

PRELIMINARY

HYDROLOGY STUDY

AND

HYDRAULICS REPORT

FOR

36-UNIT APARTMENT COMPLEX

APN: 438-220-002

PPT220032

PREPARED BY:
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8/25/23

INTRODUCTION

STUDY LOCATION:

This study area consists of approximately 2.27 acres of land with an existing single family home located at 25914 Columbia Avenue in the unincorporated area of Riverside County. The proposed project is a 36-Unit Apartment Complex. The site may be accessed via Highway 79 south from Freeway 10, thence west on Highway 74, thence south on Columbia Street to the project site.

REPORT OBJECTIVE:

The entire area of this project will be developed as 36-Unit Apartment Complex. The objective of this report is to determine the basic hydrologic response of the proposed development to both onsite and offsite storm runoff and to establish storm drain facility design criteria for this localized unit for review by the County of Riverside. The project is a "Redevelopment" in nature.

HYDROLOGY METHODOLOGY:

The rational method hydrology system and the unit hydrograph method system of the Riverside County Flood Control and Water Conservation District Hydrology Manual dated April, 1978 will be used in the analysis of the subject site to satisfy the requirements of the County of Riverside.

SUMMARY:

The project study area is approximately 2.27 acres in size and can be classified as a small project. It has an existing single family residential house to be removed. The existing terrain has a drainage pattern from east to the west.

The project site is surrounded on the north by an existing Residential Home and Apartment Complex, and Facility Care Center with their own drainage system, therefore they will not have significant impact to the project.

On the south side is an existing Residential Home and Apartment complex with their own drainage system, therefore it will not have significant impact to the project.

On the west side is an improved Columbia Street, therefore it will not have significant impact to the project site.

On the east side is a vacant land and portion of this vacant land drains into the project and it will be considered in the runoff calculation in the predevelopment condition. For the post development condition, this offsite on-flow will be captured by a catch basin at the property line and will drain through a pipe drain line onto Columbia Street to avoid comingling with the onsite runoff that is subject to WQMP requirements.

The site is in Soil Group B inside Hemet Group Map.

The post development runoff calculations will focus on the onsite excluding the offsite on-flow because this offsite on-flow is being intercepted at the property and drains separately from the onsite runoff. The Drainage Area 1 predevelopment runoff for 10-year and 100-year are the same as the post development because of its no-development status.

The storm runoff are calculated before and after development conditions for 10-year and 100-year frequencies for this purpose of Preliminary Hydrology Study.

For the post development calculations,

	Pre-Development			Post Development	
		Onsite	Offsite	Onsite	Offsite
10-year	3.22 cfs	(2.02)	(1.20)	3.08 cfs	1.20 cfs
100-year	7.00 cfs	(2.22)	(4.78)	5.11 cfs	2.22 cfs

There is an increase of 0.33 cfs for a 100-year runoff from predevelopment to post development which is too small and can be easily contained by the proposed WQMP chambers , therefore further mitigation is not necessary.

The proposed 2' wide under sidewalk drain as per Riv. Co. Std. No. 309 has a capacity of 7.77 cfs, which is more than the 100-year flow of 5.11 cfs.

The proposed 24"x24" grated catch basin at the east property line that will capture the offsite on-flow has a capacity of 6.22 cfs which more than the calculated runoff flow of 2.22 cfs.

The proposed 10" drain line that would carry the offsite on-flow to Columbia Street has a capacity of 2.36 cfs which is more than the calculated flow of 2.22 cfs.

The street capacity calculations shows that the 10-year flow can be contained easily within curb line and the 100-year flow can be contained within the right of way line

CONCLUSION:

This Preliminary Hydrology and Hydraulics Report concludes that the proposed project is safe and feasible from Hydrology and Drainage standpoint.

