Hydrology and Hydraulic Study

For

Sharp Health Chula Vista Medical Center

Prepared For:

Sharp Healthcare
8695 Spectrum Center Drive
San Diego, CA 92123

Prepared By:

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RBF Job Number:

149517

Prepared:

December 6, 2015

Revised:

March 28, 2016

Michael Baker INTERNATIONAL

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Section 1 Project Description and Scope

1.1. Project Data

Project Owner: Sharp Healthcare
8695 Spectrum Center Blvd.
San Diego, CA 92123

Project Site Address: 751 Medical Center Court

APN Number(s): 641-010-28-00

Project Location: Latitude: 32.618918°
Longitude: -117.02252°

Project Site Area: 2.54 acres

Adjacent Streets:
North: Telegraph Canyon Road
South: East Palomar Road
East: Paseo Ladera
West: Medical Center Drive

Adjacent Land Uses:
North: Residential
South: Residential
East: Residential
West: Residential

1.2. Scope of Report

This report addresses the Hydrologic and Hydraulic aspects of the project. This report does not discuss required water quality measures to be implemented on a permanent basis, nor does it address construction storm water issues. Post construction storm water issue discussions can be found under separate cover in the project "Water Quality Technical Report."

In addition, because this project proposes to disturb over one acre, a Storm Water Pollution Protection Plan for construction activities has been prepared and an NOI will be filed with the State of California prior to the start of construction.

1.3. Project Site Information

1.3.1 Project Location

The project is located in the Chula Vista are of the San Diego County. The project lies south of Telegraph Canyon Road and north of Palomar Rd. The project lies approximately 4.25 miles east of the San Diego Bay Please refer to below Figure 1: Vicinity Map for a Vicinity Map.

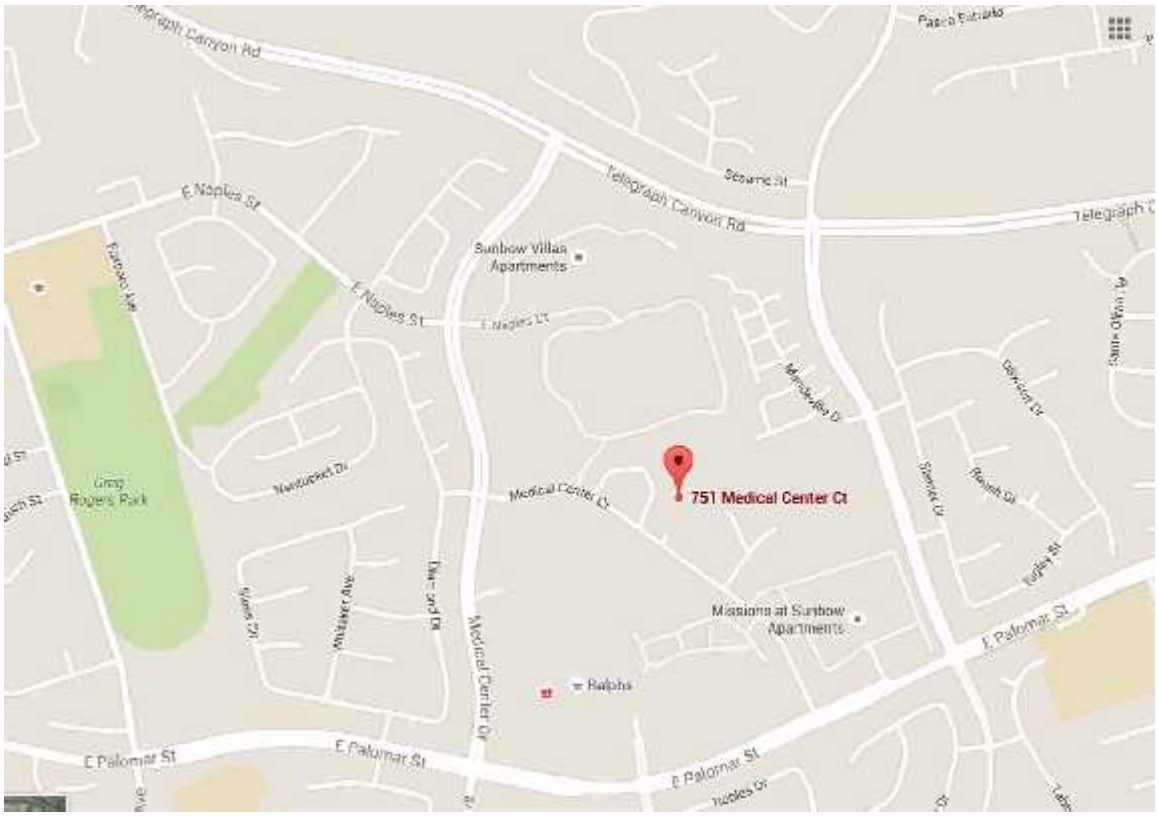

Figure 2: Vicinity Map

1.3.2 Project Description

The project is a proposed 138 room hospital tower. The project includes new on-site and relocated water, sewer and storm drain. This portion of the project is for rough grading only and no structures are proposed at this time. All surface improvements and impervious surfaces will be created as part of the future building improvements to be submitted at a later date.

1.3.3 Site Topography

Currently topography is a flat parking lot with some surrounding slopes. Post project topography will be a building located on a fully graded site.

1.3.4 Land Use and Vegetation

The current land use is a medical complex. The site is currently fully developed. The project has ornamental landscaping spread around the perimeter of the site.

1.3.5 FEMA Information

The project does not lie within any mapped floodplain (FIRM Panel 06073C2157G. The project lies within Zone X Unshaded which is outside of the 500-year floodplain.

a) Flood Zone Definitions

Zone A -- Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.

Zone AE -- Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. Base Flood Elevations (BFEs) are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.

