CEQA Preliminary Drainage Study

Pacifica Estates
County of San Diego, California

TM 5510
PDS2006-3100-5510

June 2006
Revision November 2007
Revision December 2008
Revised February 2015
Revised March 2015

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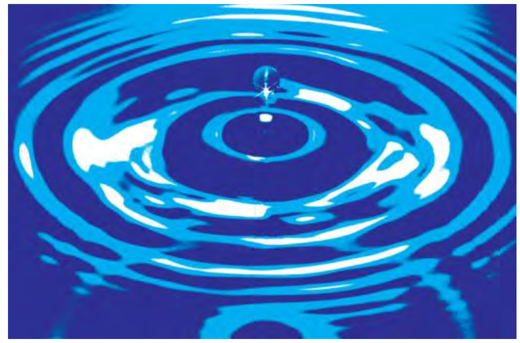
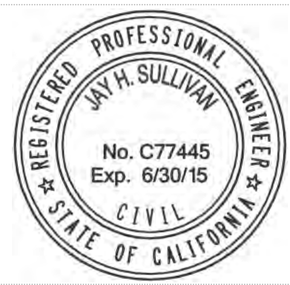


Declaration of Responsible Charge

I, hereby declare that I am the Civil Engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions code, and that the design is consistent with current design.

I understand that the check of project drawings and specifications by the County of San Diego is confined to a review only and does not relieve me, as engineer of work, of my responsibilities for project design.



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March 17, 2015

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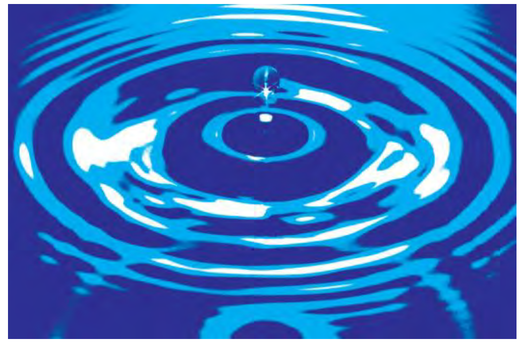

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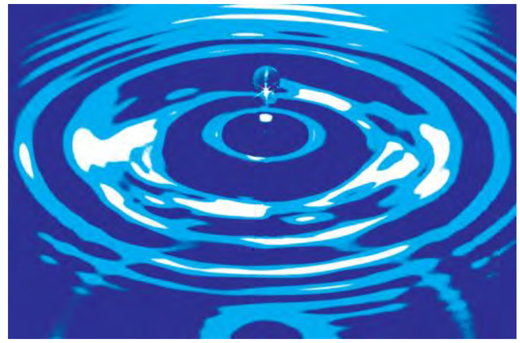

Introduction

This drainage report presents an analysis of the effects the proposed Pacifica Estates subdivision might have on the *quantity* and *pattern* of storm water runoff in the local watershed. The purpose of this report is to help fulfill requirements of the California Environmental Quality Act (CEQA). Storm water *quality* is addressed in the Storm Water Management Plan (SWMP) for the project, under separate cover from this document.

This report examines the existing and proposed hydrology of the site and nearby watershed and presents preliminary design of drainage facilities. This report is for planning purposes and does not present final design engineering recommendations for the project.

Section 1. Project Information

This section describes the location, activities, and hydrologic setting (watershed, topography, land use, soils and vegetation, drainage patterns, and impervious cover) of the project site.

1.1 Project Description

1.1.1 Project Location

The project site is located in the community of Fallbrook within the County of San Diego, California. The project is located just northeast of the intersection of Mission Road and Stage Coach Lane (reference Thomas Bros. 1027-G7). **Exhibit A** provides a location map for the site.

1.1.2 Project Activities Description

Lots 1-21 shall serve as single-family residences. Lots “A” and “C” are to remain as open space via dedication to the County of San Diego, Fallbrook Conservation District. The open spaces will protect the existing non-native wetland areas and recommended buffer zones from future development. The remaining lots “B” and “D” will consist of common area for flood control and storm water quality treatment of runoff from the developed portion of the subdivision.

1.2 Hydrologic Setting

This section summarizes the project’s size and location in the context of the larger watershed perspective, topography, soil and vegetation conditions, percent impervious area, natural and infrastructure drainage features, and other relevant hydrologic and environmental factors specific to the project area's watershed.

The project site is located in the 65,494-acre (102-square mile) Bonsall Hydrologic Sub-Area (HSA 903.12), which is part of the Lower San Luis Hydrologic Area (HA 903.10) and San Luis Rey Hydrologic Unit (HU 903.00). The 17.0-acre project accounts for approximately .025 percent (0.00025) of the local watershed area. **Exhibit B** illustrates the project site in the context of the watershed.

Table 1-1 Project Area

Area	Area (acres)	% of Total
Bonsall HSA 903.12	65,494	100%
Property	17.0	0.025%
Impervious Area (Estimate)	3.8	0.006%

1.2.1 Topography

The topography of the site is fairly simple. A ridgeline, located approximately through proposed Lots 12, 13, 7, and 8, divides the property into two parts. Approximately 80% of the site drains from the ridge line towards Ostrich Farms Creek, while the remainder drains towards Morro Road to the east. The highest point of this part of the property is located near proposed Lot 15, at an elevation of approximately 607 feet MSL. This part of the property drains south and west over a distance of approximately 510 feet to an elevation of approximately 550 feet MSL for an average grade of approximately 11.1 percent. The remaining part of the property (approximately 3.5 acres) is east of the ridgeline. The highest point of this part of the property is located within the main ridge (see proposed Lot 13), at an elevation of approximately 600 feet MSL. This part of the property drains south and east over a distance of approximately 370 feet to an elevation of approximately 560 feet MSL for an average grade of approximately 11.1 percent.

1.2.2 Current and Adjacent Land Use

The project site is currently used for private residences. Existing single family residential land is located to the north and south of the project site. Prior to residential use, the site had been used for agricultural purposes. The site is bounded on the west side by Ostrich Farms Creek and Mission Road. Along the eastern edge the site is bounded by Morro Road. The area within Ostrich Farms Creek is considered non-native wetland, while the remaining portion (about 14 acres) is considered undeveloped grassy meadow. **Exhibit C** and **Exhibit D** illustrate the County of San Diego General Plan and Zoning near the project site, respectively.

Table 1-2 Summary of Site Soil Types.

Soil Name	Symbol	Hydrologic Soil Type	Erodibility	Area (acre)	Fraction
Tujunga Sand 0-5%	TuB	A	Low	2.55	0.15
SOIL TYPE A SUBTOTAL				***2.55***	***0.15***
Fallbrook Sandy Loam 5-9%	FaC	B	Moderate	0.51	0.03
Fallbrook Sandy Loam 9-15% (Eroded)	FaD2	B	Moderate	6.63	0.39
Vista Coarse Sandy Loam 15-30%	VsE	B	Moderate	0.34	0.02
SOIL TYPE B SUBTOTAL				***7.48***	***0.44***
	n/a	C	n/a	0	0
SOIL TYPE C SUBTOTAL				***0***	***0***
Placentia Sandy Loam 2-9%	PeC	D	Moderate	6.97	0.41
SOIL TYPE D SUBTOTAL				***6.97***	***0.41***
TOTAL				**17.0**	**1.00**

1.2.3 Soil and Vegetation Conditions

No soils report has been prepared at this preliminary stage of the project. Therefore, the Soil Survey for the San Diego Area by the Soil Conservation Service (1973) forms the basis of this discussion.

Soils on the project site vary with respect to permeability and all are considered to be low to moderately erodible. The Soil Survey indicates that there are a variety of soils present on the site. Approximately 44 percent of the project site consists of SCS Hydrologic Soil Type B, primarily in the form of Fallbrook and Vista Coarse Sandy Loam soils. Placentia sandy loam, Hydrologic Soil Type D, constitutes another 41 percent. The remaining 15 percent is made up of Tujunga Sand, Hydrologic Group A, within the Ostrich Creek streambed. All the soils on the project site are considered low to moderately erodible. Table 1-2 summarizes the soils on the project site. **Exhibit E** illustrates the soil types and limits.

1.2.4 Existing Drainage Patterns and Facilities

The project site consists of a natural high point roughly 300’ west of Morro Road. About 80% of the site drains to the west from this high point towards the existing wetlands adjacent to Mission Road. The remaining portion drains in an easterly direction towards Morro Road. Off-site flows to Ostrich Farms Creek enter the site from the northwest tract corner and flow through the wetland areas to the southwest corner. There are no known storm drain improvements on site or in close proximity to downstream receiving areas.

1.2.5 Floodplain Mapping

The Federal Emergency Management Agency (FEMA) has not mapped any Special Flood Hazard Areas (SFHAs) for Ostrich Farms Creek through the project site. Analysis of off-site flows to Ostrich Farms Creek is beyond the scope of this study; however, flows in Ostrich Farms Creek were taken from the Flood and Drainage Report for the Fallbrook Area.

The County of San Diego Floodplain Map (Map 430-1695) was reviewed to identify the existing County Floodway and 100-Year Floodline (shown in **Exhibit G**).

1.2.6 Downstream Conditions

Analysis of downstream conditions has not been attempted, because the project site plan has been designed to detain storm water flows to match pre-development levels.

1.2.7 Impervious Cover

The site has little impervious cover under the existing condition. The project will add approximately 3.8 acres of impervious area to the project site. This estimate assumes that each residential unit will contribute 5,000 square feet of impervious area, that there will be approximately 1,200 linear feet of a 36-foot wide on-site private road with 4-foot wide sidewalks on each side, and that there will be about a 300' long 24' wide paved emergency access.

Section 2. Methodology and Design Criteria

This section summarizes the design criteria and methodology applied during drainage analysis of the project site. The design criteria and methodology follow the County of San Diego Hydrology Manual (June 2003) and the Hydraulic Design and Procedure Manual (April 1993) as appropriate for the project site.

2.1 Rational Method

Rational Method Peak Flow for the area of interest at the southwest corner of the development footprint was calculated using methodology in the County of San Diego Hydrology manual for the rational method. These calculations were performed for both the existing and proposed conditions, so as to quantify increase in peak rate of discharge. Runoff coefficients were based upon researched soils data and Table 3-1 of the County Hydrology Manual for the existing condition. Proposed condition assumed a Type D soil, and "Low Density Residential" land use. Time of concentration was calculated per Section 3.1.4. of the County Hydrology Manual and corresponding runoff intensities for the 100-year storm were based upon a 6-hour precipitation of 3.0 inches.

Using results from rational method calculations for peak flow in both existing and proposed conditions, 6 hour hydrographs were generated using the County approved software prepared by Rick Engineering Company, which utilizes the methods described in Section 6 of the San Diego County Hydrology Manual. By overlaying both the pre-development and post-development hydrographs for the 100-year 6-hour event, we were able to estimate the required detention storage volume for this project at approximately 1.0 acre-feet (see Appendix B for the Preliminary Basin Sizing calculation). Other calculations done in conjunction with the project SWMP have shown a requirement of an additional 0.2 acre-feet to treat the required water quality event (Vbmp). Therefore the total required storage volume for both basins (which are connected by an equalization pipe) is 1.2 acre-feet. At this volume the basins provide both flood control and water quality treatment.

Rational Method Peak Flow for the area that drains to Morro Road shall be reduced as a result of development. Contributing area from the on-site portion of the Tract has been shown to be approximately 3.8 acres. (Refer to Appendix “A”.) This same area will flow through the on-site street and storm drain system so that it can be treated and discharged in the detention ponds to be constructed as part of development. The remaining drainage area to Morro Road has been shown to be substantially reduced, and therefore no detailed flow rate calculations have been prepared at this time. (Refer to Appendix “B”.)

Preliminary design flows for the Street “A” bridge crossing of Ostrich Farms Creek were taken from previously approved record drawings prepared by Hunsaker and Associates for the Pepper Tree Park Unit 1 Subdivision. (Refer to County of DPW Record File No. 1113-3, Bin No. 2026-B, plan sheet 7 of 9.) These improvement plans show information for a box culvert structure which was constructed in very near proximity to where the currently proposed one is indicated on the Pacifica Estates Project Tentative Map. The design flow indicated on the record drawings is 1700 cfs. This flow was confirmed in the Flood and Drainage Management Report for the Fallbrook Area. We have utilized this flow in preparing preliminary culvert hydraulic calculations, so that structure size and road elevations can be realistically established. These preliminary hydraulic calculations are included in Appendix “B” and are based upon methodology recommended in the Federal Highway Authority Series No. 5. Design Manual (Hydraulic Design of Culverts).

A project specific Hydromodification Mitigation report has been prepared by RBF Consulting under separate cover. Mitigation will be provided by draining each of the 21 residential lots and the associated drive aisle to the two proposed bioretention areas located near the westerly project boundary. Refer to the County approved study dated June 2014 for specifics related to hydromodification mitigation.

Section 3. Hydrologic Effects of Project

This section characterizes the quantities and location of storm water runoff from the project site. Discussion of the water quality aspects of the project can be found in the Storm Water Management Plan (SWMP), which is under separate cover from this report.

3.1 Drainage Patterns

The proposed project will not alter or divert drainage, as compared to predevelopment conditions. Riprap energy dissipaters will be located at all discharge locations. Through the inclusion Low Impact Development (LID) and Treatment Control BMPs (TC-BMP), the proposed project will result in a reduced 100-year peak flow discharge rate to both the west (South Mission Road) and to the east (Morro Road), as compared to existing conditions. Refer to Table 3-1 on page 7 for flow rates.

3.2 Impervious Cover

The project will add approximately 3.8 acres of impervious area (22.4 percent of the project site) in the form of rooftops, streets, and access roads.

3.3 Peak Runoff

The project will not increase the peak 100-year storm discharge from the 13-acre watershed, because extended detention basins have been included in the site plan to capture and meter the flow rates of most runoff from the proposed development. The anticipated mitigating effect of the detention basins is reflected in the peak flow (Q) for the “Proposed with Detention” Condition in Table 3-1. The two proposed basins are connected via an equalization pipe beneath the on-site drive aisle. As such, only one discharge location is proposed, refer to Node A on the proposed hydrologic work map in Appendix B.

Table 3-1 on the following page summarizes the hydrologic effects in terms of calculated peak runoff from the watershed under both existing and proposed conditions. Nodes at points of drainage discharge from the project pre- and post-development (corresponding with Table 3-1 below) are labeled on the hydrology maps in Appendix A and Appendix B, respectively.

Table 3-1 Summary of Hydrology Analysis

Condition	Node	A (acre)	C	T_i (min)	T_t (min)	T_c (min)	I (in/hr)	L (ft)	Q (cfs)
Pre-development 100-Year (P_6 = 3.0 in)	A	10.2	0.25	6.9	4.1	11.0	4.8	805	12.2
Pre-development 100-Year (P_6 = 3.0 in)	B1	1.2	0.30	-	-	5	7.9	490	2.8
Pre-development 100-Year (P_6 = 3.0 in)	B2	2.1	0.30	-	-	5	7.9	227	5.0
Proposed 100-Year (P_6 = 3.0 in)	A	12.7	0.46	10.5	2.3	12.8	4.3	210	25.1
Proposed w/ Detention 100-Year (P_6 = 3.0 in)	A	12.7	0.46	10.5	2.3	12.8	4.3	210	9.9
Proposed 100-Year (P_6 = 3.0 in)	B1	0.2	0.30	-	-	5	7.9	240	0.5
Proposed w/ Detention 100-Year (P_6 = 3.0 in)	B2	0.6	0.30	-	-	5	7.9	375	1.4
Open Space Lot A*	n/a	1.29	0.25	n/a	n/a	n/a	n/a	n/a	n/a
Open Space Lot B*	n/a	2.37	0.25	n/a	n/a	n/a	n/a	n/a	n/a

* Lots A and B remain open space under proposed conditions, no development proposed. Given no development, detailed hydrologic analysis has not been performed – these areas align with the natural existing creek, as such, a local hydrologic analysis is not meaningful.

3.4 Project Erosion and Siltation

Because runoff over erodible surfaces will be restricted to flows from the individual lots, and because the proposed grading will limit the flows and velocities of runoff generated, neither erosion nor siltation are anticipated. While Table 1-2 describes on-site soils as low to moderately erodible, Table 3-1 shows that the average velocity associated with overland flows will decrease in the post-development condition from approximately 2.0 fps pre-development to 0.3 fps. For the proposed condition this velocity applies only to the initial concentration of flow on the typical lot. Once flows have concentrated and exited a given lot, the flows are conveyed via impervious surfaces (gutters and storm drain pipes) not subject to erosion.

Section 4. Hydraulic Effects of the Project

This section characterizes the hydraulic behavior of Ostrich Farms Creek pre- and post-development, as well as impacts to the floodway. To address these issues a hydraulic model was developed using the US Army Corps HEC-RAS software.

4.1 Adequacy of Existing Infrastructure

The County of San Diego Flood and Drainage Management Report for the Fallbrook Area (February, 1992) indicates that the existing 8' x 12' arch culvert that passes Ostrich Farms Creek under Stage Coach Lane is inadequate to pass 1,700 cfs. The hydraulic model developed confirms that for the pre-development (existing) 100-year flood event, Stage Coach Lane will be overtopped because the existing culvert can pass only 1,000 cfs of the total 1,700 cfs flow. Overtopping creates a backwater effect that controls all hydraulic parameters between the downstream project boundary and Stage Coach Lane (e.g. the project has neither adverse nor mitigating impacts on existing hydraulic conditions). The undersized culvert poses a flooding risk to both people and property near the intersection of Stage Coach Lane and Mission Road.

Table 4-1 summarizes the culvert capacity problems at Stage Coach Lane with results from HEC-RAS modeling.