UNDER SIDEWALK DRAIN

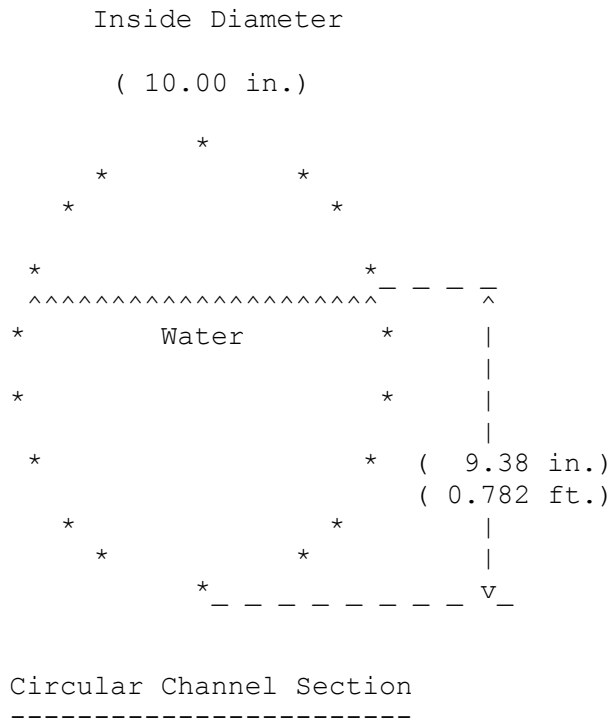
```

          |<----- ( 2.00') ----->|
          |
* * * * *                               * * * * *
* *                                     * *
* ^^^Water Surface ( 0.50')^^^* *
* *                                     * *
* *                                     * *
* *                                     * *
* * * * * * * * * * * * * * * * * *
* * * * * * * * * * * * * * * * *

```

Rectangular Open Channel

Flowrate	7.772	CFS
Velocity	7.772	fps
Depth of Flow	0.500	feet
Critical Depth	0.777	feet
Total Depth	0.500	feet
Base Width	2.000	feet
Slope of Channel	2.000	%
X-Sectional Area	1.000	sq. ft.
Wetted Perimeter	3.000	feet
AR^(2/3)	0.481	
Mannings 'n'	0.013	



Flowrate	2.357	CFS
Velocity	4.435	fps
Pipe Diameter	10.000	inches
Depth of Flow	9.380	inches
Depth of Flow	0.782	feet
Critical Depth	0.682	feet
Depth/Diameter (D/d)	0.938	
Slope of Pipe	1.000	%
X-Sectional Area	0.531	sq. ft.
Wetted Perimeter	2.199	feet
AR^(2/3)	0.206	
Mannings 'n'	0.013	
Min. Friction Slope, 10 inch		
Pipe Flowing Full	1.157	%

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Orifice Equation

The flow capacity of any inlet grate in a sump or ponded condition is a function of the depth of water over the grate and the open area of the grate. For this calculation, the orifice equation is used. The orifice equation can be used to determine the flow through a grate.

$$Q = 0.0108 \times A \times \sqrt{d}$$

Q = flow (ft³/s)A = open area of grate (in²)

d = depth of water over grate (in)

Orifice Flow Calculator

Options:

Enter A and d, click Calculate to solve for Q (flow)

Enter Q and d, click Calculate to solve for A (grate open area)

*Indicates required field

Q = Flow (ft³/s):A = Open area of grate (in²):

* d = Depth of water over grate (in):

Calculate

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Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 08/24/23 File: COLUMB1.out

10-YEAR
PRE-DEVELOPMENT

***** Hydrology Study Control Information *****

English (in-lb) Units used in input data file

Program License Serial Number 6260

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)

For the [Hemet] area used.

10 year storm 10 minute intensity = 1.960(In/Hr)

10 year storm 60 minute intensity = 0.760(In/Hr)

100 year storm 10 minute intensity = 3.050(In/Hr)

100 year storm 60 minute intensity = 1.180(In/Hr)

Storm event year = 10.0

Calculated rainfall intensity data:

1 hour intensity = 0.760(In/Hr)

Slope of intensity duration curve = 0.5300

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 87.000(Ft.)

Top (of initial area) elevation = 1668.800(Ft.)

Bottom (of initial area) elevation = 1667.000(Ft.)

Difference in elevation = 1.800(Ft.)

Slope = 0.02069 s(percent)= 2.07

TC = $k(0.530) * [(length^3) / (elevation\ change)]^{0.2}$

Initial area time of concentration = 6.870 min.