Zone X (Shaded) – Areas between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood.

Zone X (Unshaded) Areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance flood

Figure 3: FEMA Firmette

1.3.6 Existing Drainage Improvements

Drainage from the site runs from west to east. The existing storm drain pipe runs under the proposed building site, across the existing access road, down the slope to the east before discharging into the existing channel that flows north/south along the easterly property line.

The northerly portion of the project flows to east to one of two water quality basins. These basins are to remain in the interim condition.

1.3.7 Proposed Improvements

In the proposed condition, drainage flows in the same general direction. However, the existing storm drain is being routed around the building, to the south of the existing building.

The proposed project includes new water, sewer and dry utilities as well as the new building and site improvements. The project proposes the construction of two Modular Wetland Systems BF-3's to treat the storm water as well as two 9,750 cf cisterns to store the storm water. The storm

water is metered out of the tanks to achieve the required Hydromodification Management.

Impervious areas in the pre-project condition and the post-project condition are nearly the same. However, for the hydromodification plan, any impervious areas that are being replaced have been treated as pervious areas for the analysis.

Section 2 Study Objectives

The specific objectives of this study are as follows:

- To provide hydrologic analysis of the project site for the 100-year, 6-hour storm event under existing and proposed conditions,
- To provide a hydraulic analysis of the project to ensure that the correct sizes of pipes and inlets have been chosen,
- And to ensure that no additional runoff or downstream impacts occur due to this project.

Section 3 Methodology

3.1. Hydrology

Hydrologic analysis has been completed using the Rational Method (Q = CIA). Whereas,

Q = rate of flow in cubic feet per second

C = Coefficient of runoff,

I = intensity of rainfall based on the time of concentration and the 6-hour, 100-year precipitation

A=Area of the basin.

For this project, a composite coefficient of runoff was used. Data was entered into an Excel Spreadsheet which calculates the runoff based on the County of San Diego methodology electronically, therefore reducing errors.

The following software packages were used in the analysis of the project:

- Microsoft Excel (Rational Method Hydrology)
- AutoCAD Civil 3d Hydraflow Hydragraph Extension 2013 (Storm Routing)
- RatHydro (Rational Method Hydragraphs)
- Flowmaster (Hydraulic Analysis for Open Channels and Pipes for Storm Routing)

3.2. Hydraulics

Proposed improvements include new grated storm drain inlets in paved areas, and a new underground storm drain system. Private underground storm drain will consist of PVC or HDPE pipe with watertight joints. Public storm drain, if applicable, will consist of reinforced concrete pipe, with a minimum strength of 2000-D.

Runoff will ultimately be discharged from the project site at the same location as the existing condition, to the existing cleanout at the southwest corner of the project site.

Proposed improvements will not increase the total peak flow runoff, as compared to existing conditions, through the use of two large cisterns.

Manning's equation will be used to calculate the depth of flow being conveyed through proposed pipes and for existing pipes which experience additional flows

as a result of the proposed improvements. Proposed pipes with diameters of less than 12 inches will not be individually calculated for depth and velocity, however, the capacity was verified against tables showing the maximum flow in the smaller pipes.

The following software packages were used in the analysis of the project:

- Hydraflow Hydragraph Extension for AutoCAD Civil 3d 2013 (Storm Routing)
- Hydraflow Storm Sewer Extension for AutoCAD Civil 3d 2013 (Hydraulic and Energy Grade Lines)
- Hydraflow Express Extensions Extension for AutoCAD Civil 3d 2013 (Storm Routing)
- RatHydro (Rational Method Hydrographs)
- Bentley Flowmaster (Hydraulic Analysis for Open Channels and Pipes for Storm Routing)

Section 4 Results

4.1. Hydrologic Results

The following tables summarize the hydrologic analysis of the project.

- **Table 1 – Existing Condition**, summarizes the existing hydrologic properties of the project site.
- **Table 2 – Proposed Condition (Unmitigated)**, summarizes the proposed condition hydrology of the site in the unmitigated condition.
- **Table 3 – Comparison of Existing to Proposed Flows**, compares existing flows to the proposed flows.

Table 1 – Existing Condition

Sub Basin No.	Runoff Coefficient	Basin Intensity	Basin Area (acres)	Runoff (cfs)
Basin A	0.85	6.85	1.18	6.84
Basin B	0.85	5.18	1.37	6.02
TOTALS			2.55	12.86

Table 2 – Proposed Condition (Unmitigated)

Sub Basin No.	Runoff Coefficient	Basin Intensity	Basin Area (acres)	Runoff (cfs)
Basin A	0.85	6.85	1.18	6.84
Basin B	0.85	5.18	1.37	6.02
TOTALS			2.55	12.86

Table 3 – Comparison of Existing to Proposed Flows 2, 10 and 25 year

Frequency*	Existing Condition (cfs)	Proposed Condition (cfs)	Difference
2-Year	0.23	0.02	-0.21
10-Year	0.43	0.37	-0.06
25-year	0.95	0.65	-0.30

*See SDHM Results for calculations of existing and proposed calculations.

Section 5 Conclusions

As indicated in the Table of Hydrologic Results, the proposed improvements will not increase the total 100-year, 6-hour peak flow rate. This is because no hardscape is being created by the project, the grading is for future improvements only.

There is not a significant concern for erosion as the site is previously developed. Potential for erosion for the proposed condition shall be minimized by following items listed in the Erosion Control Plan (part of the Rough Grading Plans). Runoff shall flow over relatively flat areas where scour is not a concern. Runoff is not proposed over any sloped areas.

Section 6 Certification

This Hydrology and Hydraulics report has been prepared under the direction of the following Registered Civil Engineer. The Registered Civil Engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based. The plans and specifications in this Hydrology and Hydraulics report are not for construction purposes; the contractor shall refer to final approved construction documents for plans and specifications.

