Depth	1.63	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00841	ft/ft