Rainfall intensity = 2.397(In/Hr) for a 10.0 year storm

UNDEVELOPED (poor cover) subarea

Runoff Coefficient = 0.706

Decimal fraction soil group A = 0.000

Decimal fraction soil group B = 1.000

Decimal fraction soil group C = 0.000

Decimal fraction soil group D = 0.000

RI index for soil(AMC 2) = 67.00

Pervious area fraction = 1.000; Impervious fraction = 0.000

Initial subarea runoff = 1.202(CFS)

Total initial stream area = 0.710(Ac.)

Pervious area fraction = 1.000

+++++
Process from Point/Station 2.000 to Point/Station 3.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 2.243(CFS)
Depth of flow = 0.292(Ft.), Average velocity = 1.969(Ft/s)
***** Irregular Channel Data *****

Information entered for subchannel number 1 :

Point number	'X' coordinate	'Y' coordinate
1	0.00	0.75
2	10.00	0.00
3	20.00	0.75

Manning's 'N' friction factor = 0.022

Sub-Channel flow = 2.243(CFS)
' ' flow top width = 7.794(Ft.)
' ' velocity = 1.969(Ft/s)
' ' area = 1.139(Sq.Ft)
' ' Froude number = 0.908

Upstream point elevation = 1667.000(Ft.)
Downstream point elevation = 1662.000(Ft.)
Flow length = 451.000(Ft.)
Travel time = 3.82 min.
Time of concentration = 10.69 min.
Depth of flow = 0.292(Ft.)
Average velocity = 1.969(Ft/s)
Total irregular channel flow = 2.243(CFS)
Irregular channel normal depth above invert elev. = 0.292(Ft.)
Average velocity of channel(s) = 1.969(Ft/s)
Adding area flow to channel
SINGLE FAMILY (1 Acre Lot)
Runoff Coefficient = 0.469
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.800; Impervious fraction = 0.200
Rainfall intensity = 1.897(In/Hr) for a 10.0 year storm
Subarea runoff = 2.018(CFS) for 2.270(Ac.)
Total runoff = 3.220(CFS) Total area = 2.980(Ac.)
Depth of flow = 0.335(Ft.), Average velocity = 2.156(Ft/s)
End of computations, total study area = 2.98 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.848
Area averaged RI index number = 40.3

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 08/24/23 File: COLUMB24.out

100-YEAR
PREDEVELOPMENT

***** Hydrology Study Control Information *****
English (in-lb) Units used in input data file

Program License Serial Number 6260

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)

For the [Hemet] area used.

10 year storm 10 minute intensity = 1.960 (In/Hr)

10 year storm 60 minute intensity = 0.760 (In/Hr)

100 year storm 10 minute intensity = 3.050 (In/Hr)

100 year storm 60 minute intensity = 1.180 (In/Hr)

Storm event year = 100.0

Calculated rainfall intensity data:

1 hour intensity = 1.180 (In/Hr)

Slope of intensity duration curve = 0.530

+++++

Process from Point/Station 1.000 to Point/Station 2.000

**** INITIAL AREA EVALUATION ****

Initial area flow distance = 87.000 (Ft.)

Top (of initial area) elevation = 1668.800 (Ft.)

Bottom (of initial area) elevation = 1667.000 (Ft.)

Difference in elevation = 1.800 (Ft.)

Slope = 0.02069 s(percent) = 2.07

$TC = k(0.530) * [(length^3) / (elevation\ change)]^{0.2}$

Initial area time of concentration = 6.870 min.

Rainfall intensity = 3.722 (In/Hr) for a 100.0 year storm

UNDEVELOPED (poor cover) subarea

Runoff Coefficient = 0.839

Decimal fraction soil group A = 0.000

Decimal fraction soil group B = 1.000

Decimal fraction soil group C = 0.000

Decimal fraction soil group D = 0.000

RI index for soil(AMC 3) = 83.20

Pervious area fraction = 1.000; Impervious fraction = 0.000

Initial subarea runoff = 2.218 (CFS)

Total initial stream area = 0.710 (Ac.)