Table 4-1 Stage Coach Lane Culvert Hydraulics

Location	WSE	Road Crown	$Q_{culvert}$	Q_{weir}	Q_{total}	$V_{culvert}$
	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(fps)
Stage Coach Lane	531.31	530.00	1,078.48	621.52	1,700.00	14.30

The undersized culvert at Stage Coach Lane effectively disconnects the proposed project and any hydraulic impacts to Ostrich Farms Creek from all downstream reaches.

The County of San Diego Flood and Drainage Management Report for the Fallbrook Area (February, 1992) also indicates several existing deficiencies for the "Stage Coach Lane Tributary" (referred to herein as Stage Coach Creek), which confluences with Ostrich Farms Creek south of the intersection of Mission Road and Stage Coach Lane. The existing deficiencies include inadequate (undersized) drainage facilities at the high school and Winterhaven Road, as well as some scour and flooding.

4.2 Adequacy of Proposed Infrastructure

The proposed Street "A" bridge located approximately 600' upstream from Stage Coach Lane will pass Ostrich Farms Creek through a 10' x 30' arch culvert. Hydraulic modeling indicates that the proposed culvert will convey the entire 100-year flood flow. Preliminary hydraulic calculations are presented in Appendix B.

4.3 Ostrich Farms Creek Hydraulics

A hydraulic model of the 100-year flood event was developed using HEC-RAS. The model results indicate that the proposed project will affect minor changes to water surface elevations in Ostrich Farms Creek in the reach immediately adjacent to the project site. The water surface profiles generated for pre- and post-development conditions are shown in Appendix A and Appendix B, respectively.

The results of the HEC-RAS model were also compared to the County Floodway Elevations presented on San Diego County Floodplain Map 430-1695, Sheet 7 of 9, dated November 11, 1984. For comparison, the HEC-RAS cross sections were interpolated to provide floodway elevations at or near the County Floodplain Cross Sections. Table 4-2 summarizes the County Floodway, pre-development, and post-development hydraulic conditions in Ostrich Farms Creek in the reach adjacent to the proposed project.

In comparing the County Floodway Elevations and the hydraulic grade line (HGL) in the 100-year existing condition HEC-RAS calculation, there are several notable differences.[2] The HEC-RAS analysis calculated the HGL upstream from Stage Coach Lane to be

[2] The precise reasons for the differences shown in Table 4-2 cannot be determined without the County flood study input.

approximately 2.5 feet less than the County Floodway Elevation, with a corresponding reduction in flooded width. Given that this difference occurs in a reach experiencing a backwater condition, it is likely that the difference in elevation is caused by differences in either the flow rate or the modeled Stage Coach Lane crossing cross section.

Floodplain width and floodway elevation for the County Floodplain Map and the HEC-RAS model match more closely – less than 0.7 foot difference – at the upstream cross sections (County Stations 22.900 and 23.320) that are not subject to a backwater condition. These differences likely occur because the HEC-RAS model uses more cross sections with more recent topography and/or is based upon a different flow rate than the County study.

A comparison of the HEC-RAS 100-year pre-development and post-development hydraulic models indicates that the proposed culvert crossing of Ostrich Farms Creek will not impact flow conditions upstream or downstream from the proposed property (i.e. HGL, flow velocity, and flooded width match). While there are slight variations in the locations of calculated hydraulic jumps, the variation is less than 10 feet. A new hydraulic jump will occur within the proposed culvert crossing; however, there is sufficient height in the arch to prevent the culvert from sealing. The new hydraulic jump will actually reduce the flow velocity and scour potential within the proposed crossing.

The HEC-RAS model also indicates that the proposed detention basin lies partially inside the County 100-year floodplain. Because this grading occurs in a reach experiencing a backwater condition, the HGL is unaffected by the grading activity.

The complete HEC-RAS model output for the pre- and post-development conditions is provided in Appendix A and Appendix B, respectively.

Table 4-2 Summary of Hydraulic Conditions

County Floodplain Study			HEC-RAS	Pre-Development				Post-Development			
Station	Floodway Elevation (ft)	Floodplain Width (ft)	Station (ft)	HGL (ft)	Velocity (fps)	Flooded Width (ft)	Shear Stress (lb/ft^2)	HGL (ft)	Velocity (fps)	Flooded Width (ft)	Shear Stress (lb/ft^2)
22.371	531.9	440	100	531.31	5.90	280.00	0.30	531.31	5.90	280.00	0.30
22.380	533.8	480	109.571	531.34	5.70	276.08	0.28	531.34	5.70	276.08	0.28
22.550	533.8	360	262.714	531.43	5.80	143.01	0.35	531.43	5.80	143.01	0.35
22.900	533.8	135	602[3]	533.07	17.25	135.96	3.81	534.32	12.74	-	-
23.320	539.4	45	997.8	539.85	16.23	46.81	3.58	539.85	16.23	46.81	3.58

[3] Data is provided for Post-Development cross section 612 (Proposed Culvert), which is located at the proposed culvert outlet. WSE and Velocity are provided at the upstream entrance to the proposed culvert. The difference in elevation between pre- and post-development is caused by a hydraulic jump inside the culvert.

4.4 Ostrich Farms Creek Erosion and Siltation

Table 4-2 and the complete output in Appendices A and B present the shear stresses acting upon the substrate in Ostrich Farms Creek. For all cross-sections modeled, the shear stresses in the existing condition equal or exceed the shear stresses in the post-development condition. As such, it can be stated that the project provides minor mitigation for the erosive effects of the 100-year flow in Ostrich Farms Creek.

It is, however, important to note that for the actual shear stresses and the sandy substrate observed (see Table 1-2, the existing conditions map in Appendix A, and the picture on previous page) that channel protection is recommended (see **Exhibit H** for reference materials relating to erosion and channel protection in Ostrich Farms Creek). Allowable shear stresses for medium-sized sand particles (0.01 to 0.02 inches) like those found in Ostrich Farms Creek range from 0.027 lb/ft^2 to 0.032 lb/ft^2. To resist the worst-case shear stresses calculated by HEC-RAS for Ostrich Farms Creek post-development, a protective rock riprap lining with a mean diameter of 10.7 inches is recommended.

Section 5. Summary and Conclusions

This section provides a summary discussion of the potential effects of the proposed project on local water resources in terms of quantity and location.

- The proposed project will not alter or divert flow, as compared to existing conditions. Easterly and westerly 100-year peak flow discharge will be reduced under proposed conditions, as compared to existing conditions.
- The project will not increase peak 100-year discharges in Ostrich Farms Creek or other points downstream. It accomplishes this by means of on-site bioretention basins. These basins are connected with an equalization pipe, thus only the southerly basin discharges from the site (Node A on the proposed hydrologic work map in Appendix B).
- There are no County Master Plan drainage facilities shown in the approved Comprehensive Plan that would affect the project.
- The existing culvert that passes Ostrich Farms Creek under Stage Coach Lane is inadequate. For the 100-year flood event Stage Coach Lane is overtopped by flow, which produces a backwater effect that will cause flooding near Stage Coach Lane. The proposed project has no impact, adverse or mitigating, upon this situation.

- The project will not affect the capacity of existing drainage facilities on- or off-site. The project site currently contains no drainage improvements and the bridge and other storm drainage pipes proposed as part of this project will be designed to convey the peak 100-year flows without causing flooding of proposed structures.
- While the proposed project provides a minor mitigating effect on shear stresses in Ostrich Farms Creek, a protective lining will be necessary to guard against erosion for the 100-year flood event (see **Exhibit H**).

Section 6. CEQA Summary

This section summarizes the results of the hydrology, hydraulics and drainage analysis in the context of CEQA significance guidelines.

6.1 Drainage

6.1.1 Erosion and/or Sedimentation

Would 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 that would result in substantial erosion or siltation on- or off-site?

No. The project will not alter existing drainage patterns of the site area in a manner that would result in substantial erosion or siltation. The project does not alter the course of a stream or river.

- The project proposes to preserve the alignment and profile of the streambed of the Ostrich Farms Creek on the project site. Stream crossings will be constructed as clear spans or with similar low-impact configurations, which will minimize disruption to the hydraulic and sediment regimes of the stream.
- Flows may be concentrated at certain locations, including storm drain outfalls. However, all existing and proposed storm drain outfalls will be outfitted with appropriate energy dissipation devices. These energy dissipation devices, along with other storm water Best Management Practices (BMPs), will help preclude significant erosion and/or siltation on-site and off-site.

6.1.2 Flooding

Does 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, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?

No. The project will not alter existing drainage patterns of the site area in a manner that would result in flooding on- of off-site. The project does not alter the course of a stream or river.

- The drainage study demonstrates that the project will not increase the peak 100-year storm discharge to the east or west, as compared to existing conditions

6.1.3 Drainage System Capacity

Does the project create or contribute runoff water that would exceed the capacity of existing or planned storm water drainage systems?

No. The project will not create or contribute to runoff water that would exceed the capacity of existing or planned storm water drainage systems.

- The project would not affect any County master-planned drainage facilities, per the Comprehensive Plan.

6.2 Flood Hazards

6.2.1 Residential Flood Hazard

Would the project place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map, including County Floodplain Maps?

No. The project does not propose to locate any housing within the 100-year flood hazard area.

- The project does not propose any development within the 100-year floodplain or other Special Flood Hazard Area (SFHA) designated by FEMA or the County of San Diego.

6.2.2 Flood Flow

Does the project place within a 100-year flood hazard area structures that would impede or redirect flood flows?

No. The project does not propose to locate any structures or grading in the floodplain that would impede or redirect flood flows.

- The project does not propose any development within the 100-year floodplain or other Special Flood Hazard Area (SFHA) designated by FEMA or the County of San Diego.

- Stream crossings will be constructed as clear spans or similar low-impact configurations, which will minimize disruption to the hydraulic and sediment regimes of the stream.

6.2.3 Flood Hazard

Does the project expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

No. The project does not place any people or structures at significant risk of loss, injury, or death due to flooding.

- The project does not propose any development within the 100-year floodplain or other Special Flood Hazard Area (SFHA) designated by FEMA or the County of San Diego.
- The project will ensure emergency access during significant flood events. The project is not located behind a levee or below a dam that would present a flood hazard upon its failure.

6.2.4 Other Hazards

Is the project at significant risk of inundation by seiche, tsunami, or mudflow?

No. The project is not located within an area at risk of inundation by seiche (lake slosh) tsunami, or mud flow.

6.3 Waiver and Release Agreements

The project does not alter downstream flow characteristics significantly, either due to increase in flow or flood condition, diversion of flow, or flow concentration. Therefore, it should not be necessary to obtain waiver and release agreements from any affected property owners.

Section 7. References

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

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Exhibit "A"

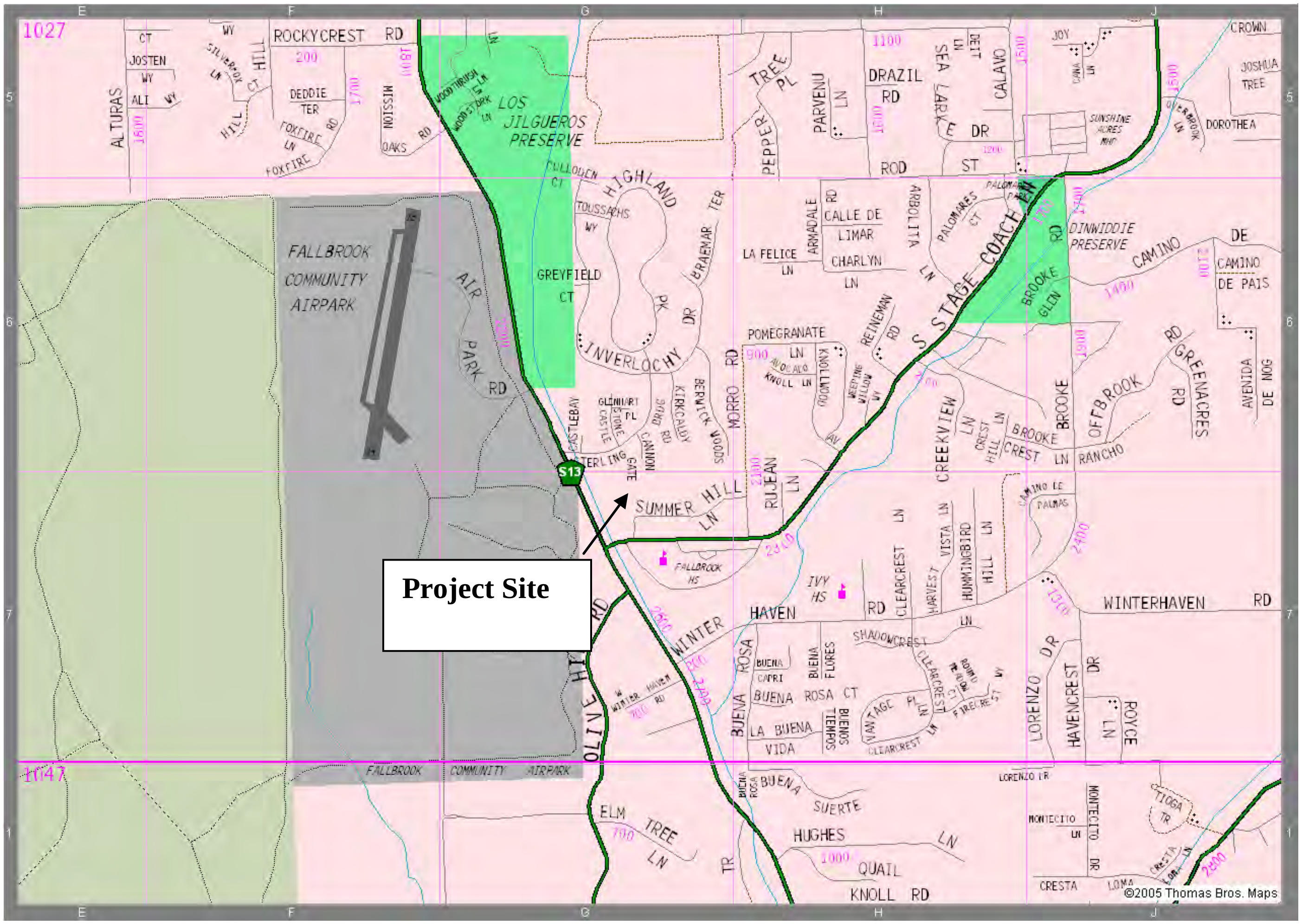
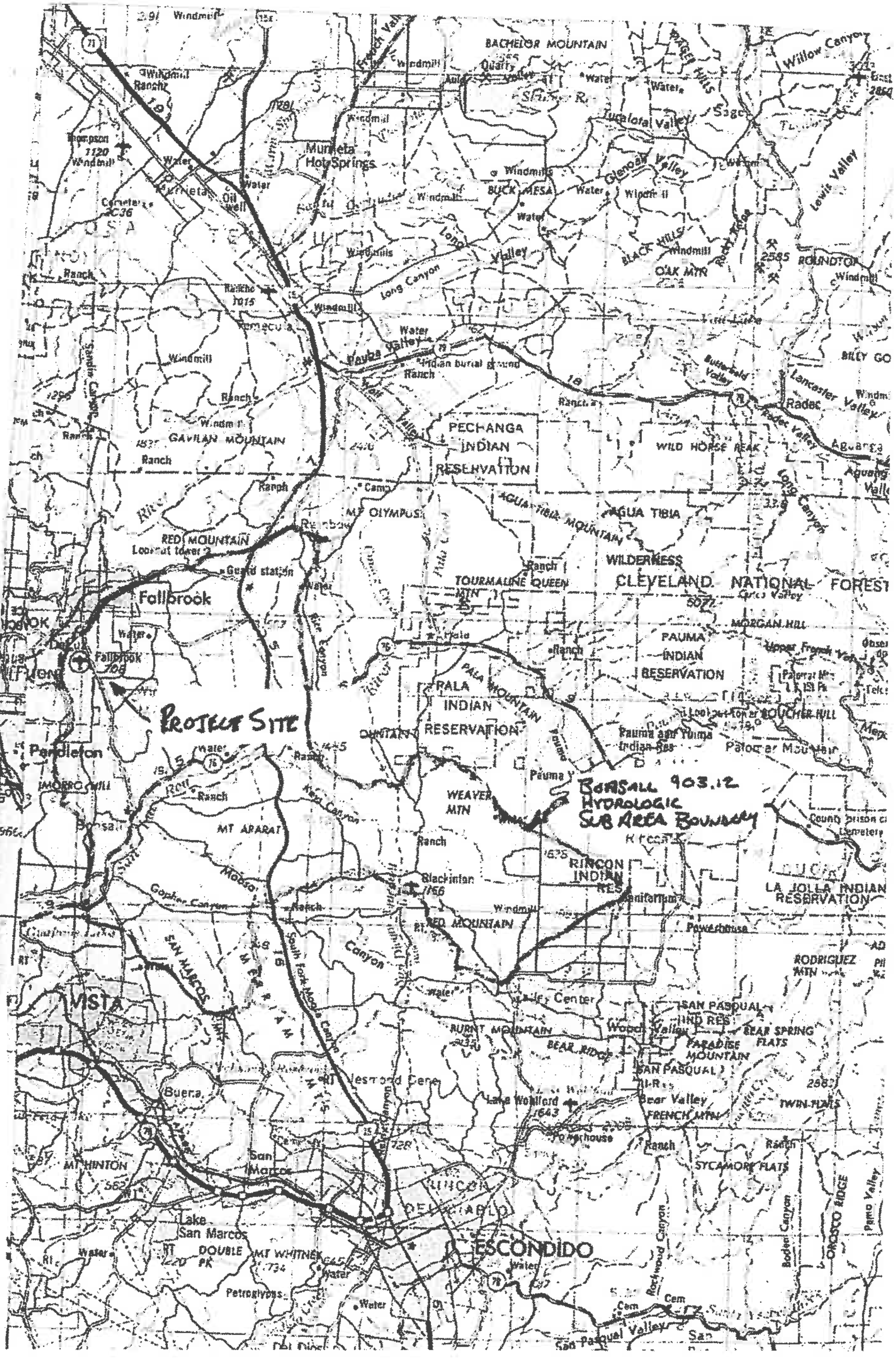