Richard S. Tomlinson, Jr. RCE 59276 January 28, 2016

Section 7 References

County of San Diego, 2012. Grading Ordinance (October 2012)

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

County of San Diego, 2014, Hydraulic Design Manual (September 2014)

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

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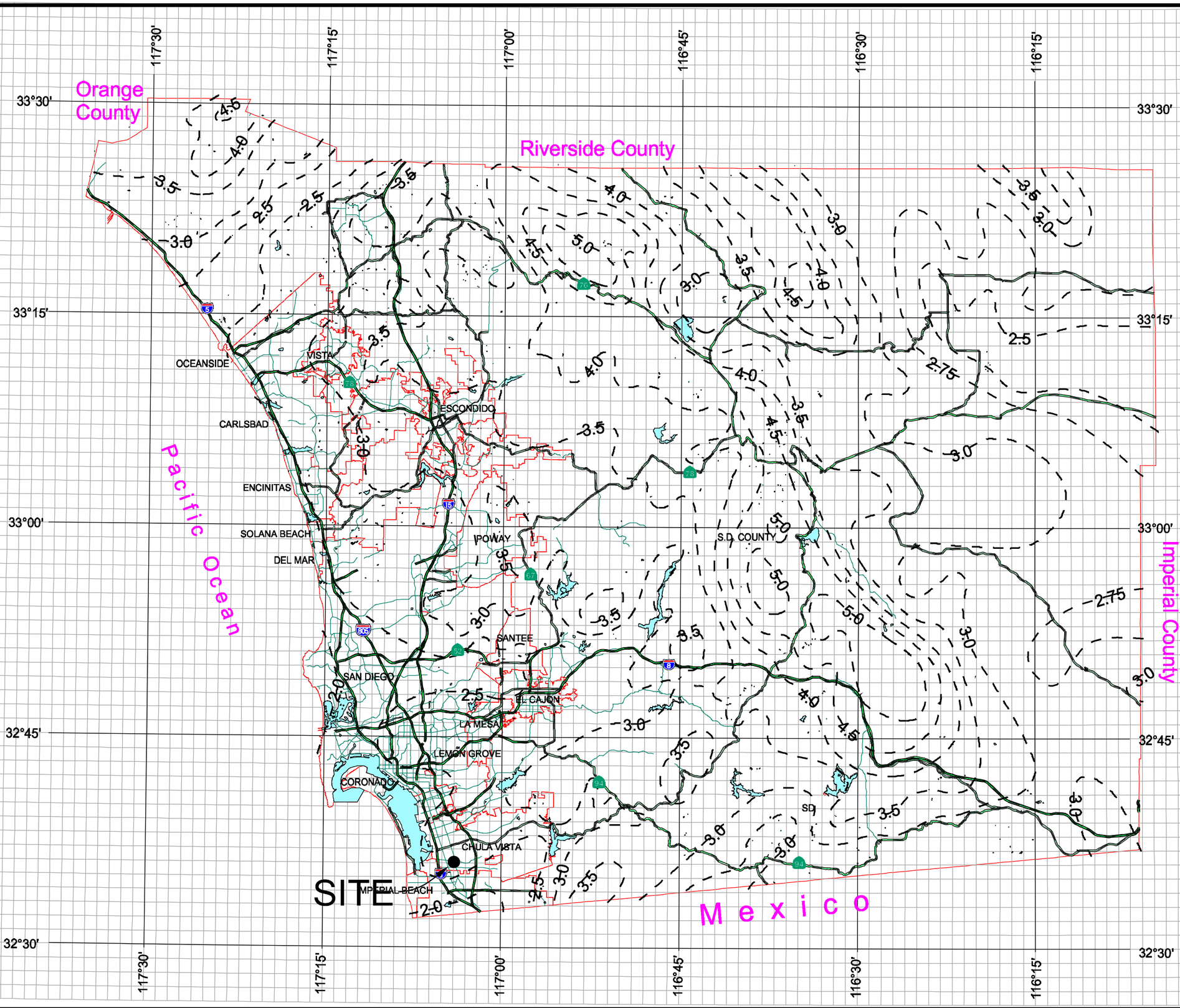
Appendix A
Rainfall Isopluvials

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)



N W E S

3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

Orange County

Riverside County

Imperial County

Mexico

Pacific Ocean

SITE

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
CHULA VISTA
IMPERIAL BEACH
SD

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles

Appendix B
FEMA Flood Plain Maps

ance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

0 250 500 750 1,000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2157G

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA

AND INCORPORATED AREAS

PANEL 2157 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CHULA VISTA, CITY OF	065021	2157	G
SAN DIEGO COUNTY	060284	2157	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
06073C2157G