Pervious area fraction = 1.00

+++++
 Process from Point/Station 2.000 to Point/Station 3.000
 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 4.649(CFS)
 Depth of flow = 0.384(Ft.), Average velocity = 2.363(Ft/s)
 ***** Irregular Channel Data *****

Information entered for subchannel number 1 :
 Point number 'X' coordinate 'Y' coordinate
 1 0.00 0.75
 2 10.00 0.00
 3 20.00 0.75
 Manning's 'N' friction factor = 0.022

Sub-Channel flow = 4.649(CFS)
 ' ' flow top width = 10.243(Ft.)
 ' ' velocity = 2.363(Ft/s)
 ' ' area = 1.967(Sq.Ft)
 ' ' Froude number = 0.950

Upstream point elevation = 1667.000(Ft.)
 Downstream point elevation = 1662.000(Ft.)
 Flow length = 451.000(Ft.)
 Travel time = 3.18 min.
 Time of concentration = 10.05 min.
 Depth of flow = 0.384(Ft.)
 Average velocity = 2.363(Ft/s)
 Total irregular channel flow = 4.649(CFS)
 Irregular channel normal depth above invert elev. = 0.384(Ft.)
 Average velocity of channel(s) = 2.363(Ft/s)

Adding area flow to channel
 SINGLE FAMILY (1 Acre Lot)
 Runoff Coefficient = 0.693
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 1.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 RI index for soil(AMC 3) = 52.00
 Pervious area fraction = 0.800; Impervious fraction = 0.200
 Rainfall intensity = 3.042(In/Hr) for a 100.0 year storm
 Subarea runoff = 4.782(CFS) for 2.270(Ac.)
 Total runoff = 7.000(CFS) Total area = 2.980(Ac.)
 Depth of flow = 0.448(Ft.), Average velocity = 2.618(Ft/s)
 End of computations, total study area = 2.98 (Ac.)
 The following figures may
 be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.848
 Area averaged RI index number = 40.3

10-YEAR
POST DEVELOPMENT

***** Hydrology Study Control Information *****
English (in-lb) Units used in input data file

Program License Serial Number 6260

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Hemet] area used.

10 year storm 10 minute intensity = 1.960(In/Hr)
10 year storm 60 minute intensity = 0.760(In/Hr)
100 year storm 10 minute intensity = 3.050(In/Hr)
100 year storm 60 minute intensity = 1.180(In/Hr)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.760(In/Hr)
Slope of intensity duration curve = 0.5300

+++++
Process from Point/Station 2.000 to Point/Station 3.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 775.000(Ft.)
Top (of initial area) elevation = 1667.000(Ft.)
Bottom (of initial area) elevation = 1662.350(Ft.)
Difference in elevation = 4.650(Ft.)
Slope = 0.00600 s(percent)= 0.60
 $TC = k(0.323) * [(length^3) / (elevation\ change)]^{0.2}$
Initial area time of concentration = 12.862 min.
Rainfall intensity = 1.719(In/Hr) for a 10.0 year storm
APARTMENT subarea type
Runoff Coefficient = 0.788
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.200; Impervious fraction = 0.800
Initial subarea runoff = 3.075(CFS)
Total initial stream area = 2.270(Ac.)
Pervious area fraction = 0.200
End of computations, total study area = 2.27 (Ac.)
The following figures may

be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(A_p) = 0.200

Area averaged RI index number = 32.0

 100-YEAR
 POST DEVELOPMENT

***** Hydrology Study Control Information *****
 English (in-lb) Units used in input data file

Program License Serial Number 6260

Rational Method Hydrology Program based on
 Riverside County Flood Control & Water Conservation District
 1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)

For the [Hemet] area used.

10 year storm 10 minute intensity = 1.960(In/Hr)

10 year storm 60 minute intensity = 0.760(In/Hr)

100 year storm 10 minute intensity = 3.050(In/Hr)

100 year storm 60 minute intensity = 1.180(In/Hr)

Storm event year = 100.0

Calculated rainfall intensity data:

1 hour intensity = 1.180(In/Hr)