Exhibit A Vicinity Map (Reference Thomas Bros. 1027 Section G-7)

Exhibit “B”



BACHELOR MOUNTAIN
Murrieta Hot Springs
Murrieta
BUCK MESA
Long Canyon
Long Valley
Willow Canyon
Lewis Valley
BLACK HILLS
OAK MTN
ROUNDTOP
Pauba Valley
Indian burial ground
Radec
Aguanga
Lancaster Valley
GAVILAN MOUNTAIN
PECHANGA INDIAN RESERVATION
WILD HORSE PEAK
MT OLYMPUS
AGUA TIBIA MOUNTAIN
AGUA TIBIA
WILDERNESS
CLEVELAND NATIONAL FOREST
Rainbow
RED MOUNTAIN
Lookout tower
Guard station
Fallbrook
TOURMALINE QUEEN MTN
MORGAN HILL
PAUMA INDIAN RESERVATION
PALA MOUNTAIN
PALA INDIAN RESERVATION
Pauma and Yuima Indian Res
Palomar Mountain
PROJECT SITE
Pendleton
Bonsall
WEAVER MTN
Pauma
BONSALL 903.12 HYDROLOGIC SUB AREA BOUNDARY
MT ARARAT
Gopher Canyon
RINCON INDIAN RES
LA JOLLA INDIAN RESERVATION
Sanitarium
Powerhouse
RED MOUNTAIN
RODRIGUEZ MTN
SAN MARCOS
VISTA
Valley Center
SAN PASQUAL IND RES
BEAR SPRING FLATS
PARADISE MOUNTAIN
BURNT MOUNTAIN
BEAR RIDGE
Lake Wohlford
Bear Valley
FRENCH MTN
TWIN PEAKS
Buena
MT HINTON
San Marcos
SYCAMORE FLATS
Lake San Marcos
DOUBLE PK
MT WHITNEY
ESCONDIDO
Petroglyphs
Rockwood Canyon
Boden Canyon
OROSCO RIDGE
Pamo Valley
San Pasqual Valley

Exhibit "C"

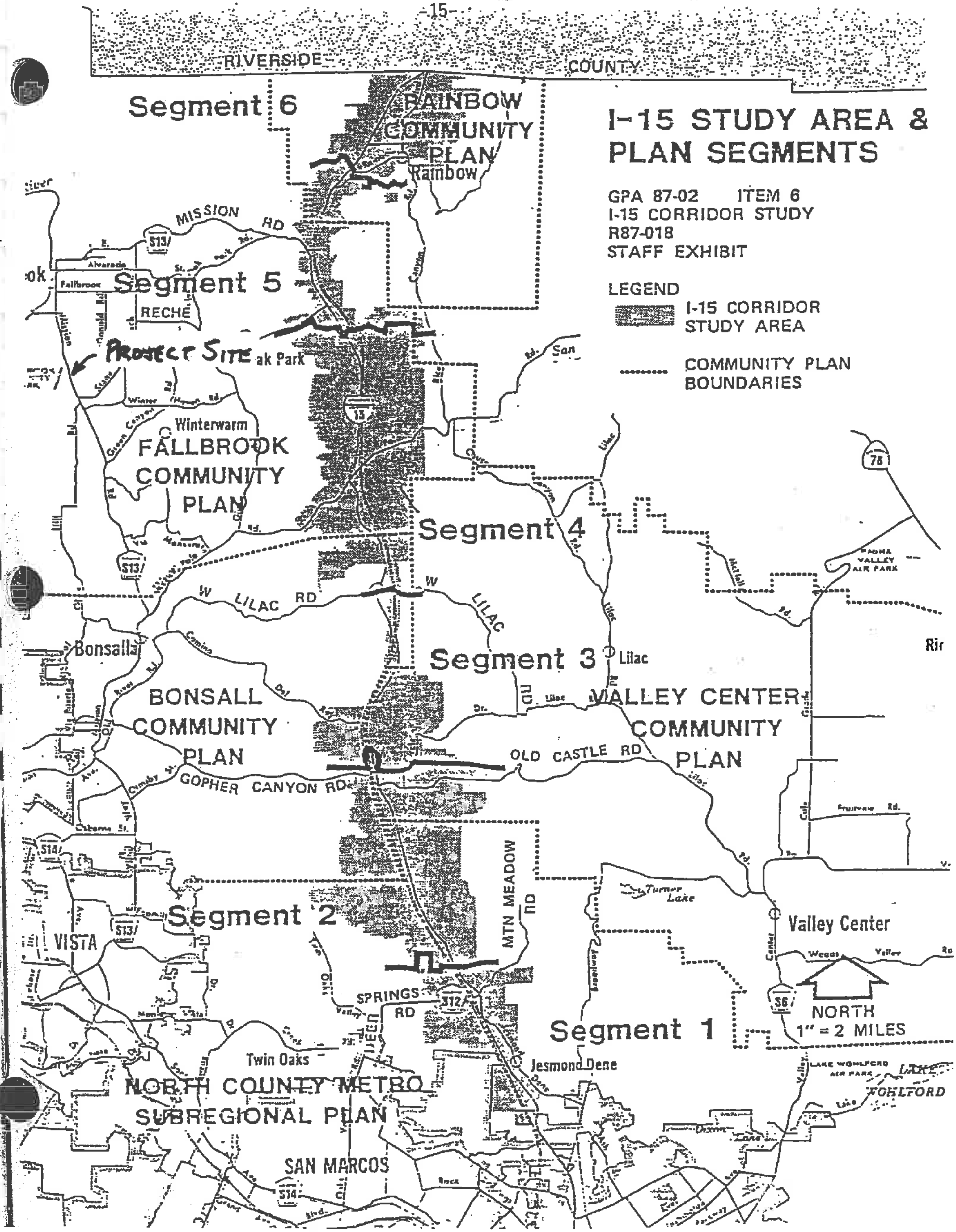
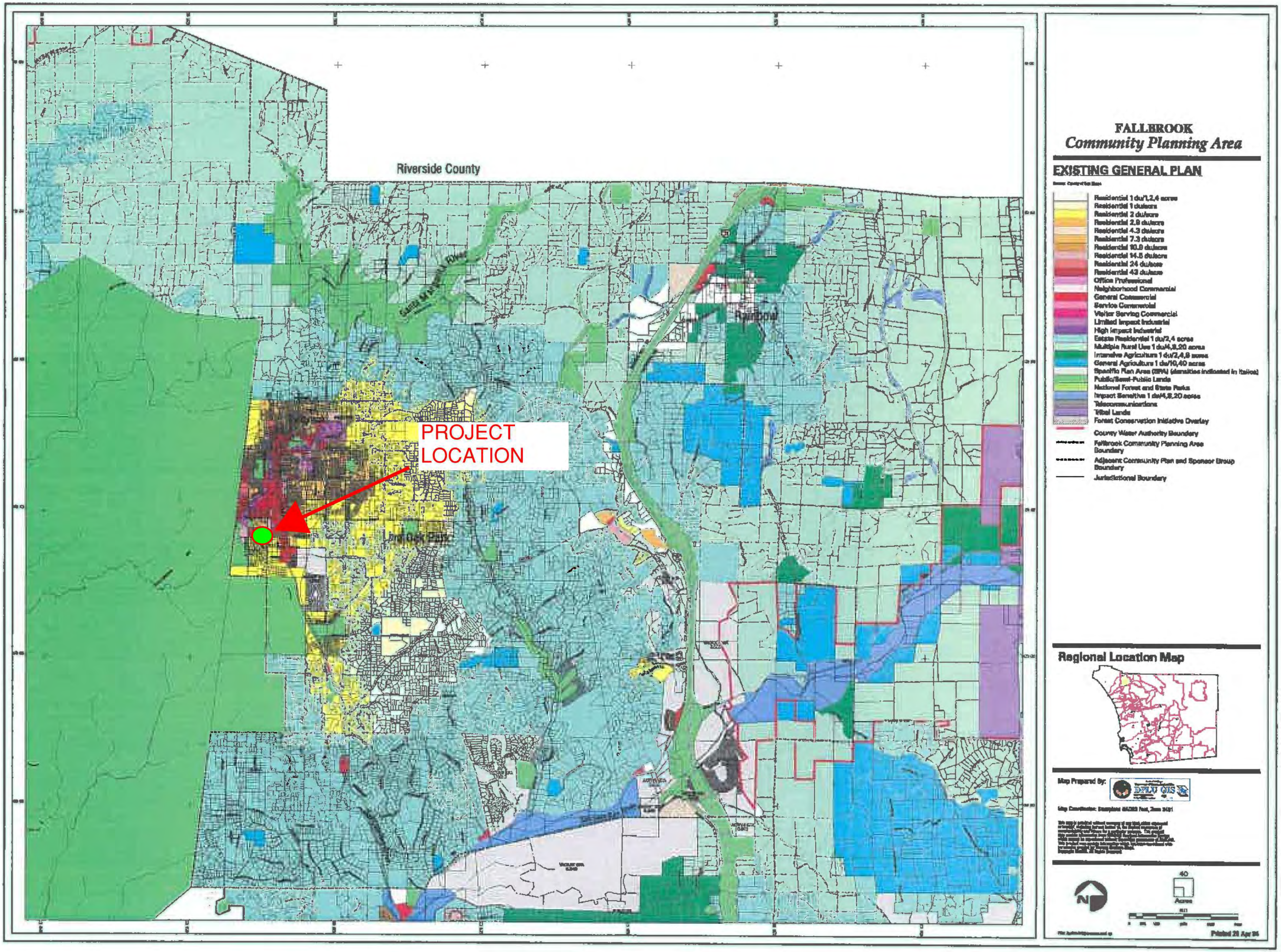

RIVERSIDE COUNTY
Segment 6
RAINBOW COMMUNITY PLAN
Rainbow
I-15 STUDY AREA & PLAN SEGMENTS
GPA 87-02 ITEM 6
I-15 CORRIDOR STUDY
R87-018
STAFF EXHIBIT
LEGEND
I-15 CORRIDOR STUDY AREA
COMMUNITY PLAN BOUNDARIES
MISSION RD
Segment 5
RECHE
PROJECT SITE
Winterwarm
FALLBROOK COMMUNITY PLAN
Segment 4
W LILAC RD
Bonsall
Segment 3
Lilac
BONSALL COMMUNITY PLAN
VALLEY CENTER COMMUNITY PLAN
OLD CASTLE RD
GOPHER CANYON RD
MTN MEADOW RD
Segment 2
VISTA
Turner Lake
Valley Center
SPRINGS RD
Segment 1
NORTH
1" = 2 MILES
Twin Oaks
Jesmond Dene
NORTH COUNTY METRO SUBREGIONAL PLAN
SAN MARCOS
LAKE WOHLFORD

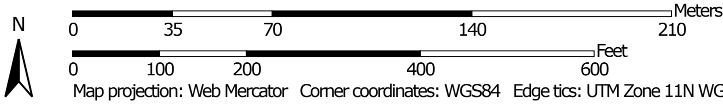
Exhibit “D”



Riverside County
Rainbow
Live Oak Park
PROJECT LOCATION
FALLBROOK
Community Planning Area
EXISTING GENERAL PLAN
Residential 1 du/1,2,4 acres
Residential 1 du/acre
Residential 2 du/acre
Residential 2.9 du/acre
Residential 4.3 du/acre
Residential 7.3 du/acre
Residential 10.9 du/acre
Residential 14.5 du/acre
Residential 24 du/acre
Residential 43 du/acre
Office Professional
Neighborhood Commercial
General Commercial
Service Commercial
Visitor Serving Commercial
Limited Impact Industrial
High Impact Industrial
Estate Residential 1 du/2,4 acres
Multiple Rural Use 1 du/4,8,20 acres
Intensive Agriculture 1 du/2,4,8 acres
General Agriculture 1 du/10,40 acres
Specific Plan Area (SPA) (densities indicated in italics)
Public/Semi-Public Lands
National Forest and State Parks
Impact Sensitive 1 du/4,8,20 acres
Telecommunications
Tribal Lands
Forest Conservation Initiative Overlay
County Water Authority Boundary
Fallbrook Community Planning Area Boundary
Adjacent Community Plan and Sponsor Group Boundary
Jurisdictional Boundary
Regional Location Map
Map Prepared By:
DPLU GIS
40
Acres

Exhibit “E”

Map Scale: 1:2,650 if printed on A landscape (11" x 8.5") sheet.



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 8, Sep 17, 2014

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

Date(s) aerial images were photographed: May 3, 2010—Jun 19, 2010

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
FaC	Fallbrook sandy loam, 5 to 9 percent slopes	C	0.5	2.9%
FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded	C	8.0	43.9%
PeC	Placentia sandy loam, 2 to 9 percent slopes, warm MAAT, MLRA 19	C	7.6	41.6%
RaB	Ramona sandy loam, 2 to 5 percent slopes	C	0.0	0.2%
TuB	Tujunga sand, 0 to 5 percent slopes	A	2.0	10.9%
VsE	Vista coarse sandy loam, 15 to 30 percent slopes	B	0.1	0.5%
Totals for Area of Interest			**18.3**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Exhibit “F”

INTENTIONALLY OMITTED

Exhibit "G"

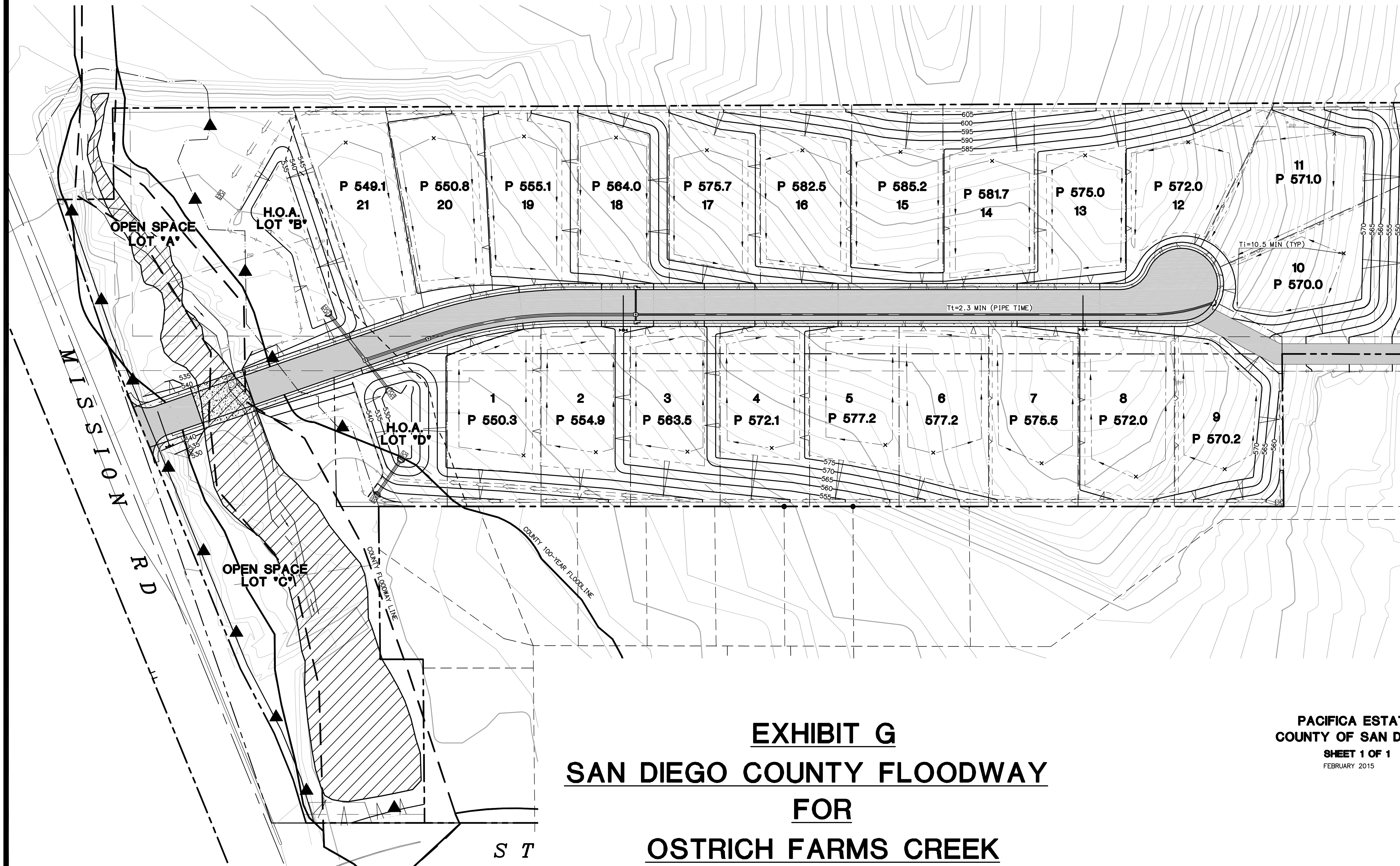


EXHIBIT G
SAN DIEGO COUNTY FLOODWAY
FOR
OSTRICH FARMS CREEK

PACIFICA ESTATES
COUNTY OF SAN DIEGO, CA
SHEET 1 OF 1
FEBRUARY 2015

RBF CONSULTING
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CARLSBAD, CALIFORNIA 92008
760.476.9193 ▪ FAX 760.476.9198 ▪ www.RBF.com

H:\PDATA\55100256\CADD\CARLSBAD\STORMWATER\256EX007.DWG TFRANSSON

Exhibit “H”