MAP REVISED
MAY 16, 2012

Federal Emergency Management Agency

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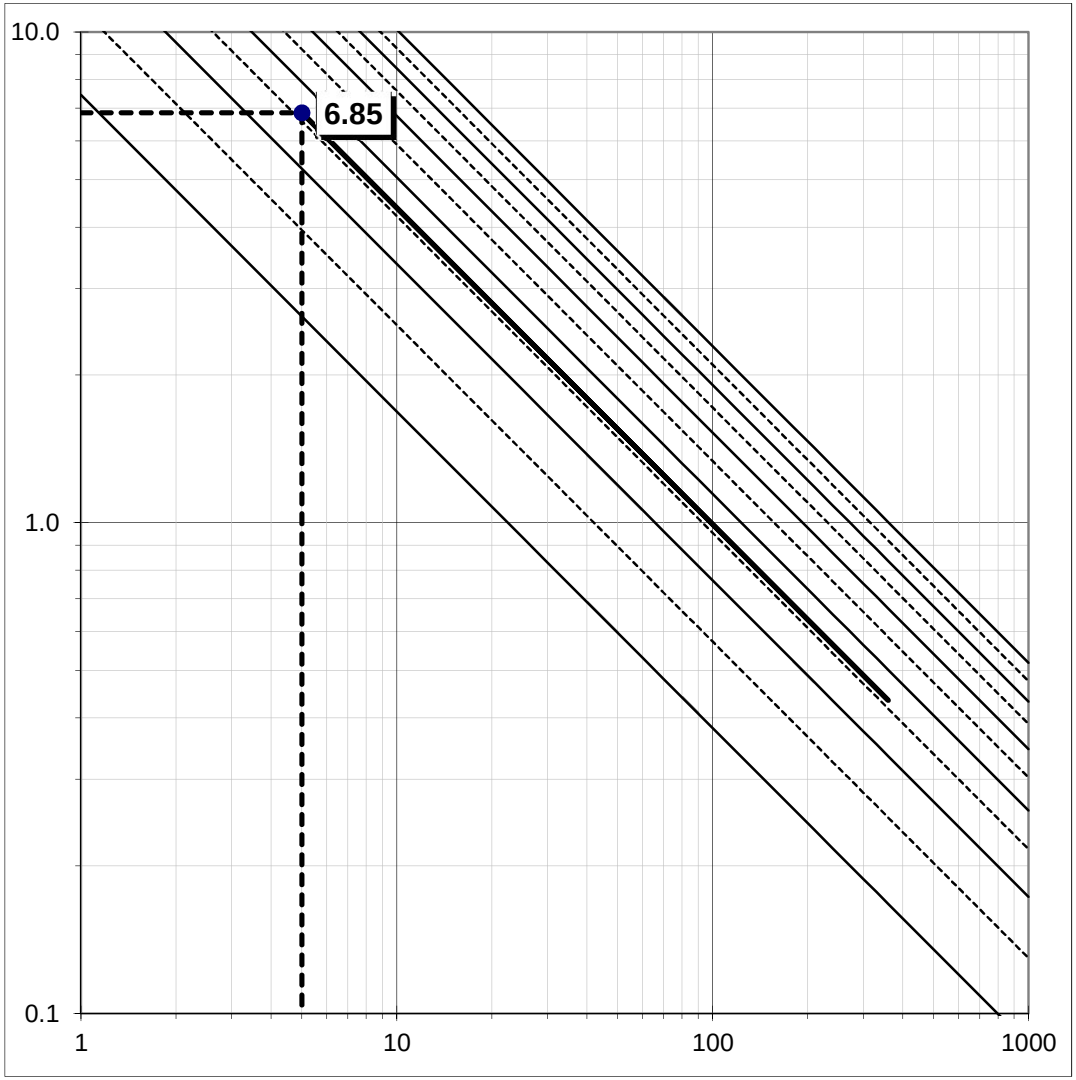
Appendix C
Existing Condition Hydrologic Work Map & Calculations



Sharp Chula Vista

Existing Basin 1

Time of Concentration Calculations

Natural Areas

Land Use = Commercial

C = 0.85

Dist. = 390.00 ft.

slope = 8.000 %

$T_C = \frac{1.8(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$

T_c = 5.00 min.

* Minimum T_c = 5 Minutes

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 = 2.6 in. — P_6 must be within

P_{24} = 4.5 in. — 45% to 65% of P_{24}.

P_6 / P_{24} = 58% — Adjust P_6 as needed.

Adjusted **P_6**= 2.60 in.

T_c (**D**) = 5.00 min.