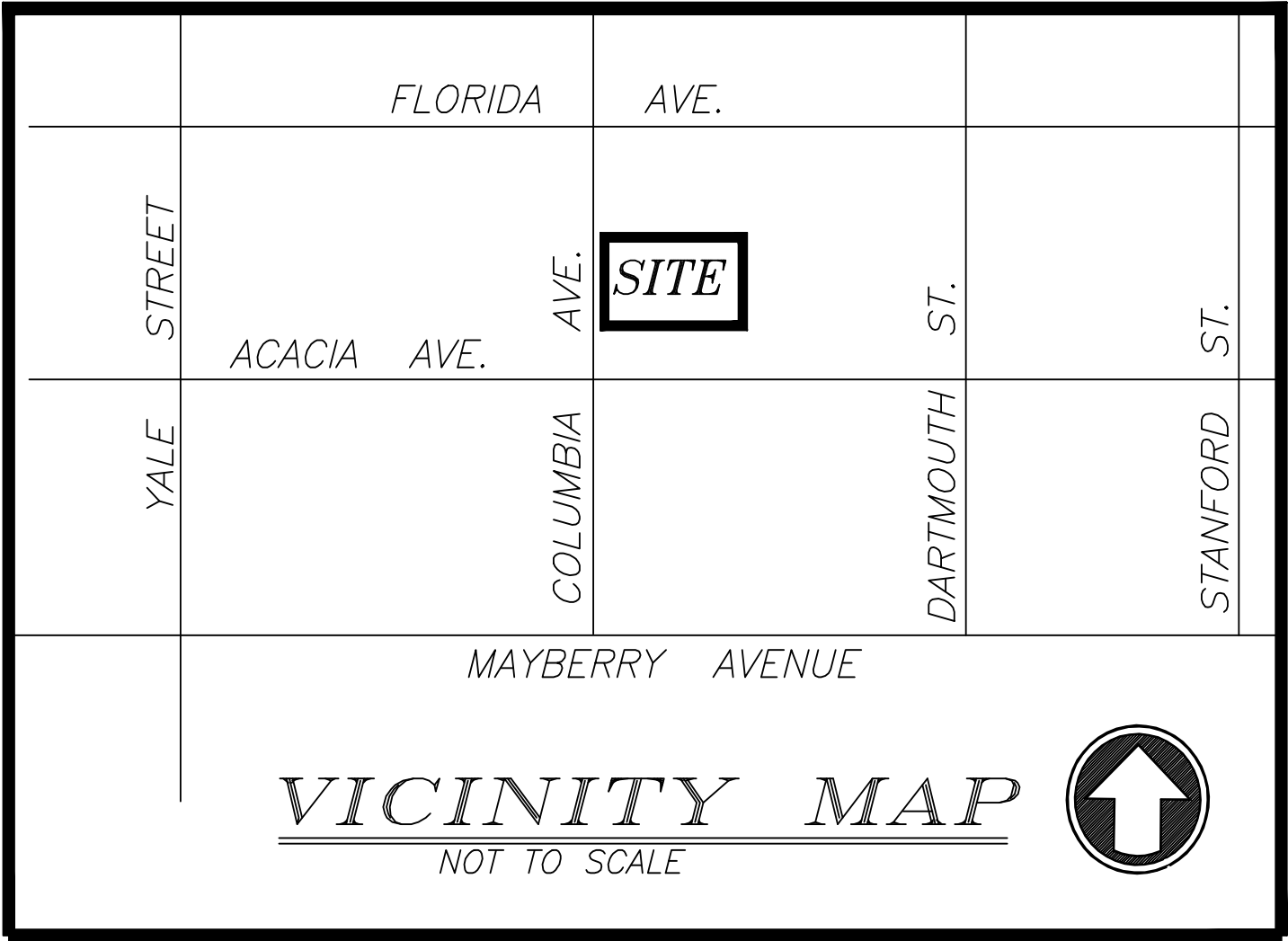
Slope of intensity duration curve = 0.5300

+++++
 Process from Point/Station 2.000 to Point/Station 3.000
 **** INITIAL AREA EVALUATION ****

 Initial area flow distance = 775.000(Ft.)
 Top (of initial area) elevation = 1667.000(Ft.)
 Bottom (of initial area) elevation = 1662.350(Ft.)
 Difference in elevation = 4.650(Ft.)
 Slope = 0.00600 s(percent)= 0.60
 $TC = k(0.323) * [(length^3) / (elevation\ change)]^{0.2}$
 Initial area time of concentration = 12.862 min.
 Rainfall intensity = 2.669(In/Hr) for a 100.0 year storm
 APARTMENT subarea type
 Runoff Coefficient = 0.843
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 1.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 RI index for soil(AMC 3) = 52.00
 Pervious area fraction = 0.200; Impervious fraction = 0.800
 Initial subarea runoff = 5.109(CFS)
 Total initial stream area = 2.270(Ac.)

