

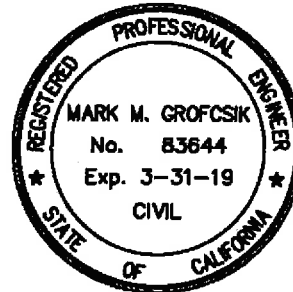
Appendix B:
**Cordoba Center – Supplemental Drainage
Information to Respond to SCVWD Comments on the
Draft EIR**



Civil Engineering

303 Potrero St., Suite 42-202
Santa Cruz, CA 95060
831-425-3901

mark@riengineering.com



Memorandum

To: Kim Tchantz, MSP, CEP
From: Mark Grofcsik
Date: 11/20/2018
Re: Cordoba Center – Supplemental Drainage Information to Respond to SCVWD Comments on Draft EIR

The proposed drainage system for the project has been designed to detain stormwater and release runoff at a rate equal to the predevelopment flowrates for the 10 and 100-year design storms. Metered runoff will be achieved by using drainage outlet structures with two orifices that are sized to match the pre-development flow rates. During smaller storms, the lower orifice will discharge at the 10-year design rate. During larger storms, a second orifice set at a higher elevation will concurrently release stormwater so that the overall stormwater discharge rate leaving the site will match the 100-year predevelopment discharge rate. Exact orifice diameters and pipe sizes will be determined at the construction document stage.

The majority of the site will drain to a proposed bioretention swale in a large area at the southern portion of the site. This depressed area is over 18,500 square feet in area, and has ample storage volume for stormwater generated by the addition of 135,590 square feet of impervious surface on the site. The bioretention swale will allow for stored runoff to infiltrate into the ground. The outlet structure at the southwestern corner of the site will be metered to discharge at the predevelopment 10 and 100-year design storm runoff rate.

On the eastern side of the property, a combined buried retention and detention chamber will infiltrate and store runoff before releasing at pre-development rates for the 10 and 100-year design storms.

Our design has set aside adequate stormwater storage and treatment areas to meet the low impact development and post-construction management requirements. Through using metered stormwater runoff to release at predevelopment rates, adverse downstream impacts are not anticipated for the 10 and 100-year design storms. Preliminary engineering calculations support the conclusions above. More refined calculations and details will be provided as we progress further towards final design, as is typically done with drainage plans.

Regards,

Mark Grofcsik
RCE 83644

RI Engineering, Inc.



DRAINAGE CALCULATIONS

For

Cordoba Center

At

**Monterey Road
Santa Clara County
Morgan Hill, California
APN 779-06-002**

October 23, 2014

Revised: December 1, 2015

Prepared For:

SVIC

Prepared By:

**RI Engineering, Inc.
Project Number 10-036-1**



RECEIVED
JAN 04 2016

COUNTY OF SANTA CLARA
PLANNING OFFICE

2145-10P-10A-10G-10EIR

Design Criteria

Storm drainage calculations described in this document have been done in conformance with the Santa Clara County Drainage Manual 2007.

Project Description

The project consists of constructing two new large buildings and a plaza area for the Cordoba Center on a 15.98-acre lot located on Monterey Road in Morgan Hill, CA. Accessory buildings include a maintenance building, caretaker residence, and a campground with bathroom facilities. Associated improvements include constructing paved access roads, gravel parking stalls, fire truck turnaround, a cemetery yard, a hiking path, and an orchard area. The project will create approximately 3.75 acres of new impervious area and 0.68 acres of new permeable gravel and paver areas.

Existing Conditions

The property has a ridge along the northern edge. The area to the north of the ridge has a steep slope and drains northward into the Llagas Creek. No improvements are proposed in this area. The area to the south of the ridge has a slope of 28% and gradually reduces to 5% at the south property line.

The area to the south of the ridge is split into two drainage basins for this report and calculations (see attached Existing Drainage Map). Basin A is located to the west and encompasses most of the site. Basin A drains southerly downslope overland until reaching an existing shallow drainage channel parallel to the southeast property line. Stormwater is conveyed in the channel to the southern property corner before leaving the site. Basin A soils are in hydrologic group “C”. The Basin A soil located at the southwest property line has high infiltration values of 1.28 inches per hour per USDA soil mapping.

Basin B is located on the eastern portion of the side. Runoff in Basin B sheet flows down the slope and toward a shallow roadside ditch along Monterey Road. Basin B soils are in hydrologic group “B”. The Basin B soil located at the eastern property corner has a high infiltration value of 1.28 inches per hour per USDA soil mapping.

Both Basin A and B are currently covered with mixed grasses, weeds, and trees. A rational method coefficient of 0.15 is used for hydrologic group “B” soils, and 0.35 is used for hydrologic group “C” soils. The Mean Annual Precipitation is 19.5 inches (per Santa Clara County Drainage Manual Figure A-2). The Basin A existing peak runoff for a 10-year storm event is approximately 5.34 cfs, and peak runoff for a 100-year storm event is approximately 7.67 cfs (See table 2). Basin B existing peak runoff for a 10-year storm event is approximately 0.31 cfs, and peak runoff for a 100-year storm event is approximately 0.44 cfs (See table 6).

Proposed Development

Stormwater runoff will be directed away from the proposed buildings onsite by positive grading. The stormwater runoff will be captured by grass lined swales and conveyed to catch basins and transported through closed pipes under the proposed driveway to detention areas along the southern edge of the property.

After the proposed development, the Basin A post-development runoff rate for a 10-year design storm event created by the new impervious area will be approximately 8.40 cfs. This is an increase of 3.06 cfs from the existing condition. The Basin A post-development runoff rate for a 100-year design storm event will be approximately 12.09 cfs. This is an increase of 4.42 cfs from the existing condition (see table 2).