I = 6.85 in/hr

$I = 7.44 P_6 D^{-0.645}$

Basin Flow Calculations

Q = **6.842** **cfs**

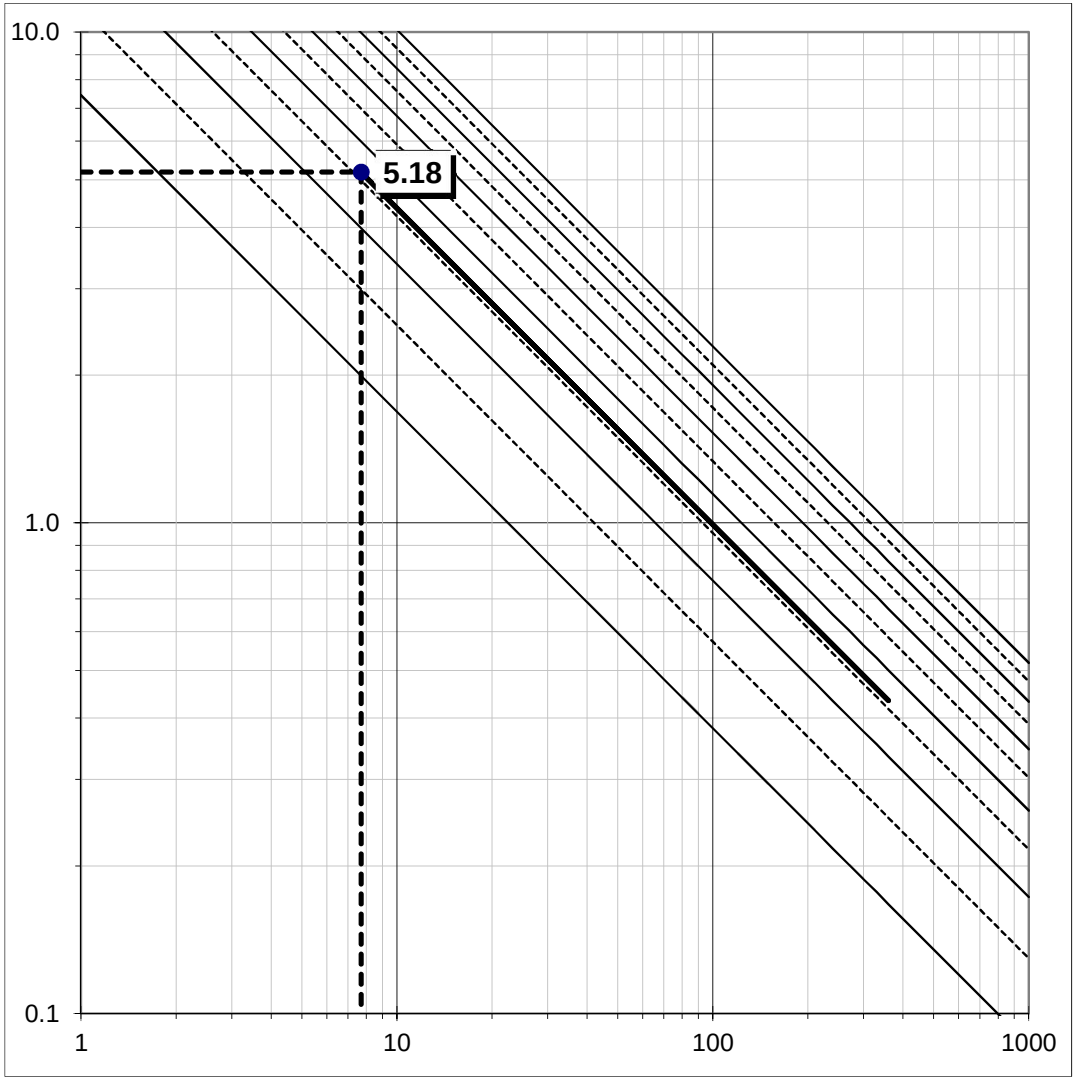
$Q = C * I * A$

C = 0.85

I = 6.85 in/hr

A = 1.175 ac.

RBF Job No. 149517



Sharp Chula Vista

Existing Basin 2

Time of Concentration Calculations

Natural Areas

Land Use = Commercial

C = 0.85

Dist. = 465.00 ft.

slope = 2.000 %

T_c = 7.70 min.

* Minimum T_c = 5 Minutes

$$T_C = \frac{1.8(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 = 2.6 in.

P_{24} = 4.5 in.

P_6 / P_{24} = 58%

Adjusted **P_6**= 2.60 in.

T_c (**D**) = 7.70 min.

I = 5.18 in/hr

P_6 must be within 45% to 65% of P_{24}. Adjust P_6 as needed.

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

Q = **6.020** **cfs**

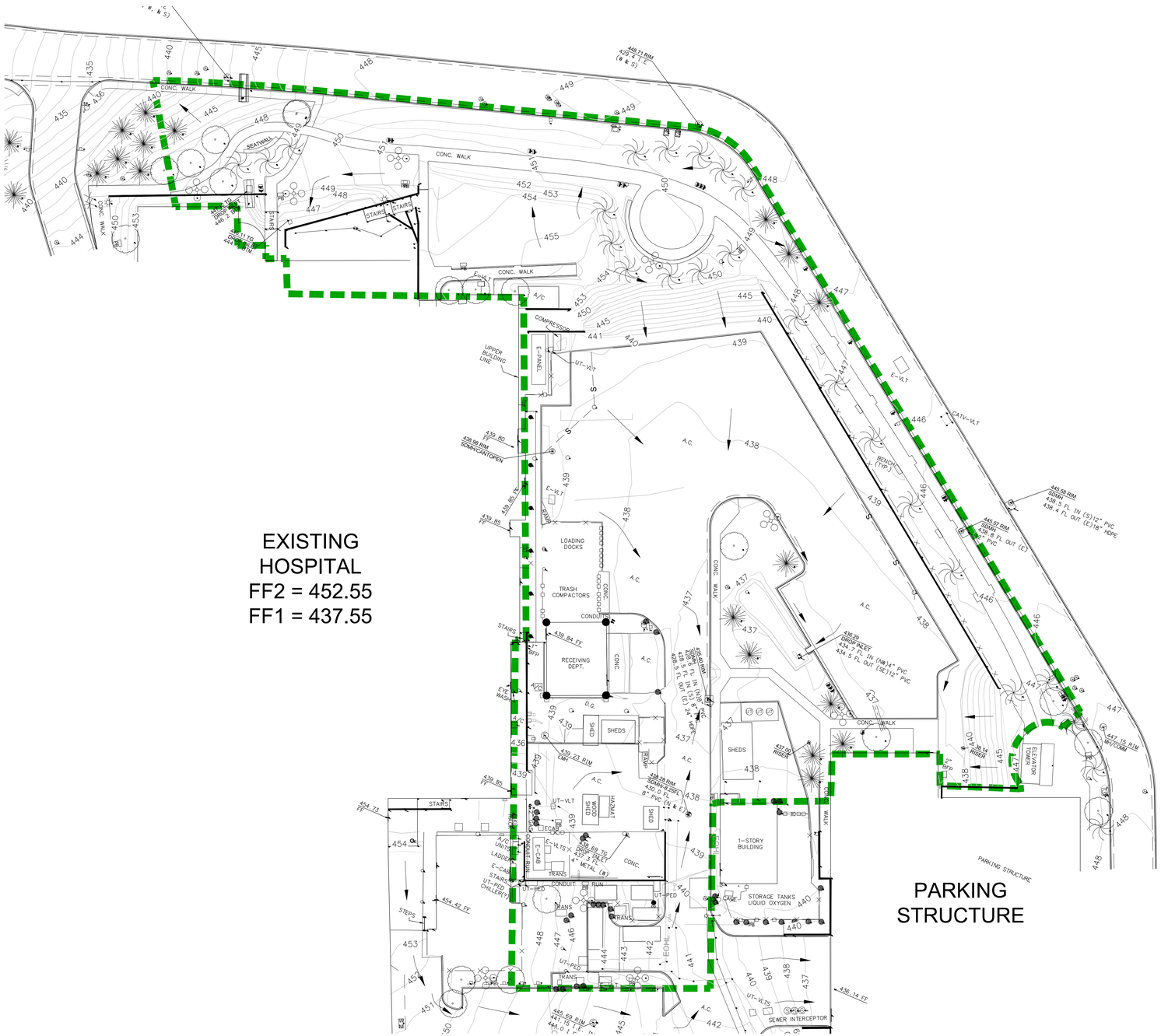
C = 0.85

I = 5.18 in/hr

A = 1.366 ac.