Pervious area fraction = 0.200
End of computations, total study area = 2.27 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(A_p) = 0.200
Area averaged RI index number = 32.0





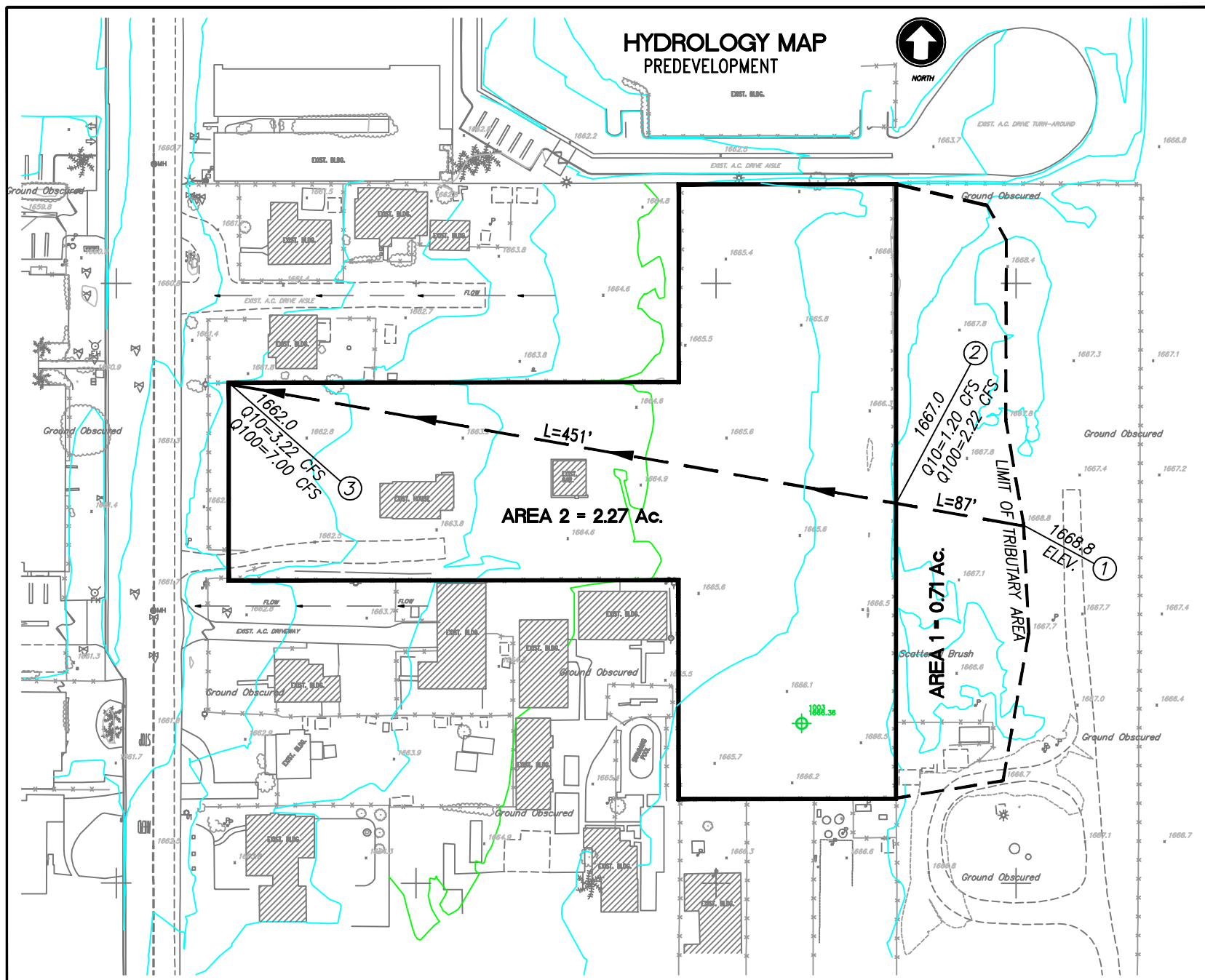
David Cordrey
Concrete Construction

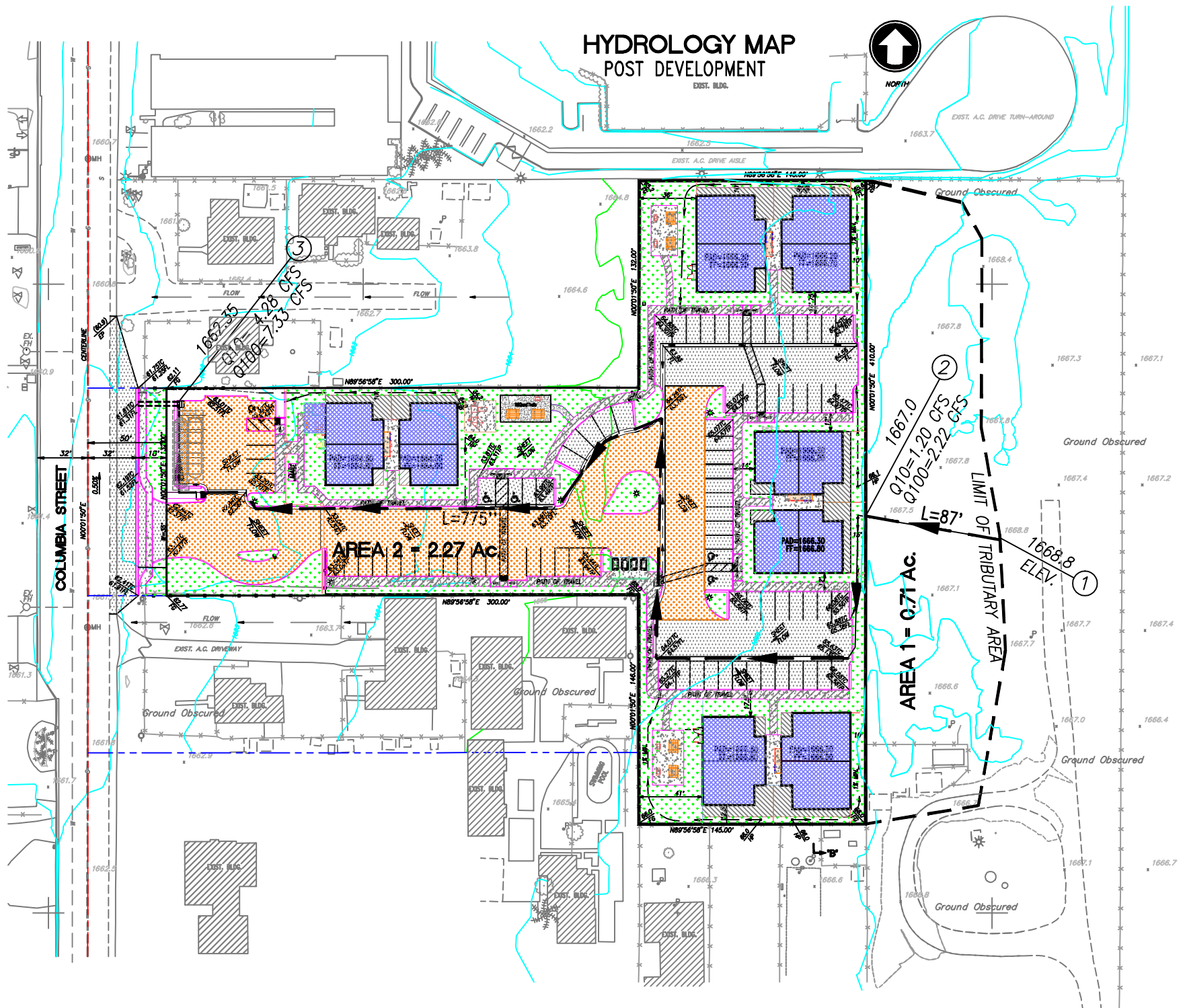
Desert Hills Memory
Care Center

Project Site

Acacia Ave

Columbia St
Google





RAINFALL INTENSITY—INCHES PER HOUR

HEMET			HIGHGROVE			HOMELAND - WINCHESTER			IDYLLWILD			LAKEVIEW		
DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY	
	10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR
5	2.84	4.40	5	3.02	4.37	5	2.91	4.37	5	4.91	7.28	5	2.77	4.16
6	2.58	4.00	6	2.75	3.97	6	2.65	3.97	6	4.47	6.62	6	2.53	3.79
7	2.37	3.68	7	2.54	3.67	7	2.44	3.67	7	4.13	6.11	7	2.34	3.51
8	2.21	3.43	8	2.37	3.42	8	2.28	3.42	8	3.85	5.70	8	2.19	3.29
9	2.08	3.23	9	2.23	3.22	9	2.15	3.22	9	3.62	5.36	9	2.07	3.10
10	1.96	3.05	10	2.11	3.05	10	2.03	3.05	10	3.43	5.08	10	1.96	2.94