TABLE 4.1 Sediment Grade Scale

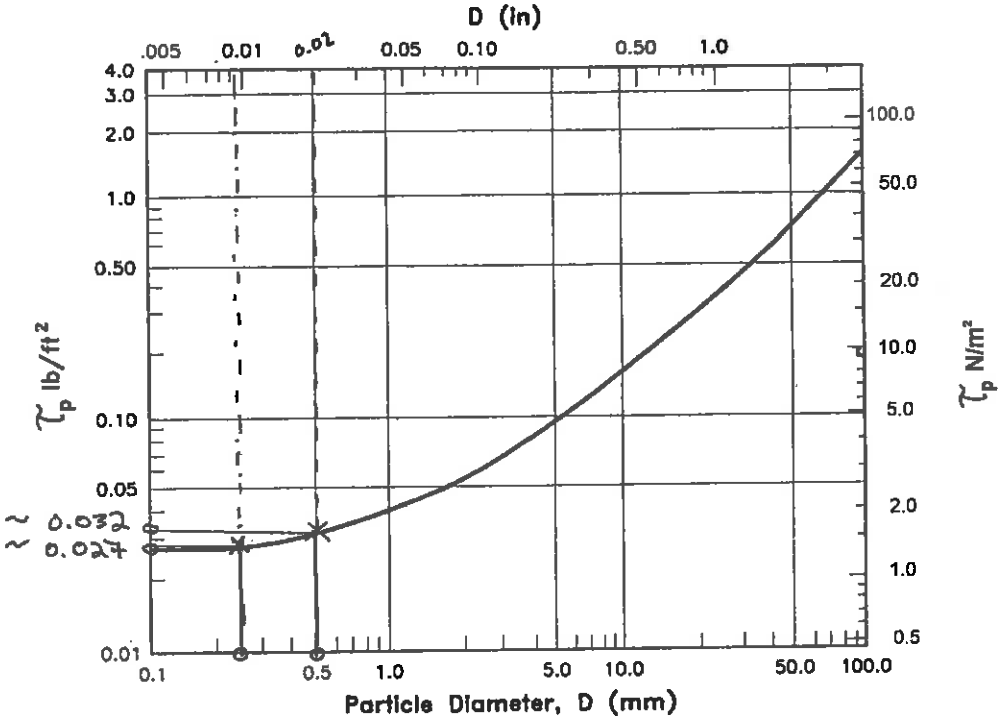
Size				Approximate Sieve Mesh Openings per Inch		
Millimeters		Microns	Inches	Tyler	U.S. Standard	Class
4000–2000			160–80			Very large boulders
2000–1000			80–40			Large boulders
1000–500			40–20			Medium boulders
500–250			20–10			Small boulders
250–130			10–5			Large cobbles
130–64			5–2.5			Small cobbles
64–32			2.5–1.3			Very coarse gravel
32–16			1.3–0.6			Coarse gravel
16–8			0.6–0.3	$2\frac{1}{2}$		Medium gravel
8–4			0.3–0.16	5	5	Fine gravel
4–2			0.16–0.08	9	10	Very fine gravel
2–1	2.00–1.00	2000–1000		16	18	Very coarse sand
$1–\frac{1}{2}$	1.00–0.50	1000–500		32	35	Coarse sand
$\frac{1}{2}–\frac{1}{4}$	0.50–0.25	500–250		60	60	Medium sand
$\frac{1}{4}–\frac{1}{8}$	0.25–0.125	250–125		115	120	Fine sand
$\frac{1}{8}–\frac{1}{16}$	0.125–0.062	125–62		250	230	Very fine sand
$\frac{1}{16}–\frac{1}{32}$	0.062–0.031	62–31				Coarse silt
$\frac{1}{32}–\frac{1}{64}$	0.031–0.016	31–16				Medium silt
$\frac{1}{64}–\frac{1}{128}$	0.016–0.008	16–8				Fine silt
$\frac{1}{128}–\frac{1}{256}$	0.008–0.004	8–4				Very fine silt
$\frac{1}{256}–\frac{1}{512}$	0.004–0.0020	4–2				Coarse clay
$\frac{1}{512}–\frac{1}{1024}$	0.0020–0.0010	2–1				Medium clay
$\frac{1}{1024}–\frac{1}{2048}$	0.0010–0.0005	1–0.5				Fine clay
$\frac{1}{2048}–\frac{1}{4096}$	0.0005–0.00024	0.5–0.24				Very fine clay

Fall Diameter. This is the diameter of a sphere having a specific gravity of 2.65 and having the same terminal velocity as the particle when each is allowed to settle alone in quiescent distilled water of infinite extent at 24°C.

A sediment sample is made up of grains having a range of sizes and other characteristics. The size distribution is obtained by the separation of a sample into a number of size classes, known as the *mechanical analysis*. The results of such analyses are represented statistically. The size distribution of a sediment sample is usually presented as a cumulative size–frequency curve plotted on probability paper (Fig. 4.1). The percentage by weight of sediment finer or smaller than a certain size is plotted against the size.

The grain size corresponding to the 50% finer point is obtained from the curve as the median size. Under the assumption of log-normal size distribution, the geometric mean size may be obtained at the intersection of the 50% line and a

CHART 23



Permissible Shear Stress For Non-cohesive Soils. (After 15)

5.2.5 Shear Stress

The permissible or critical shear stress in a channel defines the force required to initiate movement of the channel bed or lining material. Table 5-4 presents permissible shear stress values for manufactured, vegetative, and riprap channel lining. The permissible shear stress for non-cohesive soils is a function of mean diameter of the channel material as shown in chart 23. For larger stone sizes not shown in chart 23 and rock riprap, the permissible shear stress is given by the following equation:

$$\tau_p = K_u D_{50} \qquad (5\text{-}17)$$

where:

τ_p = permissible shear stress, Pa (lb/ft^2)
D_{50} = mean riprap size, m (ft)
K_u = 628 (4.0 in English Units)

For cohesive materials the plasticity index provides a good guide for determining the permissible shear stress as illustrated in chart 24.

Example 5-3

Given: *The channel section and flow conditions in example 5-2.*

Find: *Determine if a good stand of buffalo grass (Class D degree of retardance) will provide an adequate lining for this channel.*

Solution:

<u>SI Units</u>

Step 1. Determine permissible shear stress.

From table 5-4
$\tau_p = 28.7$ Pa

Step 2. Compare τ_p with the maximum shear stress in the straight section, τ_d, and with the shear stress in the bend, τ_b

$\tau_d = 43.2$ Pa
$\tau_b = 69.1$ Pa

$\tau_p = 28.74 < \tau_d = 43.2$
$\tau_p = 28.74 < \tau_b = 69.1$

Therefore, the buffalo grass does not provide adequate lining for the channel in either the straight section or in the bend.

<u>English Units</u>

Step 1. Determine permissible shear stress.

From table 5-4
$\tau_p = 0.60$ lb/ft^2

Step 2. Compare τ_p with the maximum shear stress in the straight section, τ_d, and with the shear stress in the bend, τ_b.

$\tau_d = 0.92$ lb/ft^2
$\tau_b = 1.43$ lb/ft^2

$\tau_p = 0.60 < \tau_d = 0.92$
$\tau_p = 0.60 < \tau_b = 1.43$

Therefore, the buffalo grass does not provide adequate lining for the channel in either the straight section or in the bend.

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JOB 55-100256.002

SHEET NO. 1 OF 1

CALCULATED BY BM DATE 1/15/2007

CHECKED BY ______ DATE ______

SCALE ______

Riprap Sizing

source: HEC No. 22, p. 5-18, Eqn. 5-17

HEC-RAS output (Appendix B, this report)

given: max shear stress calculated by HEC-RAS

$\tau_o = 3.58 \ lb/ft^2$ (River Station 997.8)

$K_u = 4.0$ (for imperial units)

$$\tau_p = K_u D_{50}$$

$$D_{50} = \frac{\tau_p}{K_u}$$

$$D_{50} = \frac{3.58 \ lb/ft^2}{4.0}$$

$$D_{50} = 0.895 \ ft$$

$$D_{50} = 10.74 \ in.$$

∴ Riprap with a mean diameter of ~10.7 inches is required to resist the worst-case shear stress in the post-development condition.

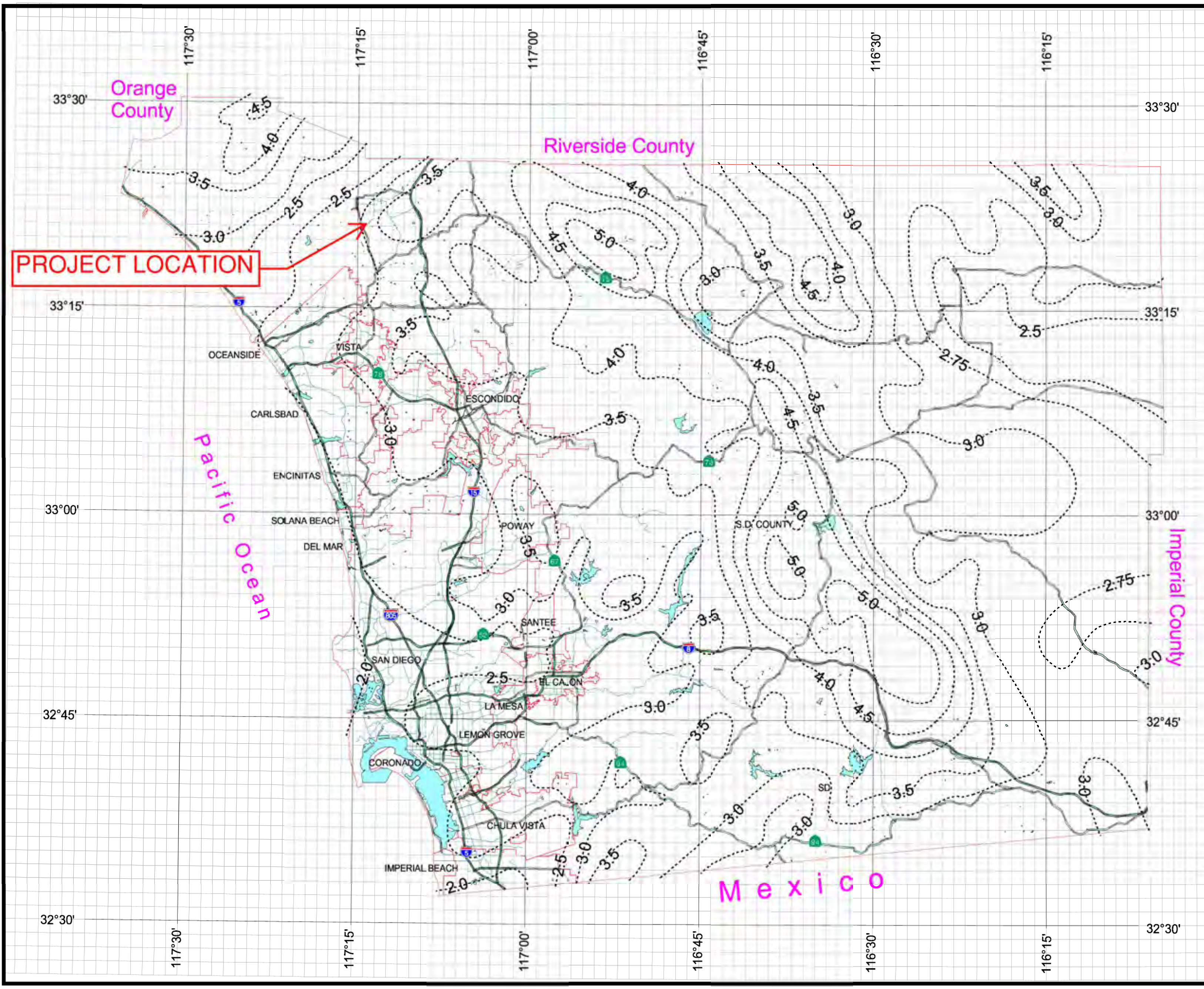
APPENDIX A

Existing Conditions Hydrology

& Hydraulics

This Section Contains:

- Work Map
- Rational Hydrograph Software Output
- HEC-RAS Output and Profile



County of San Diego Hydrology Manual

Rainfall Isopluvials

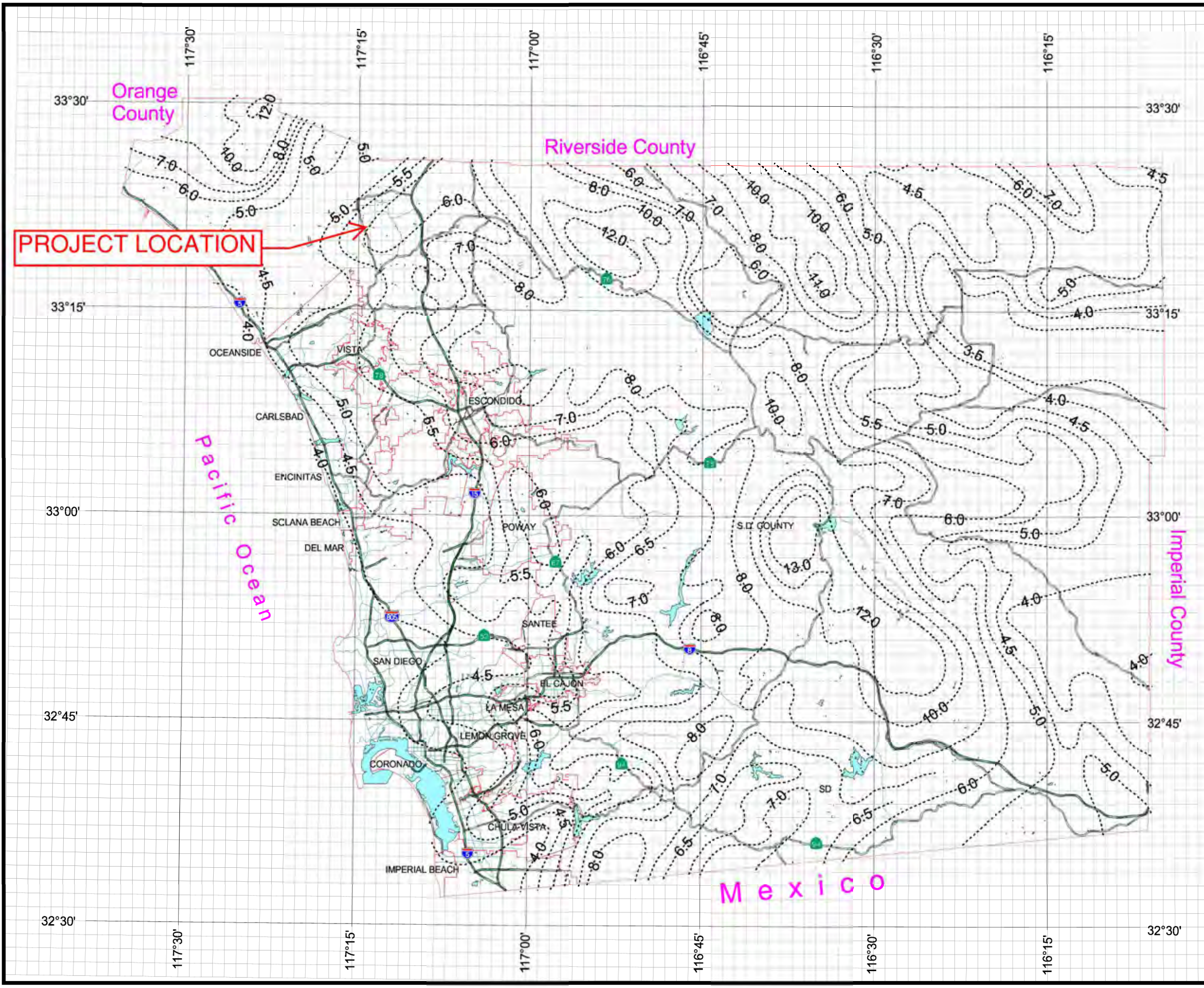
100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

We Have San Diego Covered!