$$Q = C * I * A$$

RBF Job No. 149517



DMA AREA = 2.43 ACRE

LEGEND

LIMITS OF OVERALL DRAINAGE BASIN	
FLOW DIRECTION	
BASIN	X–X
POINT OF COMPLIANCE	
EXISTING CONTOUR	400
EXISTING WATER	W
EXISTING FIRE HYDRANT	
EXISTING GATE VALVE	
EXISTING STORM DRAIN CO	
EXISTING STORM DRAIN	SD
EXISTING SEWER	S
EXISTING STREET LIGHT	
EXISTING CURB	
PROPERTY LINE	
EXISTING RECLAIMED WATER	RW
FENCE LINE	
GATE	
SITE WALL	
RETAINING WALL	
SEWER MANHOLE	S
SEWER CLEAN OUT	
STORM DRAIN MANHOLE	
DRAIN INLET/CATCH BASIN	
FIRE HYDRANT	
WATER METER	
WATER VALVE	
ELECTRIC METER	
ELECTRIC PULL BOX	
POWER POLE	
AREA LIGHT	
STREET LIGHT	
SPOT LIGHT	
UTILITY PULL BOX	
GAS METER	
IRRIGATION CONTROL BOX	
IRRIGATION CONTROL VALVE	
STORM DRAIN CLEAN OUT	C.O.
BOLLARD	
FLAG POLE	
BACK FLOW PREVENTER	BFP
ELECTRIC VAULT	EVLT
TELEPHONE PEDESTAL	TELPED
TELEPHONE VAULT	TELVLT
ELECTRIC TRANSFORMER	TRANS
WATER VAULT	WVLT

30 0 30 60 90
SCALE: 1" = 30'

SCALE: 1" = 30'

SHARP CHULA VISTA MEDICAL
CENTER OCEAN VIEW TOWER
CHULA VISTA, CA

EXISTING DRAINAGE

03 / 29 / 16

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H:\PDATA\149517\CADD\Stormwater\DWG\149517-EXISTING DRAINAGE 01.dwg, 3/28/2016 3:41:58 PM

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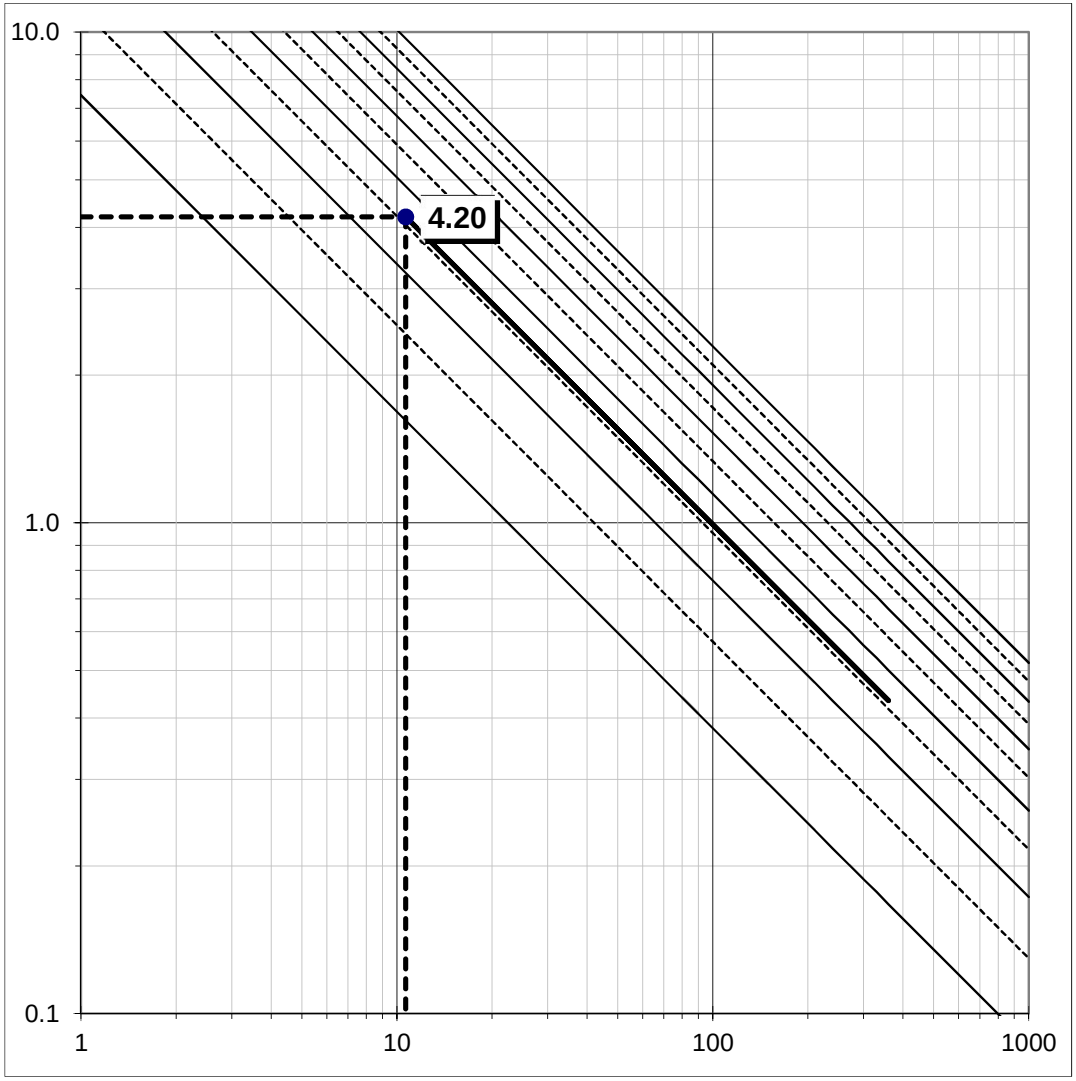
Appendix D
Proposed Condition Hydrologic Work Map & Calculations