11	1.87	2.90	11	2.01	2.90	11	1.93	2.90	11	3.26	4.83	11	1.87	2.80
12	1.78	2.77	12	1.92	2.77	12	1.85	2.77	12	3.12	4.62	12	1.79	2.68
13	1.71	2.65	13	1.84	2.66	13	1.77	2.66	13	2.99	4.43	13	1.72	2.58
14	1.64	2.55	14	1.77	2.56	14	1.71	2.56	14	2.88	4.26	14	1.66	2.48
15	1.58	2.46	15	1.71	2.47	15	1.64	2.47	15	2.78	4.11	15	1.60	2.40
16	1.53	2.38	16	1.65	2.39	16	1.59	2.39	16	2.68	3.98	16	1.55	2.32
17	1.48	2.30	17	1.60	2.31	17	1.54	2.31	17	2.60	3.85	17	1.50	2.25
18	1.44	2.23	18	1.55	2.24	18	1.50	2.24	18	2.52	3.74	18	1.46	2.19
19	1.40	2.17	19	1.51	2.18	19	1.45	2.18	19	2.45	3.64	19	1.42	2.13
20	1.36	2.11	20	1.47	2.12	20	1.42	2.12	20	2.39	3.54	20	1.39	2.08
22	1.29	2.01	22	1.40	2.02	22	1.35	2.02	22	2.27	3.37	22	1.32	1.98
24	1.24	1.92	24	1.34	1.93	24	1.29	1.93	24	2.17	3.22	24	1.26	1.90
26	1.18	1.84	26	1.28	1.85	26	1.24	1.85	26	2.09	3.09	26	1.22	1.82
28	1.14	1.77	28	1.23	1.78	28	1.19	1.78	28	2.01	2.97	28	1.17	1.76
30	1.10	1.70	30	1.19	1.72	30	1.15	1.72	30	1.94	2.87	30	1.13	1.70