N S E W

3 0 3 Miles



County of San Diego Hydrology Manual

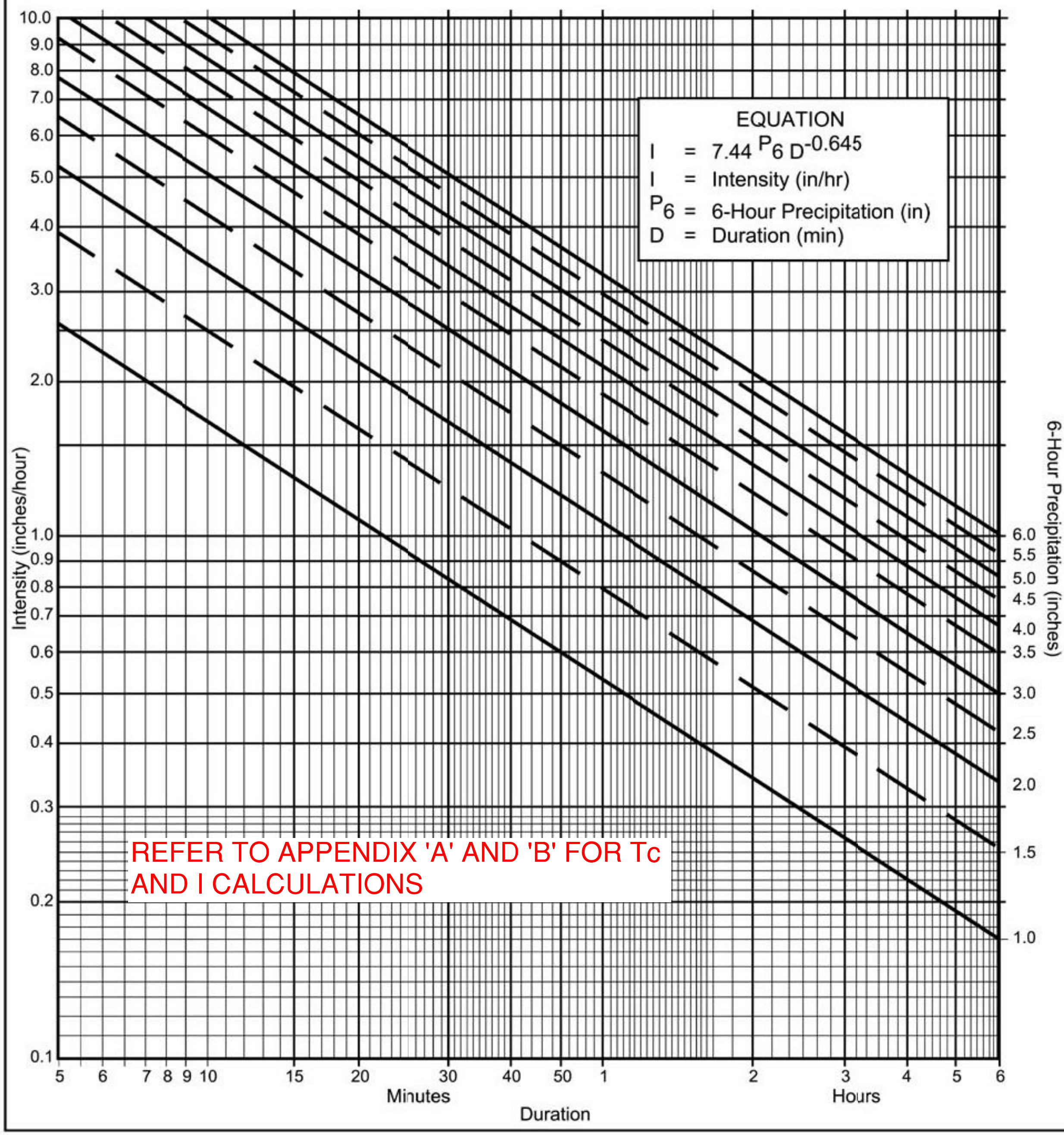
Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

-------- Isopluvial (inches)

N
W E
S

3 0 3 Miles



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 applicable 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 = 3.0 in., P_{24} = 6.0, $\frac{P_6}{P_{24}}$ = 50 %(2)

(c) Adjusted $P_6^{(2)}$ = n/a in.

(d) t_x = _______ min.

(e) I = _______ 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

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	$\boxed{0.25}$	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	$\boxed{0.46}$
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

Proposed project is less than 2 DU/AC. As a conservative measure, hydrologic soil type D selected for proposed conditions

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

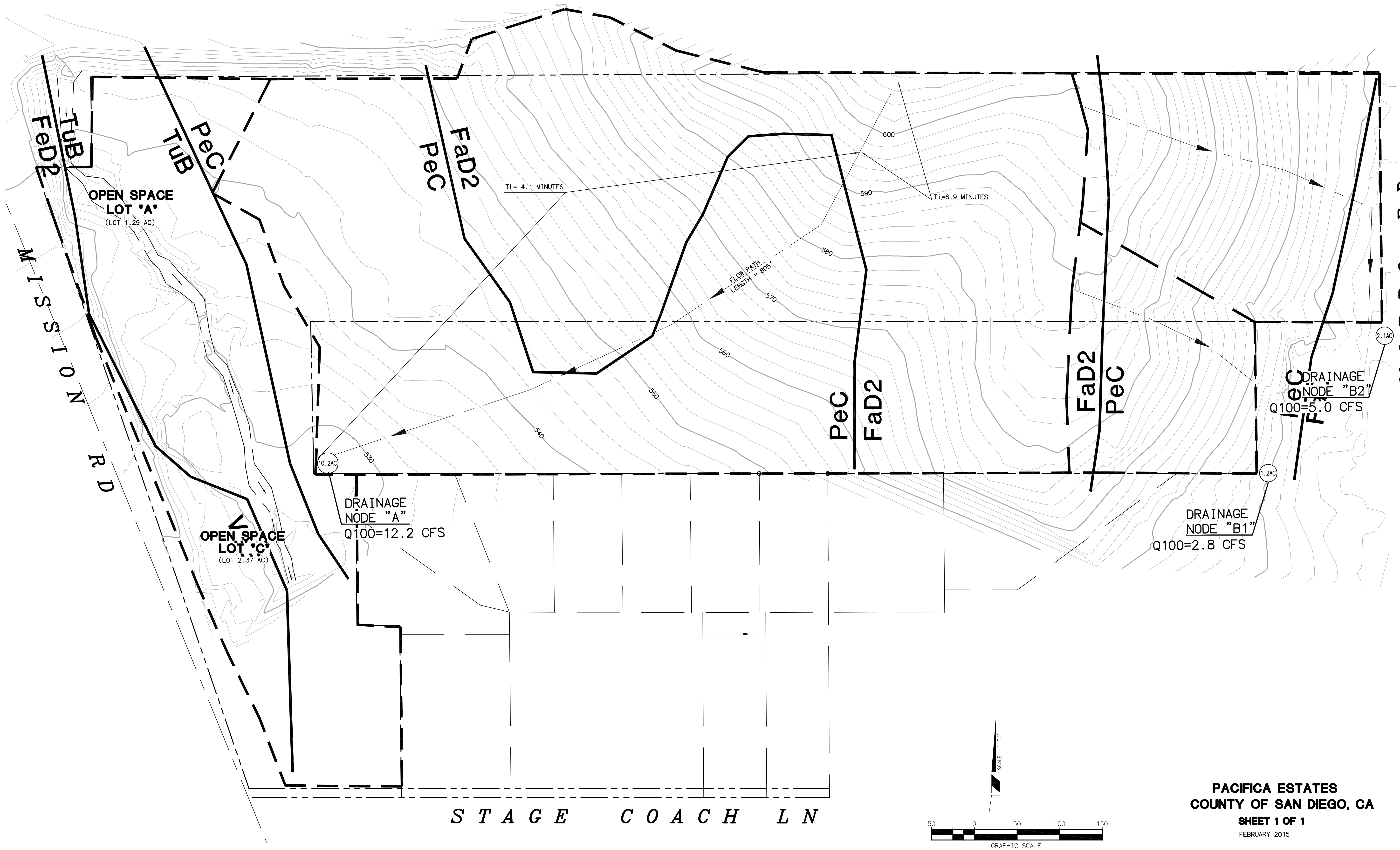
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description



PACIFICA ESTATES
COUNTY OF SAN DIEGO, CA
SHEET 1 OF 1
FEBRUARY 2015

EXISTING CONDITIONS HYDROLOGY MAP

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RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 3/17/2015
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 11 MIN.
6 HOUR RAINFALL 3 INCHES
BASIN AREA 10.2 ACRES
RUNOFF COEFFICIENT 0.25
PEAK DISCHARGE 12.2 CFS

PACIFIC ESTATES
BASIN A: EXISTING CONDITIONS
REFER TO TABLE 3-1 ON PAGE 7 FOR Tc REFERENCE

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 11	DISCHARGE (CFS) = 0.5
TIME (MIN) = 22	DISCHARGE (CFS) = 0.5
TIME (MIN) = 33	DISCHARGE (CFS) = 0.5
TIME (MIN) = 44	DISCHARGE (CFS) = 0.5
TIME (MIN) = 55	DISCHARGE (CFS) = 0.5
TIME (MIN) = 66	DISCHARGE (CFS) = 0.5
TIME (MIN) = 77	DISCHARGE (CFS) = 0.6
TIME (MIN) = 88	DISCHARGE (CFS) = 0.6
TIME (MIN) = 99	DISCHARGE (CFS) = 0.6
TIME (MIN) = 110	DISCHARGE (CFS) = 0.6
TIME (MIN) = 121	DISCHARGE (CFS) = 0.7
TIME (MIN) = 132	DISCHARGE (CFS) = 0.7
TIME (MIN) = 143	DISCHARGE (CFS) = 0.8
TIME (MIN) = 154	DISCHARGE (CFS) = 0.8
TIME (MIN) = 165	DISCHARGE (CFS) = 0.9
TIME (MIN) = 176	DISCHARGE (CFS) = 0.9
TIME (MIN) = 187	DISCHARGE (CFS) = 1.1
TIME (MIN) = 198	DISCHARGE (CFS) = 1.2
TIME (MIN) = 209	DISCHARGE (CFS) = 1.4
TIME (MIN) = 220	DISCHARGE (CFS) = 1.6
TIME (MIN) = 231	DISCHARGE (CFS) = 2.4
TIME (MIN) = 242	DISCHARGE (CFS) = 3.3
TIME (MIN) = 253	DISCHARGE (CFS) = 12.2
TIME (MIN) = 264	DISCHARGE (CFS) = 1.9
TIME (MIN) = 275	DISCHARGE (CFS) = 1.3
TIME (MIN) = 286	DISCHARGE (CFS) = 1
TIME (MIN) = 297	DISCHARGE (CFS) = 0.8
TIME (MIN) = 308	DISCHARGE (CFS) = 0.7
TIME (MIN) = 319	DISCHARGE (CFS) = 0.7
TIME (MIN) = 330	DISCHARGE (CFS) = 0.6
TIME (MIN) = 341	DISCHARGE (CFS) = 0.5
TIME (MIN) = 352	DISCHARGE (CFS) = 0.5
TIME (MIN) = 363	DISCHARGE (CFS) = 0.5
TIME (MIN) = 374	DISCHARGE (CFS) = 0

RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 3/17/2015
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 5 MIN.
6 HOUR RAINFALL 3 INCHES
BASIN AREA 1.2 ACRES
RUNOFF COEFFICIENT 0.3
PEAK DISCHARGE 2.8 CFS

PACIFIC ESTATES
BASIN B1: EXISTING CONDITIONS
REFER TO TABLE 3-1 ON PAGE 7 FOR Tc REFERENCE

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 5	DISCHARGE (CFS) = 0.1
TIME (MIN) = 10	DISCHARGE (CFS) = 0.1
TIME (MIN) = 15	DISCHARGE (CFS) = 0.1
TIME (MIN) = 20	DISCHARGE (CFS) = 0.1
TIME (MIN) = 25	DISCHARGE (CFS) = 0.1
TIME (MIN) = 30	DISCHARGE (CFS) = 0.1
TIME (MIN) = 35	DISCHARGE (CFS) = 0.1
TIME (MIN) = 40	DISCHARGE (CFS) = 0.1
TIME (MIN) = 45	DISCHARGE (CFS) = 0.1
TIME (MIN) = 50	DISCHARGE (CFS) = 0.1
TIME (MIN) = 55	DISCHARGE (CFS) = 0.1
TIME (MIN) = 60	DISCHARGE (CFS) = 0.1
TIME (MIN) = 65	DISCHARGE (CFS) = 0.1
TIME (MIN) = 70	DISCHARGE (CFS) = 0.1
TIME (MIN) = 75	DISCHARGE (CFS) = 0.1
TIME (MIN) = 80	DISCHARGE (CFS) = 0.1
TIME (MIN) = 85	DISCHARGE (CFS) = 0.1
TIME (MIN) = 90	DISCHARGE (CFS) = 0.1
TIME (MIN) = 95	DISCHARGE (CFS) = 0.1
TIME (MIN) = 100	DISCHARGE (CFS) = 0.1
TIME (MIN) = 105	DISCHARGE (CFS) = 0.1
TIME (MIN) = 110	DISCHARGE (CFS) = 0.1
TIME (MIN) = 115	DISCHARGE (CFS) = 0.1
TIME (MIN) = 120	DISCHARGE (CFS) = 0.1
TIME (MIN) = 125	DISCHARGE (CFS) = 0.1
TIME (MIN) = 130	DISCHARGE (CFS) = 0.1
TIME (MIN) = 135	DISCHARGE (CFS) = 0.1
TIME (MIN) = 140	DISCHARGE (CFS) = 0.1
TIME (MIN) = 145	DISCHARGE (CFS) = 0.1
TIME (MIN) = 150	DISCHARGE (CFS) = 0.1
TIME (MIN) = 155	DISCHARGE (CFS) = 0.1
TIME (MIN) = 160	DISCHARGE (CFS) = 0.1
TIME (MIN) = 165	DISCHARGE (CFS) = 0.1
TIME (MIN) = 170	DISCHARGE (CFS) = 0.1
TIME (MIN) = 175	DISCHARGE (CFS) = 0.1
TIME (MIN) = 180	DISCHARGE (CFS) = 0.1
TIME (MIN) = 185	DISCHARGE (CFS) = 0.2
TIME (MIN) = 190	DISCHARGE (CFS) = 0.2
TIME (MIN) = 195	DISCHARGE (CFS) = 0.2
TIME (MIN) = 200	DISCHARGE (CFS) = 0.2
TIME (MIN) = 205	DISCHARGE (CFS) = 0.2
TIME (MIN) = 210	DISCHARGE (CFS) = 0.2
TIME (MIN) = 215	DISCHARGE (CFS) = 0.3
TIME (MIN) = 220	DISCHARGE (CFS) = 0.3
TIME (MIN) = 225	DISCHARGE (CFS) = 0.3
TIME (MIN) = 230	DISCHARGE (CFS) = 0.4
TIME (MIN) = 235	DISCHARGE (CFS) = 0.6
TIME (MIN) = 240	DISCHARGE (CFS) = 0.8
TIME (MIN) = 245	DISCHARGE (CFS) = 2.8
TIME (MIN) = 250	DISCHARGE (CFS) = 0.5
TIME (MIN) = 255	DISCHARGE (CFS) = 0.3
TIME (MIN) = 260	DISCHARGE (CFS) = 0.2
TIME (MIN) = 265	DISCHARGE (CFS) = 0.2
TIME (MIN) = 270	DISCHARGE (CFS) = 0.2
TIME (MIN) = 275	DISCHARGE (CFS) = 0.2
TIME (MIN) = 280	DISCHARGE (CFS) = 0.1
TIME (MIN) = 285	DISCHARGE (CFS) = 0.1
TIME (MIN) = 290	DISCHARGE (CFS) = 0.1
TIME (MIN) = 295	DISCHARGE (CFS) = 0.1
TIME (MIN) = 300	DISCHARGE (CFS) = 0.1
TIME (MIN) = 305	DISCHARGE (CFS) = 0.1
TIME (MIN) = 310	DISCHARGE (CFS) = 0.1
TIME (MIN) = 315	DISCHARGE (CFS) = 0.1
TIME (MIN) = 320	DISCHARGE (CFS) = 0.1
TIME (MIN) = 325	DISCHARGE (CFS) = 0.1
TIME (MIN) = 330	DISCHARGE (CFS) = 0.1
TIME (MIN) = 335	DISCHARGE (CFS) = 0.1
TIME (MIN) = 340	DISCHARGE (CFS) = 0.1
TIME (MIN) = 345	DISCHARGE (CFS) = 0.1
TIME (MIN) = 350	DISCHARGE (CFS) = 0.1
TIME (MIN) = 355	DISCHARGE (CFS) = 0.1
TIME (MIN) = 360	DISCHARGE (CFS) = 0.1
TIME (MIN) = 365	DISCHARGE (CFS) = 0

RATIONAL METHOD HYDROGRAPH PROGRAM

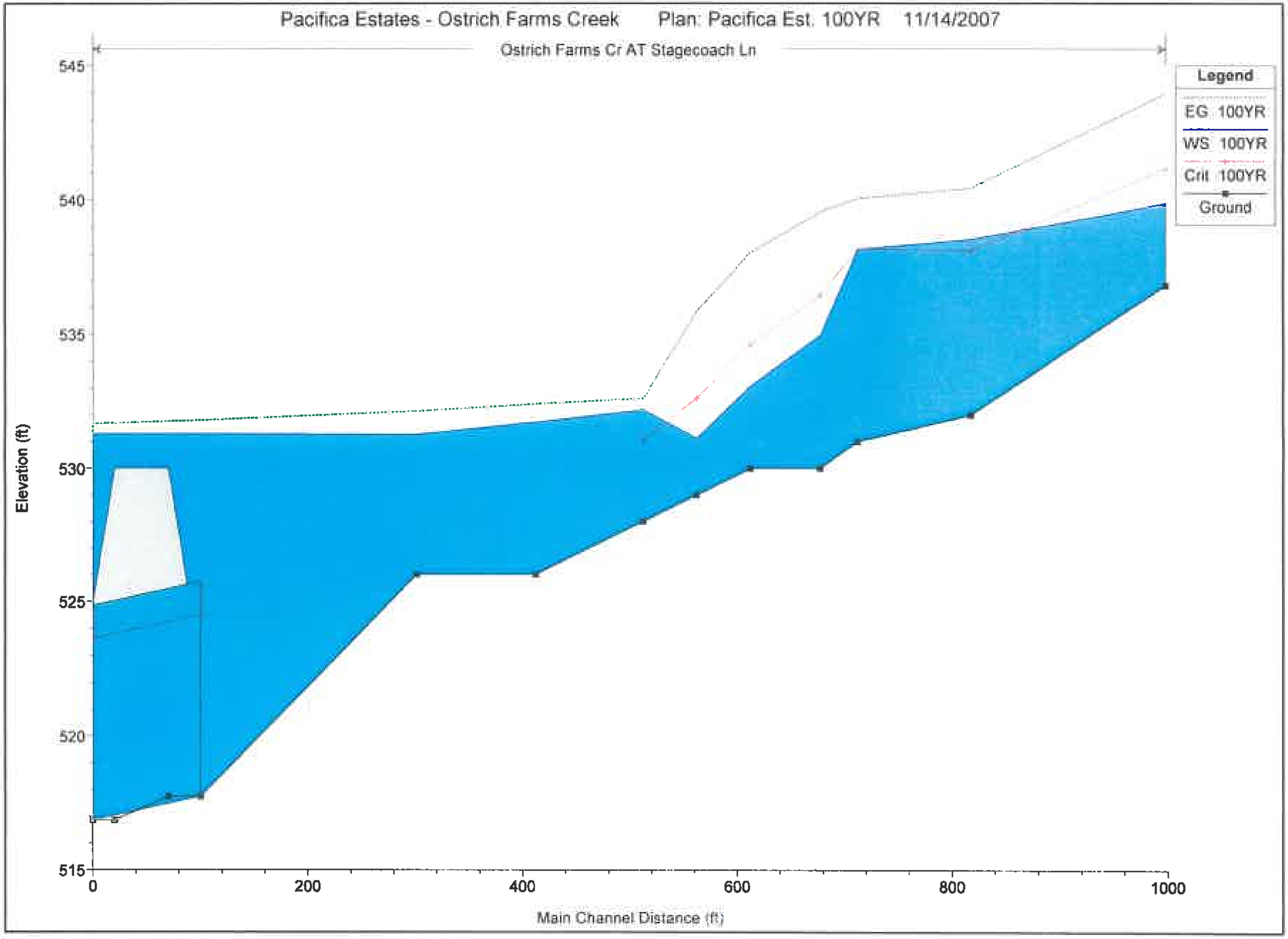
RUN DATE 3/17/2015
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 5 MIN.
6 HOUR RAINFALL 3 INCHES
BASIN AREA 2.1 ACRES
RUNOFF COEFFICIENT 0.3
PEAK DISCHARGE 5 CFS