Sharp Chula Vista

Proposed Basin 1

Time of Concentration Calculations

Natural Areas

Land Use = Commercial

C = 0.50

Dist. = 390.00 ft.

slope = 8.000 %

T_c = 10.66 min.

* Minimum T_c = 5 Minutes

$$T_C = \frac{1.8(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 = 2.6 in.

P_{24} = 4.5 in.

P_6 / P_{24} = 58%

Adjusted $\mathbf{P_6}$= 2.60 in.

T_c (**D**) = 10.66 min.

I = 4.20 in/hr

P_6 must be within 45% to 65% of P_{24}. Adjust P_6 as needed.

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

Q = **2.469** **cfs**

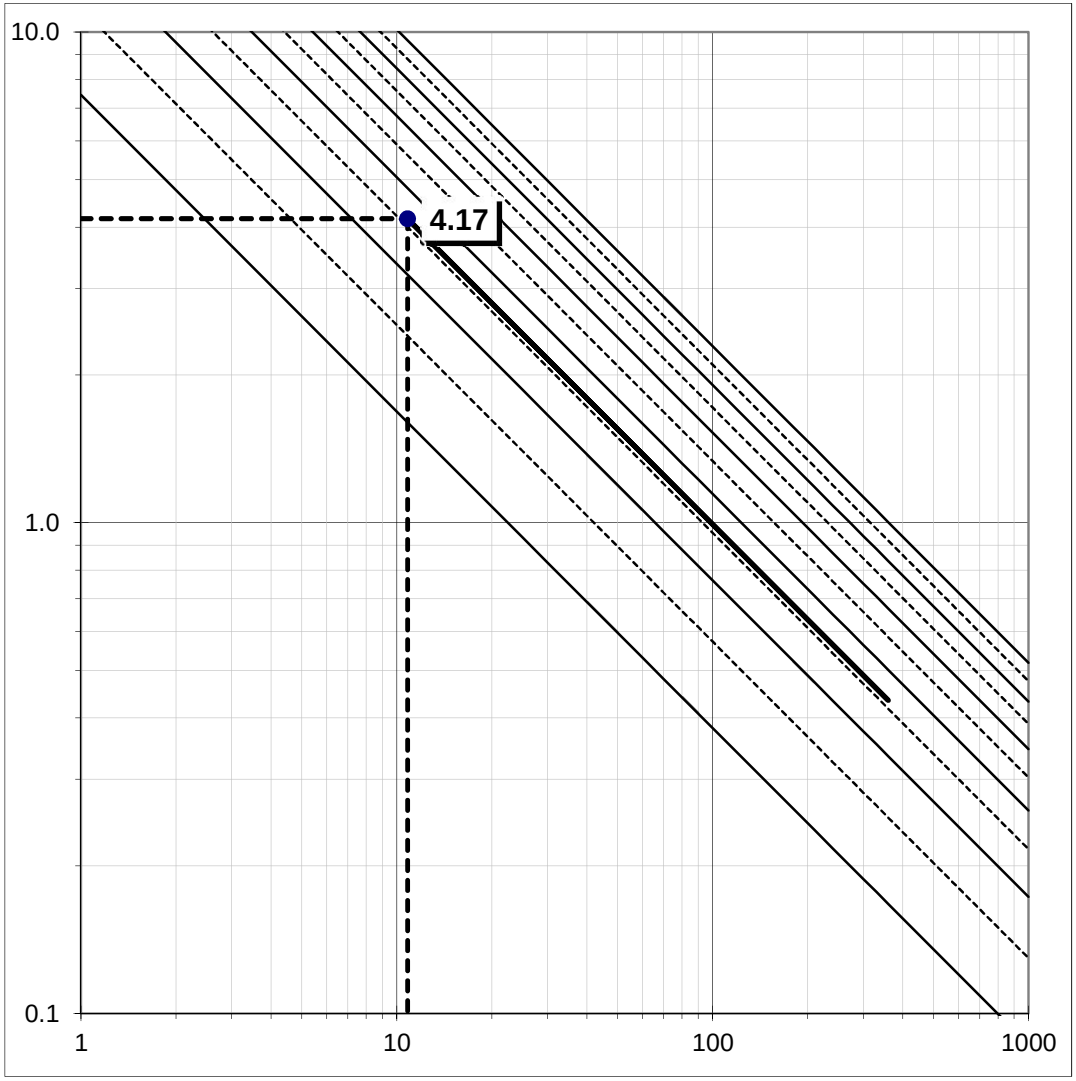
C = 0.50

I = 4.20 in/hr

A = 1.175 ac.

$$Q = C * I * A$$

RBF Job No. 149517



Sharp Chula Vista

Proposed Basin 2

Time of Concentration Calculations

Natural Areas

Land Use = Commercial

C = 0.50

Dist. = 465.00 ft.

slope = 10.000 %

$T_C = \frac{1.8(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$

T_c = 10.81 min.