32	1.06	1.65	32	1.15	1.66	32	1.11	1.66	32	1.87	2.77	32	1.10	1.64
34	1.03	1.59	34	1.12	1.61	34	1.07	1.61	34	1.81	2.69	34	1.06	1.59
36	1.00	1.55	36	1.08	1.57	36	1.04	1.57	36	1.76	2.61	36	1.03	1.55
38	.97	1.50	38	1.05	1.52	38	1.01	1.52	38	1.71	2.54	38	1.01	1.51
40	.94	1.46	40	1.02	1.48	40	.99	1.48	40	1.67	2.47	40	.98	1.47
45	.89	1.37	45	.96	1.39	45	.93	1.39	45	1.57	2.32	45	.92	1.39
50	.84	1.30	50	.91	1.32	50	.88	1.32	50	1.48	2.20	50	.88	1.31
55	.80	1.24	55	.87	1.26	55	.84	1.26	55	1.41	2.09	55	.84	1.25
60	.76	1.18	60	.83	1.20	60	.80	1.20	60	1.35	2.00	60	.80	1.20
65	.73	1.13	65	.80	1.15	65	.77	1.15	65	1.29	1.92	65	.77	1.15
70	.70	1.09	70	.77	1.11	70	.74	1.11	70	1.25	1.85	70	.74	1.11
75	.68	1.05	75	.74	1.07	75	.71	1.07	75	1.20	1.78	75	.72	1.07
80	.65	1.01	80	.71	1.03	80	.69	1.03	80	1.16	1.72	80	.69	1.04
85	.63	.98	85	.69	1.00	85	.67	1.00	85	1.13	1.67	85	.67	1.01
SLOPE = .530			SLOPE = .520			SLOPE = .520			SLOPE = .520			SLOPE = .500		

RCFC & WCD
HYDROLOGY MANUAL

STANDARD
INTENSITY - DURATION
CURVES DATA