PACIFIC ESTATES
BASIN B2: EXISTING CONDITIONS
REFER TO TABLE 3-1 ON PAGE 7 FOR Tc REFERENCE

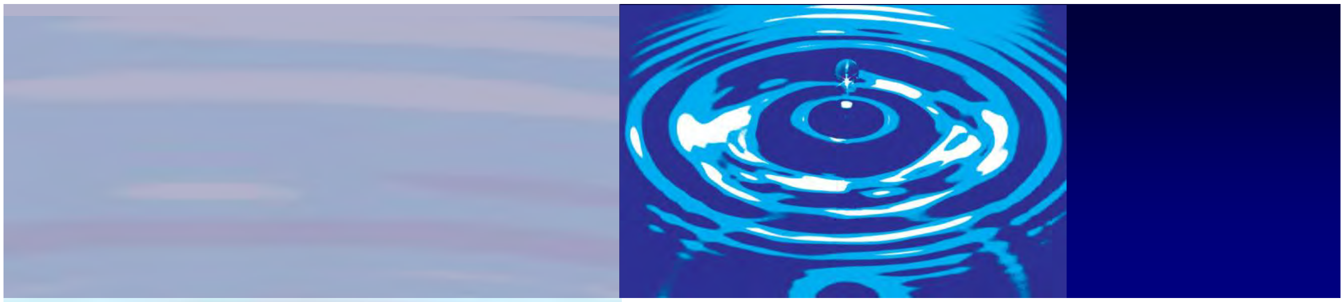
TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 5	DISCHARGE (CFS) = 0.1
TIME (MIN) = 10	DISCHARGE (CFS) = 0.1
TIME (MIN) = 15	DISCHARGE (CFS) = 0.1
TIME (MIN) = 20	DISCHARGE (CFS) = 0.1
TIME (MIN) = 25	DISCHARGE (CFS) = 0.1
TIME (MIN) = 30	DISCHARGE (CFS) = 0.1
TIME (MIN) = 35	DISCHARGE (CFS) = 0.1
TIME (MIN) = 40	DISCHARGE (CFS) = 0.1
TIME (MIN) = 45	DISCHARGE (CFS) = 0.1
TIME (MIN) = 50	DISCHARGE (CFS) = 0.1
TIME (MIN) = 55	DISCHARGE (CFS) = 0.1
TIME (MIN) = 60	DISCHARGE (CFS) = 0.1
TIME (MIN) = 65	DISCHARGE (CFS) = 0.1
TIME (MIN) = 70	DISCHARGE (CFS) = 0.1
TIME (MIN) = 75	DISCHARGE (CFS) = 0.1
TIME (MIN) = 80	DISCHARGE (CFS) = 0.1
TIME (MIN) = 85	DISCHARGE (CFS) = 0.1
TIME (MIN) = 90	DISCHARGE (CFS) = 0.1
TIME (MIN) = 95	DISCHARGE (CFS) = 0.2
TIME (MIN) = 100	DISCHARGE (CFS) = 0.2
TIME (MIN) = 105	DISCHARGE (CFS) = 0.2
TIME (MIN) = 110	DISCHARGE (CFS) = 0.2
TIME (MIN) = 115	DISCHARGE (CFS) = 0.2
TIME (MIN) = 120	DISCHARGE (CFS) = 0.2
TIME (MIN) = 125	DISCHARGE (CFS) = 0.2
TIME (MIN) = 130	DISCHARGE (CFS) = 0.2
TIME (MIN) = 135	DISCHARGE (CFS) = 0.2
TIME (MIN) = 140	DISCHARGE (CFS) = 0.2
TIME (MIN) = 145	DISCHARGE (CFS) = 0.2
TIME (MIN) = 150	DISCHARGE (CFS) = 0.2
TIME (MIN) = 155	DISCHARGE (CFS) = 0.2
TIME (MIN) = 160	DISCHARGE (CFS) = 0.2
TIME (MIN) = 165	DISCHARGE (CFS) = 0.2
TIME (MIN) = 170	DISCHARGE (CFS) = 0.2
TIME (MIN) = 175	DISCHARGE (CFS) = 0.3
TIME (MIN) = 180	DISCHARGE (CFS) = 0.3
TIME (MIN) = 185	DISCHARGE (CFS) = 0.3
TIME (MIN) = 190	DISCHARGE (CFS) = 0.3
TIME (MIN) = 195	DISCHARGE (CFS) = 0.3
TIME (MIN) = 200	DISCHARGE (CFS) = 0.3
TIME (MIN) = 205	DISCHARGE (CFS) = 0.4
TIME (MIN) = 210	DISCHARGE (CFS) = 0.4
TIME (MIN) = 215	DISCHARGE (CFS) = 0.4
TIME (MIN) = 220	DISCHARGE (CFS) = 0.5
TIME (MIN) = 225	DISCHARGE (CFS) = 0.6
TIME (MIN) = 230	DISCHARGE (CFS) = 0.7
TIME (MIN) = 235	DISCHARGE (CFS) = 1
TIME (MIN) = 240	DISCHARGE (CFS) = 1.4
TIME (MIN) = 245	DISCHARGE (CFS) = 5
TIME (MIN) = 250	DISCHARGE (CFS) = 0.8
TIME (MIN) = 255	DISCHARGE (CFS) = 0.5
TIME (MIN) = 260	DISCHARGE (CFS) = 0.4
TIME (MIN) = 265	DISCHARGE (CFS) = 0.3
TIME (MIN) = 270	DISCHARGE (CFS) = 0.3
TIME (MIN) = 275	DISCHARGE (CFS) = 0.3
TIME (MIN) = 280	DISCHARGE (CFS) = 0.2
TIME (MIN) = 285	DISCHARGE (CFS) = 0.2
TIME (MIN) = 290	DISCHARGE (CFS) = 0.2
TIME (MIN) = 295	DISCHARGE (CFS) = 0.2
TIME (MIN) = 300	DISCHARGE (CFS) = 0.2
TIME (MIN) = 305	DISCHARGE (CFS) = 0.2
TIME (MIN) = 310	DISCHARGE (CFS) = 0.2
TIME (MIN) = 315	DISCHARGE (CFS) = 0.2
TIME (MIN) = 320	DISCHARGE (CFS) = 0.2
TIME (MIN) = 325	DISCHARGE (CFS) = 0.1
TIME (MIN) = 330	DISCHARGE (CFS) = 0.1
TIME (MIN) = 335	DISCHARGE (CFS) = 0.1
TIME (MIN) = 340	DISCHARGE (CFS) = 0.1
TIME (MIN) = 345	DISCHARGE (CFS) = 0.1
TIME (MIN) = 350	DISCHARGE (CFS) = 0.1
TIME (MIN) = 355	DISCHARGE (CFS) = 0.1
TIME (MIN) = 360	DISCHARGE (CFS) = 0.1
TIME (MIN) = 365	DISCHARGE (CFS) = 0

HEC-RAS Plan: 100YR River: Ostrich Farms Cr Reach: AT Stagecoach Ln Profile: 100YR

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
AT Stagecoach Ln	997.8	100YR	1700.00	536.81	539.85	541.16	543.94	0.026039	16.23	104.74	46.81	1.91	3.58
AT Stagecoach Ln	817	100YR	1700.00	532.00	538.53	538.10	540.43	0.004092	11.18	230.94	103.18	0.85	1.29
AT Stagecoach Ln	712	100YR	1700.00	531.00	538.16	538.16	540.05	0.003190	11.84	489.24	220.92	0.81	1.32
AT Stagecoach Ln	677	100YR	1700.00	530.00	534.94	536.43	539.55	0.018509	17.74	171.48	101.53	1.71	3.75
AT Stagecoach Ln	612	100YR	1700.00	530.00	533.08	534.59	538.03	0.029016	18.00	125.68	99.51	2.05	4.29
AT Stagecoach Ln	562	100YR	1700.00	529.00	531.13	532.63	535.83	0.068494	23.23	265.88	143.60	3.02	7.80
AT Stagecoach Ln	512	100YR	1700.00	528.00	532.19	531.04	532.61	0.001593	5.33	505.48	211.07	0.51	0.33
AT Stagecoach Ln	412	100YR	1700.00	526.00	531.73		532.41	0.001784	7.02	587.01	220.64	0.57	0.52
AT Stagecoach Ln	301	100YR	1700.00	526.00	531.28		532.13	0.003242	7.43	260.92	122.05	0.72	0.66
AT Stagecoach Ln	100	100YR	1700.00	517.75	531.31	525.58	531.80	0.000541	5.90	799.30	280.00	0.30	0.30
AT Stagecoach Ln	50		Culvert										
AT Stagecoach Ln	0	100YR	1700.00	516.86	524.69	524.69	528.53	0.005322	15.73	108.07	32.23	1.00	2.30



Pacifica Estates - Ostrich Farms Creek Plan: Pacifica Est. 100YR 11/14/2007
Ostrich Farms Cr AT Stagecoach Ln
Legend
EG 100YR
WS 100YR
Crit 100YR
Ground
Elevation (ft)
545
540
535
530
525
520
515
0
200
400
600
800
1000
Main Channel Distance (ft)

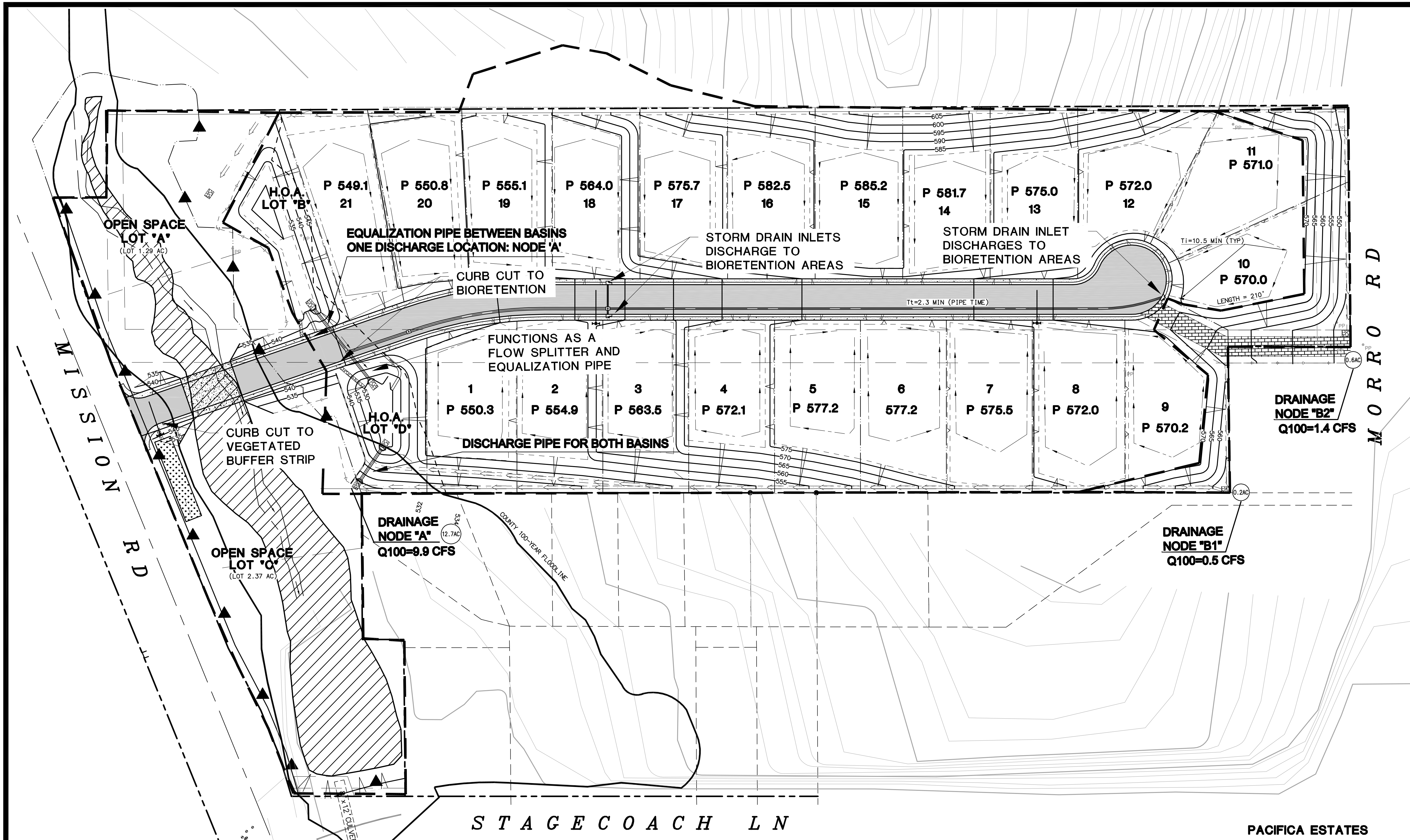


APPENDIX B

Proposed Conditions Hydrology & Hydraulics

This Section Contains:

- Work Map
- Rational Hydrograph Software Output
- HEC-RAS Output and Profile
- Preliminary Culvert Hydraulic Calculations



PROPOSED CONDITIONS HYDROLOGY MAP

PACIFICA ESTATES
COUNTY OF SAN DIEGO, CA
SHEET 1 OF 1
MARCH 2015

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RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 3/17/2015
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 13 MIN.
6 HOUR RAINFALL 3 INCHES
BASIN AREA 12.7 ACRES
RUNOFF COEFFICIENT 0.46
PEAK DISCHARGE 25.1 CFS

PACIFIC ESTATES
BASIN A: PROPOSED CONDITIONS
REFER TO TABLE 3-1 ON PAGE 7 FOR Tc REFERENCE

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 13	DISCHARGE (CFS) = 0.1
TIME (MIN) = 26	DISCHARGE (CFS) = 1.1
TIME (MIN) = 39	DISCHARGE (CFS) = 1.1
TIME (MIN) = 52	DISCHARGE (CFS) = 1.2
TIME (MIN) = 65	DISCHARGE (CFS) = 1.2
TIME (MIN) = 78	DISCHARGE (CFS) = 1.3
TIME (MIN) = 91	DISCHARGE (CFS) = 1.3
TIME (MIN) = 104	DISCHARGE (CFS) = 1.4
TIME (MIN) = 117	DISCHARGE (CFS) = 1.5
TIME (MIN) = 130	DISCHARGE (CFS) = 1.6
TIME (MIN) = 143	DISCHARGE (CFS) = 1.7
TIME (MIN) = 156	DISCHARGE (CFS) = 1.8
TIME (MIN) = 169	DISCHARGE (CFS) = 1.9
TIME (MIN) = 182	DISCHARGE (CFS) = 2.2
TIME (MIN) = 195	DISCHARGE (CFS) = 2.4
TIME (MIN) = 208	DISCHARGE (CFS) = 3
TIME (MIN) = 221	DISCHARGE (CFS) = 3.4
TIME (MIN) = 234	DISCHARGE (CFS) = 4.9
TIME (MIN) = 247	DISCHARGE (CFS) = 6.8
TIME (MIN) = 260	DISCHARGE (CFS) = 25.1
TIME (MIN) = 273	DISCHARGE (CFS) = 4
TIME (MIN) = 286	DISCHARGE (CFS) = 2.6
TIME (MIN) = 299	DISCHARGE (CFS) = 2.1
TIME (MIN) = 312	DISCHARGE (CFS) = 1.7
TIME (MIN) = 325	DISCHARGE (CFS) = 1.5
TIME (MIN) = 338	DISCHARGE (CFS) = 1.3
TIME (MIN) = 351	DISCHARGE (CFS) = 1.2
TIME (MIN) = 364	DISCHARGE (CFS) = 1.1
TIME (MIN) = 377	DISCHARGE (CFS) = 0

RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 3/17/2015
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 5 MIN.
6 HOUR RAINFALL 3 INCHES
BASIN AREA 0.2 ACRES
RUNOFF COEFFICIENT 0.3
PEAK DISCHARGE 0.5 CFS