* Minimum T_c = 5 Minutes

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 = 2.6 in. — P_6 must be within

P_{24} = 4.5 in. — 45% to 65% of P_{24}.

P_6 / P_{24} = 58% — Adjust P_6 as needed.

Adjusted **P_6**= 2.60 in.

T_c (**D**) = 10.81 min.

I = 4.17 in/hr

$I = 7.44 P_6 D^{-0.645}$

Basin Flow Calculations

Q = **2.845** **cfs**

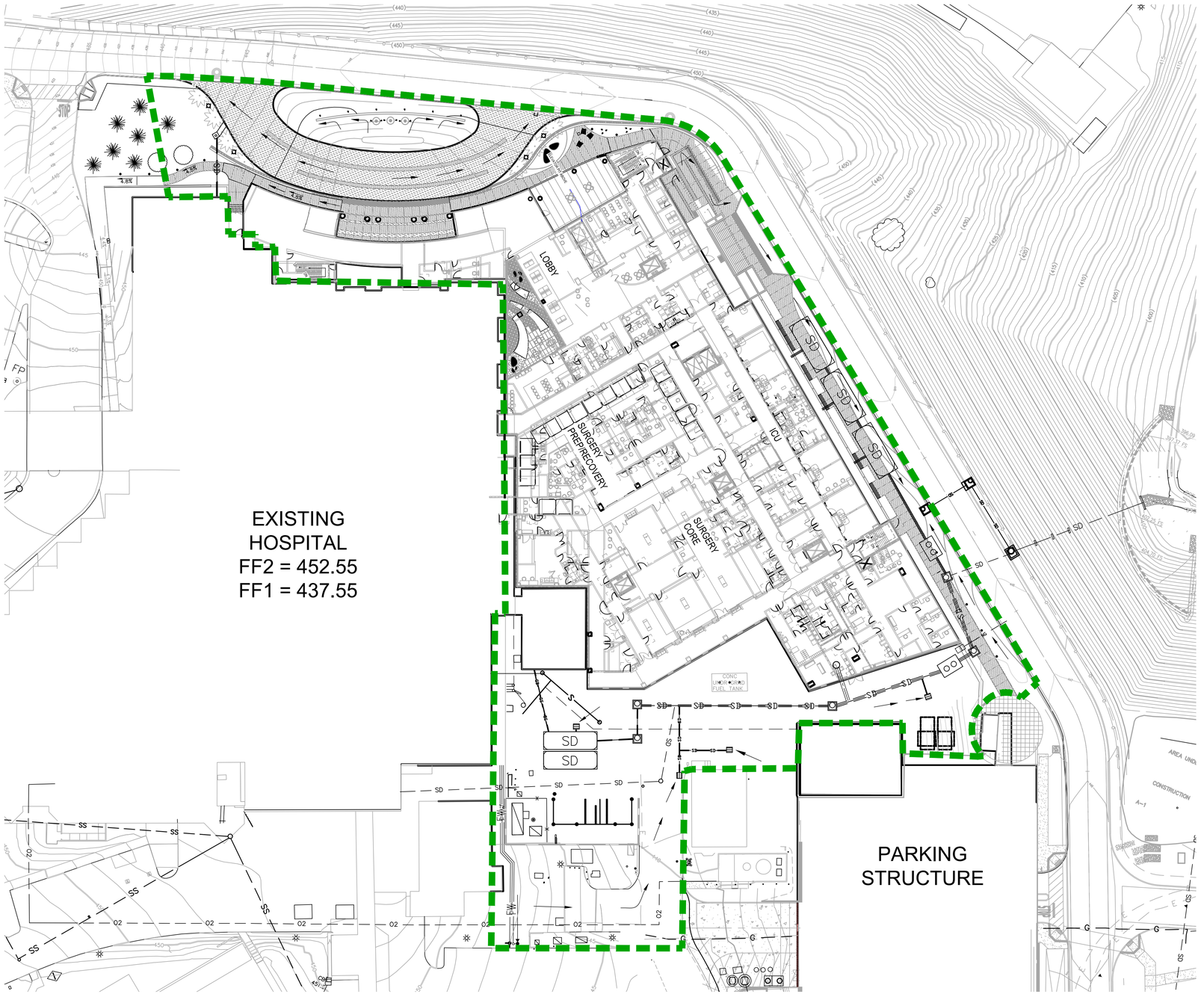
$Q = C * I * A$

C = 0.50

I = 4.17 in/hr

A = 1.366 ac.

RBF Job No. 149517



DMA AREA = 2.43 ACRE

LEGEND

- LIMITS OF OVERALL DRAINAGE BASIN
- FLOW DIRECTION
- BASIN (X-X)
- POINT OF COMPLIANCE
- EXISTING CONTOUR (400)
- EXISTING WATER
- EXISTING FIRE HYDRANT
- EXISTING GATE VALVE
- EXISTING STORM DRAIN CO
- EXISTING STORM DRAIN (SD)
- EXISTING SEWER (S)
- EXISTING STREET LIGHT
- EXISTING CURB
- PROPERTY LINE
- EXISTING RECLAIMED WATER (RW)
- FENCE LINE
- GATE
- SITE WALL
- RETAINING WALL
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- SEWER CLEAN OUT
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- DRAIN INLET/CATCH BASIN
- FIRE HYDRANT
- WATER METER
- WATER VALVE
- ELECTRIC METER
- ELECTRIC PULL BOX
- POWER POLE
- AREA LIGHT
- STREET LIGHT
- SPOT LIGHT
- UTILITY PULL BOX
- GAS METER
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SHARP CHULA VISTA MEDICAL CENTER OCEAN VIEW TOWER CHULA VISTA, CA

PROPOSED DRAINAGE

SCALE: 1"=30'

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