PACIFIC ESTATES
BASIN B1: PROPOSED CONDITIONS
REFER TO TABLE 3-1 ON PAGE 7 FOR Tc REFERENCE

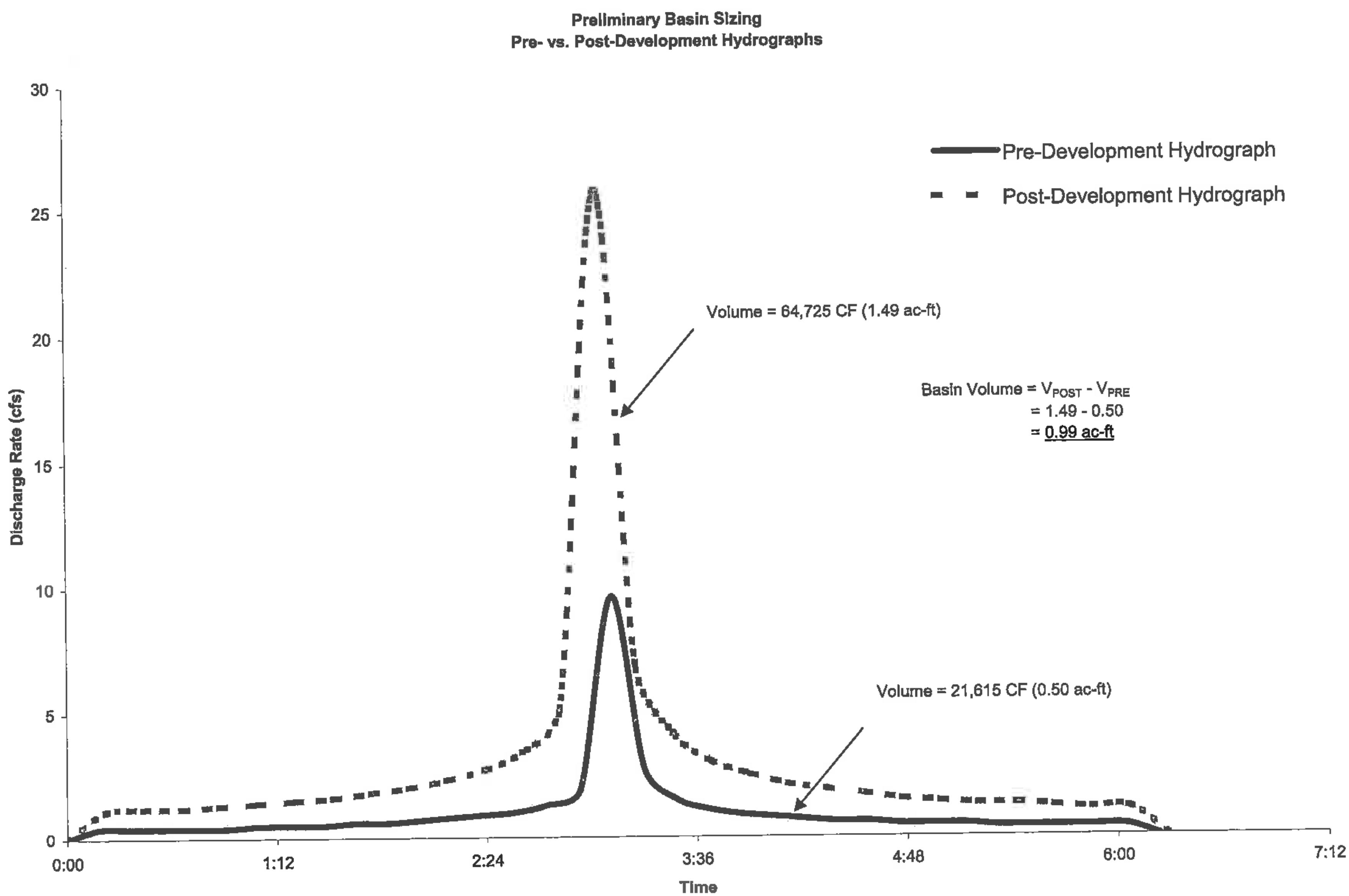
TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 5	DISCHARGE (CFS) = 0
TIME (MIN) = 10	DISCHARGE (CFS) = 0
TIME (MIN) = 15	DISCHARGE (CFS) = 0
TIME (MIN) = 20	DISCHARGE (CFS) = 0
TIME (MIN) = 25	DISCHARGE (CFS) = 0
TIME (MIN) = 30	DISCHARGE (CFS) = 0
TIME (MIN) = 35	DISCHARGE (CFS) = 0
TIME (MIN) = 40	DISCHARGE (CFS) = 0
TIME (MIN) = 45	DISCHARGE (CFS) = 0
TIME (MIN) = 50	DISCHARGE (CFS) = 0
TIME (MIN) = 55	DISCHARGE (CFS) = 0
TIME (MIN) = 60	DISCHARGE (CFS) = 0
TIME (MIN) = 65	DISCHARGE (CFS) = 0
TIME (MIN) = 70	DISCHARGE (CFS) = 0
TIME (MIN) = 75	DISCHARGE (CFS) = 0
TIME (MIN) = 80	DISCHARGE (CFS) = 0
TIME (MIN) = 85	DISCHARGE (CFS) = 0
TIME (MIN) = 90	DISCHARGE (CFS) = 0
TIME (MIN) = 95	DISCHARGE (CFS) = 0
TIME (MIN) = 100	DISCHARGE (CFS) = 0
TIME (MIN) = 105	DISCHARGE (CFS) = 0
TIME (MIN) = 110	DISCHARGE (CFS) = 0
TIME (MIN) = 115	DISCHARGE (CFS) = 0
TIME (MIN) = 120	DISCHARGE (CFS) = 0
TIME (MIN) = 125	DISCHARGE (CFS) = 0
TIME (MIN) = 130	DISCHARGE (CFS) = 0
TIME (MIN) = 135	DISCHARGE (CFS) = 0
TIME (MIN) = 140	DISCHARGE (CFS) = 0
TIME (MIN) = 145	DISCHARGE (CFS) = 0
TIME (MIN) = 150	DISCHARGE (CFS) = 0
TIME (MIN) = 155	DISCHARGE (CFS) = 0
TIME (MIN) = 160	DISCHARGE (CFS) = 0
TIME (MIN) = 165	DISCHARGE (CFS) = 0
TIME (MIN) = 170	DISCHARGE (CFS) = 0
TIME (MIN) = 175	DISCHARGE (CFS) = 0
TIME (MIN) = 180	DISCHARGE (CFS) = 0
TIME (MIN) = 185	DISCHARGE (CFS) = 0
TIME (MIN) = 190	DISCHARGE (CFS) = 0
TIME (MIN) = 195	DISCHARGE (CFS) = 0
TIME (MIN) = 200	DISCHARGE (CFS) = 0
TIME (MIN) = 205	DISCHARGE (CFS) = 0
TIME (MIN) = 210	DISCHARGE (CFS) = 0
TIME (MIN) = 215	DISCHARGE (CFS) = 0
TIME (MIN) = 220	DISCHARGE (CFS) = 0
TIME (MIN) = 225	DISCHARGE (CFS) = 0.1
TIME (MIN) = 230	DISCHARGE (CFS) = 0.1
TIME (MIN) = 235	DISCHARGE (CFS) = 0.1
TIME (MIN) = 240	DISCHARGE (CFS) = 0.1
TIME (MIN) = 245	DISCHARGE (CFS) = 0.5
TIME (MIN) = 250	DISCHARGE (CFS) = 0.1
TIME (MIN) = 255	DISCHARGE (CFS) = 0.1
TIME (MIN) = 260	DISCHARGE (CFS) = 0
TIME (MIN) = 265	DISCHARGE (CFS) = 0
TIME (MIN) = 270	DISCHARGE (CFS) = 0
TIME (MIN) = 275	DISCHARGE (CFS) = 0
TIME (MIN) = 280	DISCHARGE (CFS) = 0
TIME (MIN) = 285	DISCHARGE (CFS) = 0
TIME (MIN) = 290	DISCHARGE (CFS) = 0
TIME (MIN) = 295	DISCHARGE (CFS) = 0
TIME (MIN) = 300	DISCHARGE (CFS) = 0
TIME (MIN) = 305	DISCHARGE (CFS) = 0
TIME (MIN) = 310	DISCHARGE (CFS) = 0
TIME (MIN) = 315	DISCHARGE (CFS) = 0
TIME (MIN) = 320	DISCHARGE (CFS) = 0
TIME (MIN) = 325	DISCHARGE (CFS) = 0
TIME (MIN) = 330	DISCHARGE (CFS) = 0
TIME (MIN) = 335	DISCHARGE (CFS) = 0
TIME (MIN) = 340	DISCHARGE (CFS) = 0
TIME (MIN) = 345	DISCHARGE (CFS) = 0
TIME (MIN) = 350	DISCHARGE (CFS) = 0
TIME (MIN) = 355	DISCHARGE (CFS) = 0
TIME (MIN) = 360	DISCHARGE (CFS) = 0
TIME (MIN) = 365	DISCHARGE (CFS) = 0

RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 3/17/2015
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 5 MIN.
6 HOUR RAINFALL 3 INCHES
BASIN AREA 0.6 ACRES
RUNOFF COEFFICIENT 0.3
PEAK DISCHARGE 1.4 CFS

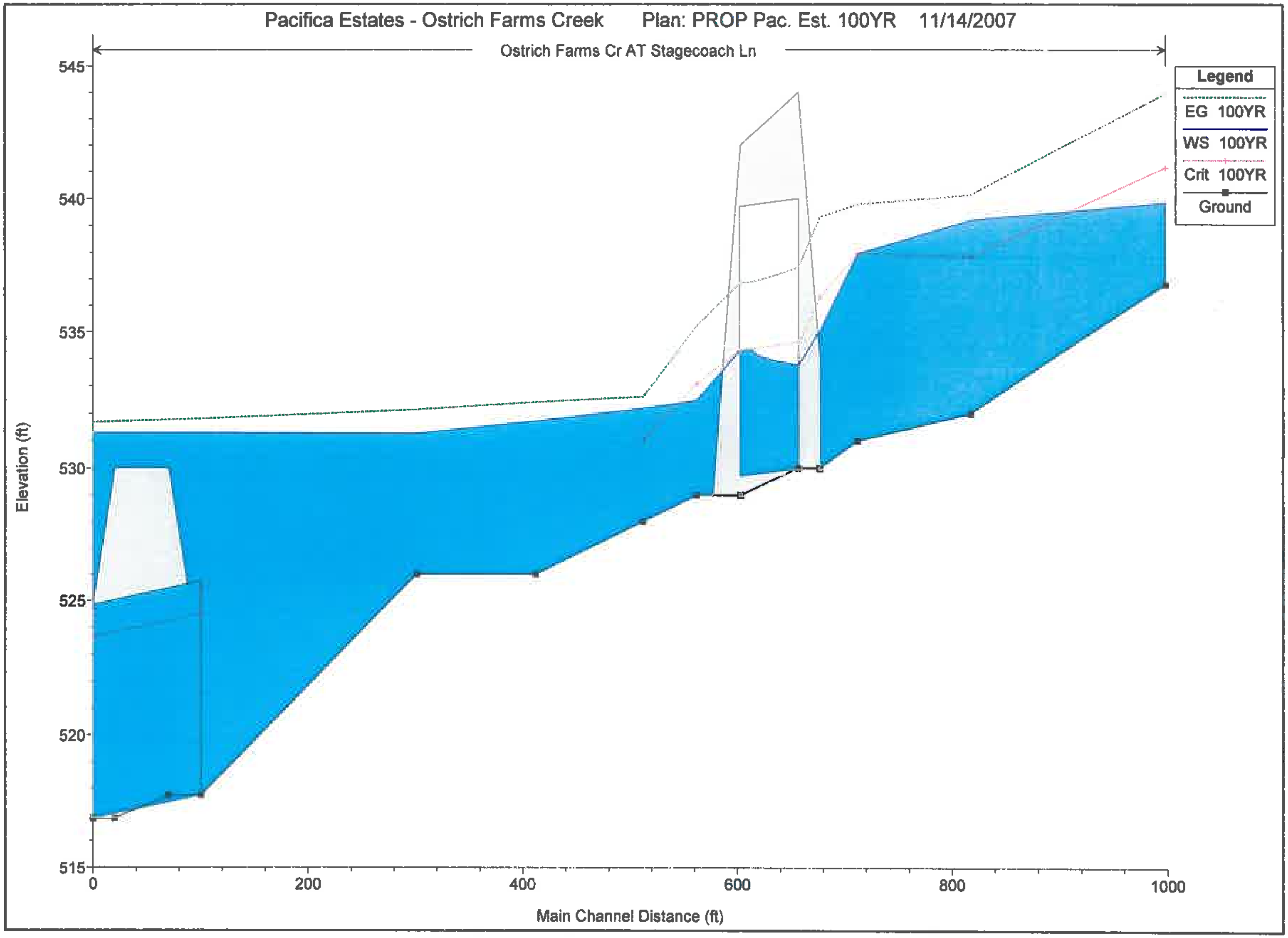
PACIFIC ESTATES
BASIN B2: PROPOSED CONDITIONS
REFER TO TABLE 3-1 ON PAGE 7 FOR Tc REFERENCE

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 5	DISCHARGE (CFS) = 0
TIME (MIN) = 10	DISCHARGE (CFS) = 0
TIME (MIN) = 15	DISCHARGE (CFS) = 0
TIME (MIN) = 20	DISCHARGE (CFS) = 0
TIME (MIN) = 25	DISCHARGE (CFS) = 0
TIME (MIN) = 30	DISCHARGE (CFS) = 0
TIME (MIN) = 35	DISCHARGE (CFS) = 0
TIME (MIN) = 40	DISCHARGE (CFS) = 0
TIME (MIN) = 45	DISCHARGE (CFS) = 0
TIME (MIN) = 50	DISCHARGE (CFS) = 0
TIME (MIN) = 55	DISCHARGE (CFS) = 0
TIME (MIN) = 60	DISCHARGE (CFS) = 0
TIME (MIN) = 65	DISCHARGE (CFS) = 0
TIME (MIN) = 70	DISCHARGE (CFS) = 0
TIME (MIN) = 75	DISCHARGE (CFS) = 0
TIME (MIN) = 80	DISCHARGE (CFS) = 0
TIME (MIN) = 85	DISCHARGE (CFS) = 0
TIME (MIN) = 90	DISCHARGE (CFS) = 0
TIME (MIN) = 95	DISCHARGE (CFS) = 0
TIME (MIN) = 100	DISCHARGE (CFS) = 0
TIME (MIN) = 105	DISCHARGE (CFS) = 0
TIME (MIN) = 110	DISCHARGE (CFS) = 0
TIME (MIN) = 115	DISCHARGE (CFS) = 0
TIME (MIN) = 120	DISCHARGE (CFS) = 0
TIME (MIN) = 125	DISCHARGE (CFS) = 0.1
TIME (MIN) = 130	DISCHARGE (CFS) = 0.1
TIME (MIN) = 135	DISCHARGE (CFS) = 0.1
TIME (MIN) = 140	DISCHARGE (CFS) = 0.1
TIME (MIN) = 145	DISCHARGE (CFS) = 0.1
TIME (MIN) = 150	DISCHARGE (CFS) = 0.1
TIME (MIN) = 155	DISCHARGE (CFS) = 0.1
TIME (MIN) = 160	DISCHARGE (CFS) = 0.1
TIME (MIN) = 165	DISCHARGE (CFS) = 0.1
TIME (MIN) = 170	DISCHARGE (CFS) = 0.1
TIME (MIN) = 175	DISCHARGE (CFS) = 0.1
TIME (MIN) = 180	DISCHARGE (CFS) = 0.1
TIME (MIN) = 185	DISCHARGE (CFS) = 0.1
TIME (MIN) = 190	DISCHARGE (CFS) = 0.1
TIME (MIN) = 195	DISCHARGE (CFS) = 0.1
TIME (MIN) = 200	DISCHARGE (CFS) = 0.1
TIME (MIN) = 205	DISCHARGE (CFS) = 0.1
TIME (MIN) = 210	DISCHARGE (CFS) = 0.1
TIME (MIN) = 215	DISCHARGE (CFS) = 0.1
TIME (MIN) = 220	DISCHARGE (CFS) = 0.1
TIME (MIN) = 225	DISCHARGE (CFS) = 0.2
TIME (MIN) = 230	DISCHARGE (CFS) = 0.2
TIME (MIN) = 235	DISCHARGE (CFS) = 0.3
TIME (MIN) = 240	DISCHARGE (CFS) = 0.4
TIME (MIN) = 245	DISCHARGE (CFS) = 1.4
TIME (MIN) = 250	DISCHARGE (CFS) = 0.2
TIME (MIN) = 255	DISCHARGE (CFS) = 0.2
TIME (MIN) = 260	DISCHARGE (CFS) = 0.1
TIME (MIN) = 265	DISCHARGE (CFS) = 0.1
TIME (MIN) = 270	DISCHARGE (CFS) = 0.1
TIME (MIN) = 275	DISCHARGE (CFS) = 0.1
TIME (MIN) = 280	DISCHARGE (CFS) = 0.1
TIME (MIN) = 285	DISCHARGE (CFS) = 0.1
TIME (MIN) = 290	DISCHARGE (CFS) = 0.1
TIME (MIN) = 295	DISCHARGE (CFS) = 0.1
TIME (MIN) = 300	DISCHARGE (CFS) = 0.1
TIME (MIN) = 305	DISCHARGE (CFS) = 0
TIME (MIN) = 310	DISCHARGE (CFS) = 0
TIME (MIN) = 315	DISCHARGE (CFS) = 0
TIME (MIN) = 320	DISCHARGE (CFS) = 0
TIME (MIN) = 325	DISCHARGE (CFS) = 0
TIME (MIN) = 330	DISCHARGE (CFS) = 0
TIME (MIN) = 335	DISCHARGE (CFS) = 0
TIME (MIN) = 340	DISCHARGE (CFS) = 0
TIME (MIN) = 345	DISCHARGE (CFS) = 0
TIME (MIN) = 350	DISCHARGE (CFS) = 0
TIME (MIN) = 355	DISCHARGE (CFS) = 0
TIME (MIN) = 360	DISCHARGE (CFS) = 0
TIME (MIN) = 365	DISCHARGE (CFS) = 0


Preliminary Basin Sizing
Pre- vs. Post-Development Hydrographs
Pre-Development Hydrograph
Post-Development Hydrograph
Volume = 64,725 CF (1.49 ac-ft)
Basin Volume = V_{POST} - V_{PRE}
= 1.49 - 0.50
= 0.99 ac-ft
Volume = 21,615 CF (0.50 ac-ft)
Discharge Rate (cfs)
Time
30
25
20
15
10
5
0
0:00
1:12
2:24
3:36
4:48
6:00
7:12

HEC-RAS Plan: PROP 100YR River: Ostrich Farms Cr Reach: AT Stagecoach Ln Profile: 100YR

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
AT Stagecoach Ln	997.8	100YR	1700.00	536.81	539.85	541.16	543.94	0.026039	16.23	104.74	46.81	1.91	3.58
AT Stagecoach Ln	817	100YR	1700.00	532.00	539.22	537.85	540.14	0.001994	8.45	600.86	198.85	0.60	0.71
AT Stagecoach Ln	712	100YR	1700.00	531.00	537.97	537.97	539.79	0.003295	11.80	541.62	244.99	0.82	1.32
AT Stagecoach Ln	677	100YR	1700.00	530.00	535.06	536.32	539.32	0.016289	17.05	161.57	107.28	1.62	3.43
AT Stagecoach Ln	612		Culvert										
AT Stagecoach Ln	562	100YR	1700.00	529.00	532.50	533.10	535.21	0.015675	16.11	339.53	224.58	1.62	3.12
AT Stagecoach Ln	512	100YR	1700.00	528.00	532.20	531.04	532.60	0.001558	5.28	522.15	205.39	0.51	0.33
AT Stagecoach Ln	412	100YR	1700.00	526.00	531.73		532.41	0.001783	7.02	584.44	217.62	0.57	0.52
AT Stagecoach Ln	301	100YR	1700.00	526.00	531.28		532.13	0.003242	7.43	260.92	122.05	0.72	0.66
AT Stagecoach Ln	100	100YR	1700.00	517.75	531.31	525.58	531.80	0.000541	5.90	799.30	280.00	0.30	0.30
AT Stagecoach Ln	50		Culvert										
AT Stagecoach Ln	0	100YR	1700.00	516.86	524.69	524.69	528.53	0.005322	15.73	108.07	32.23	1.00	2.30



Pacifica Estates - Ostrich Farms Creek Plan: PROP Pac. Est. 100YR 11/14/2007
Ostrich Farms Cr AT Stagecoach Ln
Legend
EG 100YR
WS 100YR
Crit 100YR
Ground
Elevation (ft)
545
540
535
530
525
520
515
0
200
400
600
800
1000
Main Channel Distance (ft)

240

PROJECT: Pacifica Estates

STATION:

SHEET ____ **OF** ____

CULVERT DESIGN FORM

DESIGNER / DATE: RJ / 7/10/06

REVIEWER / DATE: ____ / ____

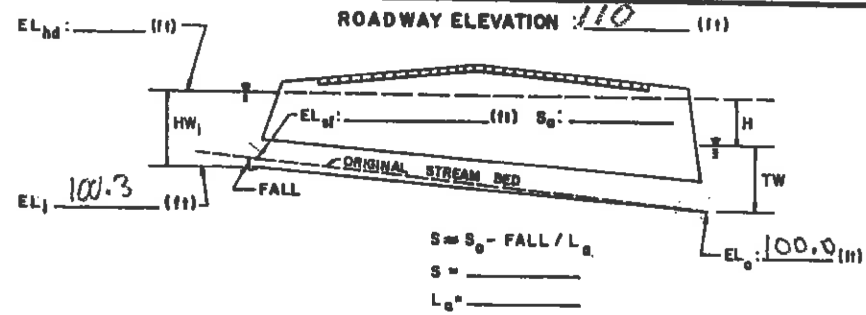
HYDROLOGICAL DATA

SEE ADD'L SHTS.

- ☐ METHOD:
- ☐ DRAINAGE AREA: ____ ☐ STREAM SLOPE:
- ☐ CHANNEL SHAPE:
- ☐ ROUTING: ____ ☐ OTHER:

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
	1,700	



CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS: INLET CONTROL HW_i/D (2)	HW_i	FALL (3)	EL_{hi} (4)	OUTLET CONTROL TW (5)	d_c	$\frac{d_c+D}{2}$	h_o (6)	k_e	H (7)	EL_{ho} (8)	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
10'x30' Arch Culvert	1700	1,700	.80	8.0	0	108.3		4.8	7.4	7.4	0.5	1.7'	109.1	109.1	7.8	

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) $HW_i/D = HW/D$ OR HW_i/D FROM DESIGN CHARTS

(3) $FALL = HW_i - (EL_{hd} - EL_{sf})$; FALL IS ZERO FOR CULVERTS ON GRADE

(4) $EL_{hi} = HW_i + EL_i$ (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) $h_o = TW$ or $(d_c + D/2)$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + k_e + (29n^2 L)/R^{1.33}\right] V^2/2g$

(8) $EL_{ho} = EL_o + H + h_o$

SUBSCRIPT DEFINITIONS:

- a. APPROXIMATE
- f. CULVERT FACE
- hd. DESIGN HEADWATER
- hi. HEADWATER IN INLET CONTROL
- ho. HEADWATER IN OUTLET CONTROL
- i. INLET CONTROL SECTION
- o. OUTLET
- sf. STREAMBED AT CULVERT FACE
- tw. TAILWATER

COMMENTS / DISCUSSION:

Calculations Based Upon n=0.022 For Corrugated Metal. "Con Span" Bridge will Exceed Hydraulically Because of Lower 'n' Value. Approximate Size & Road Elevation Appropriate For Tentative Map

CULVERT BARREL SELECTED:

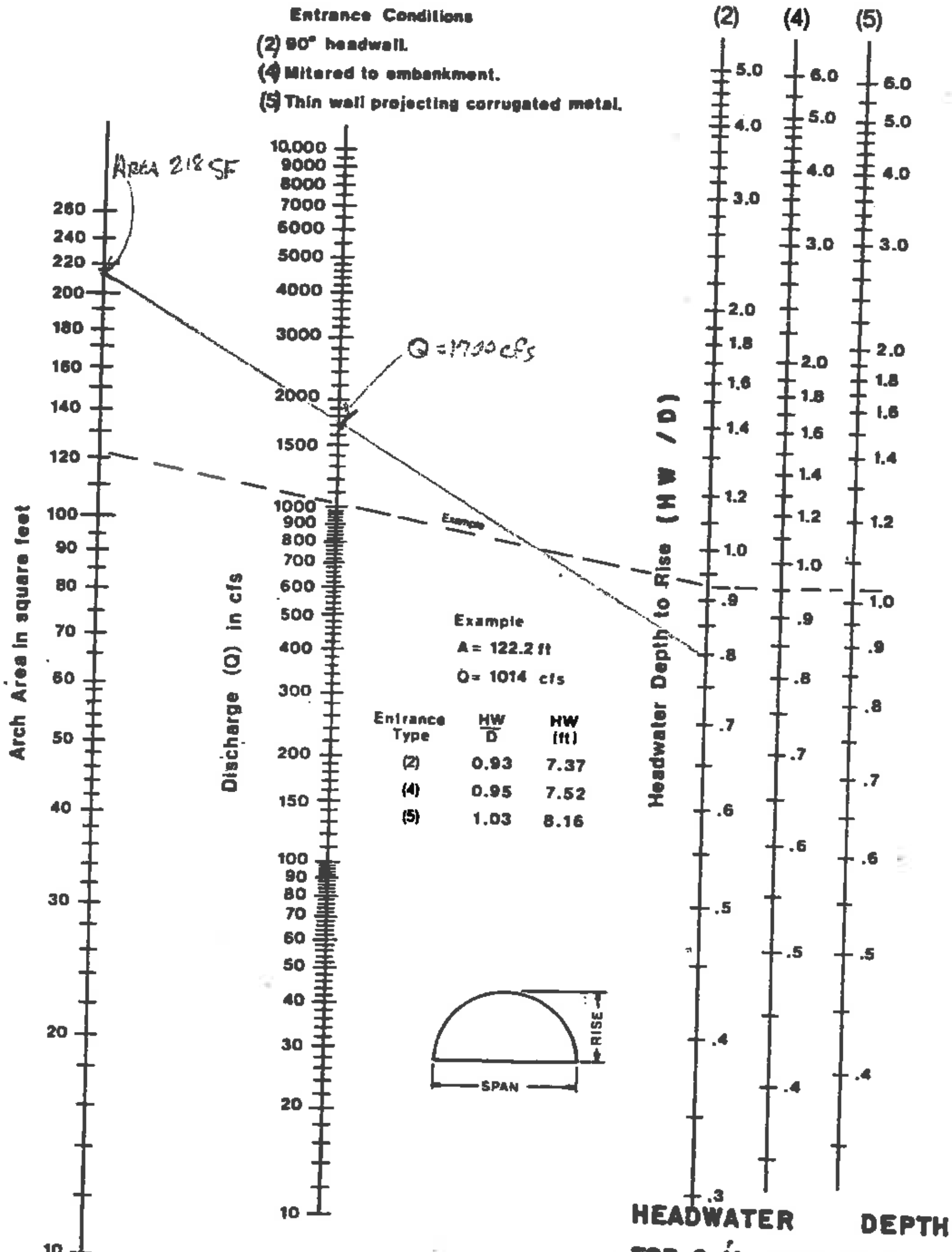
SIZE:

SHAPE:

MATERIAL: n .022

ENTRANCE:

CHART 41

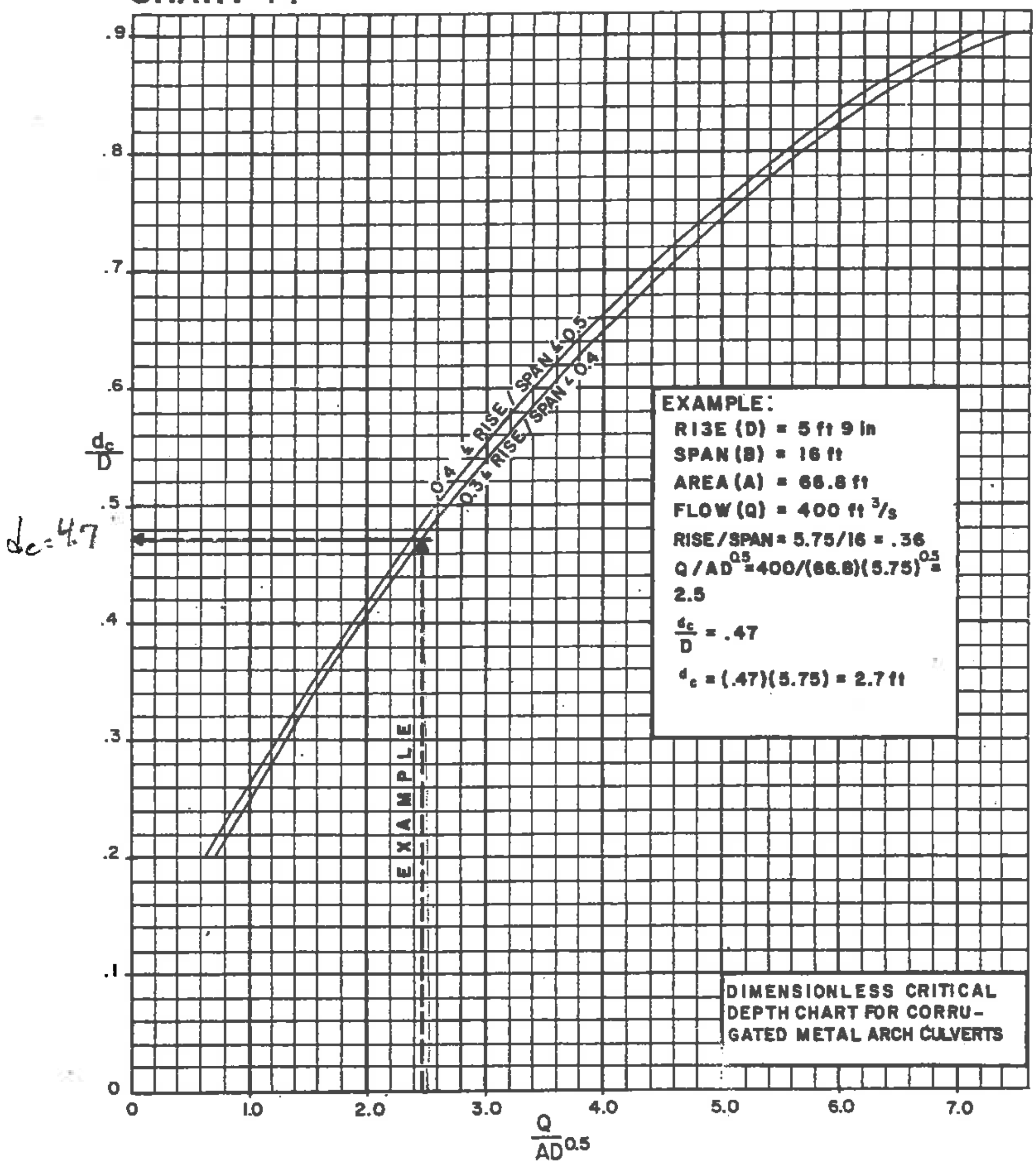


HEADWATER DEPTH
FOR C.M. ARCH CULVERTS
$0.3 \leq$ RISE / SPAN < 0.4
WITH INLET CONTROL

Duplication of this nomograph may distort scale

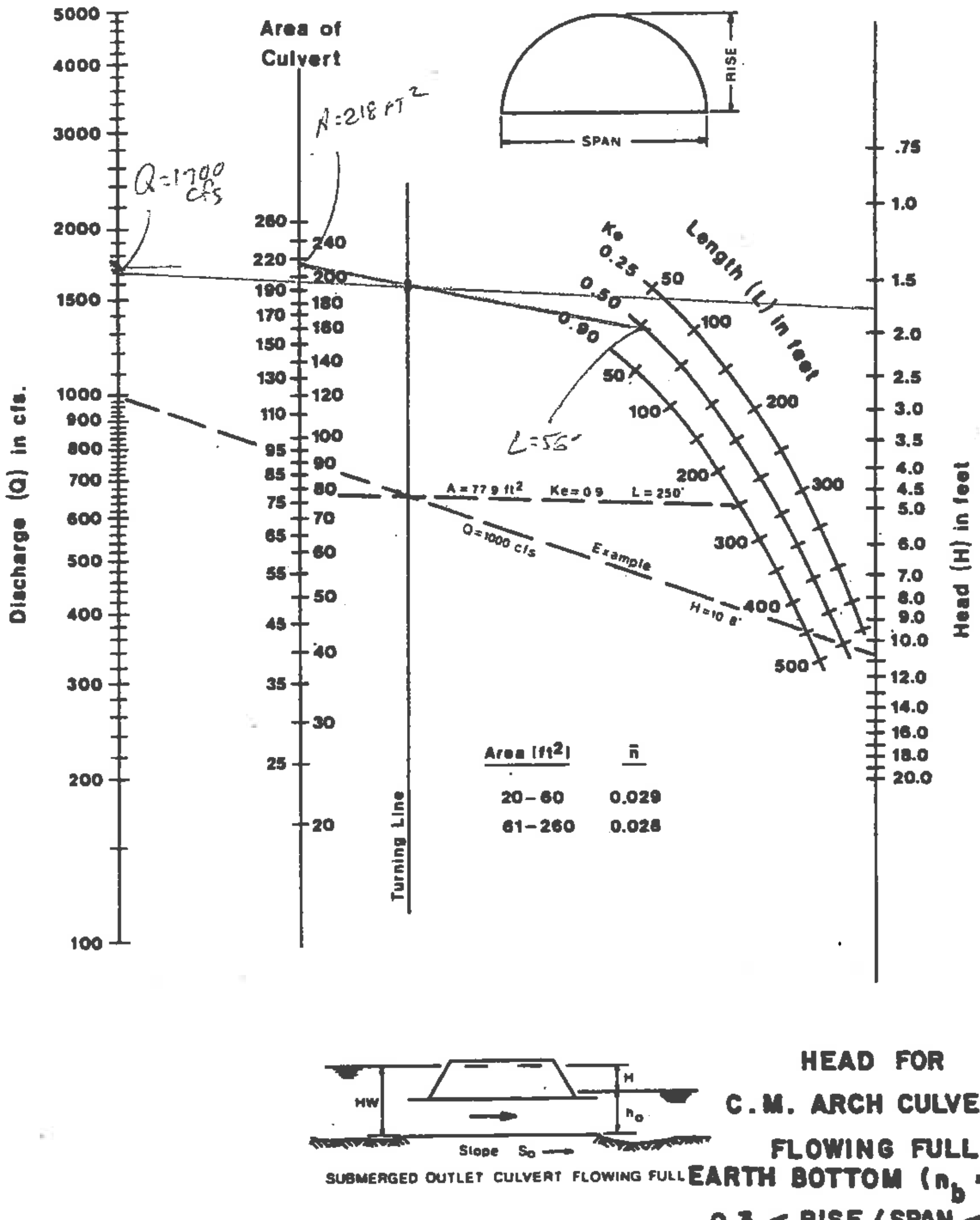
Nomographs adapted from material furnished by Kaiser Aluminum and Chemical Corporation

CHART 44



$$\frac{1,700}{218\,(10^{0.5})} = \frac{1,700}{689.4} = 2.47$$

CHART 48



HEAD FOR C.M. ARCH CULVERTS FLOWING FULL EARTH BOTTOM (n_b = 0.022)

0.3 ≤ RISE / SPAN < 0.4

Nomographs adapted from material furnished by Kaiser Aluminum and Chemical Corporation

Duplication of this nomograph may distort scale