The increase in runoff from Basin A will be mitigated by directing runoff to a depressed stormwater detention and retention area along the southwest property line. The existing soil in the area has a high infiltration rate of 1.27 inches per hour and will serve to infiltrate runoff. Excess runoff that cannot be infiltrated will leave the site at the southern property corner per existing conditions. A metered outlet has been designed to outlet stormwater from the detention/retention area at or below the existing peak runoff rate.

After the proposed development, the Basin B post-development runoff rate for a 10-year design storm event created by the new impervious area will be approximately 0.51 cfs. This is an increase of 0.20 cfs from the existing condition. The Basin B post-development runoff rate for a 100-year design storm event will be approximately 0.73 cfs. This is an increase of 0.28 cfs from the existing condition (see table 6).

The increase in runoff from Basin B will be mitigated by directing runoff to an stormwater detention and retention system using underground chambers. The detention and retention system will serve to infiltrate stormwater, and have a metered outlet near the top of the storage area. Excess runoff that cannot be infiltrated within the underground chamber will leave the site through an outlet pipe under the proposed driveway and discharge to the existing flowpath along Monterey Ave. The metered outlet has been designed to outlet stormwater from the detention/retention area at or below the existing peak runoff rate.

Downstream drainage paths will remain the same as predevelopment conditions. Basin A will continue to discharge out the southern corner of the property. Basin B will continue to flow into the existing drainage system of Monterey Road. Runoff leaving the parcel will be kept at predevelopment rates.

Conclusion

Runoff will be controlled and discharged at predevelopment rates. The increased runoff from the new improvements can be adequately mitigated by the usage of the proposed retention/detention areas. No significant impact to downstream properties is anticipated as a result of this project.

Attachments

Basin A

- Table 1: Time of Concentration
- Table 2: Qpre and Qpost
- Table 3: Detention Calculation
- Table 4: Orifice Design

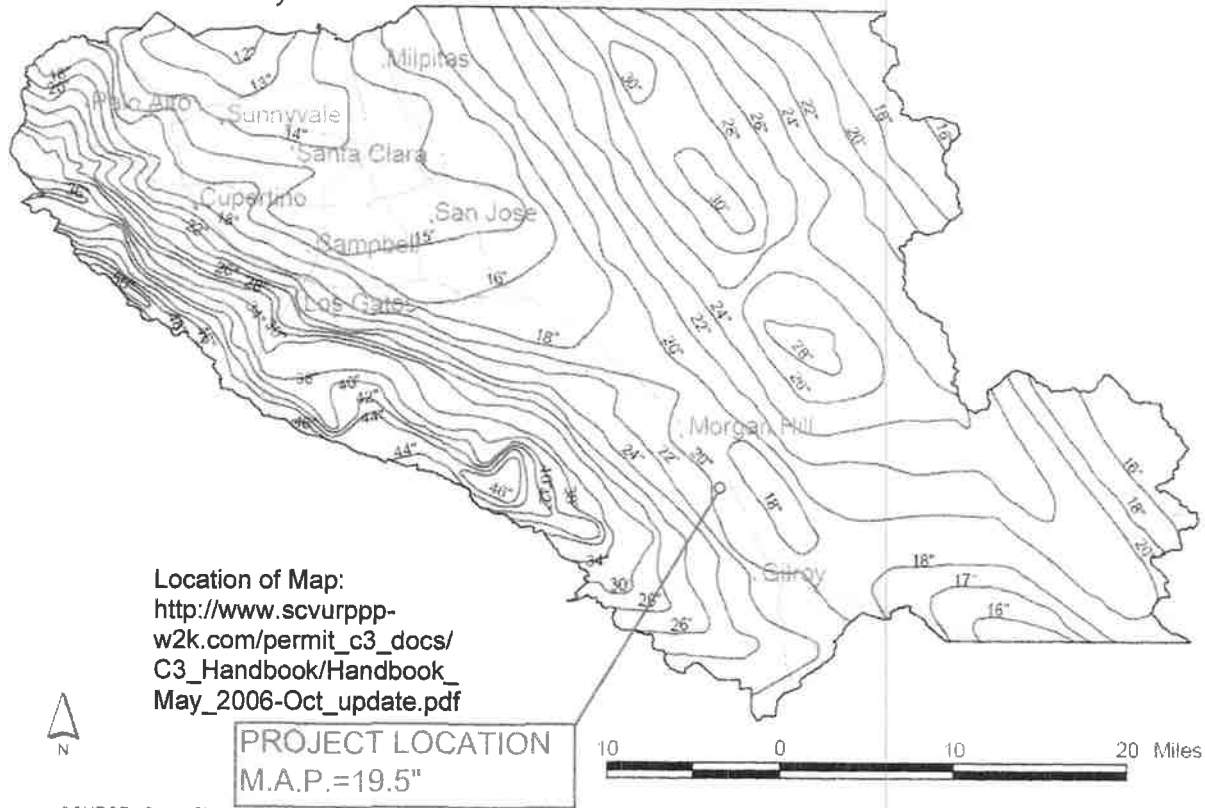
Basin B

- Table 5: Time of Concentration
- Table 6: Qpre and Qpost
- Table 7: Detention Calculation

Existing Drainage Map
Proposed Drainage Map



Figure A-2
Mean Annual Precipitation Map
Santa Clara County



Location of Map:
http://www.scvurppp-w2k.com/permit_c3_docs/C3_Handbook/Handbook_May_2006-Oct_update.pdf

SOURCE: Santa Clara Valley Water District. Mean Annual Precipitation Map. San Francisco & Monterey Bay Region 1998

Figure A-2: Mean Annual Precipitation, Santa Clara County

Lands of New Cordoba Center
 Monterey Road
 Santa Clara County, CA
 APN 779-06-02



HYDROLOGY for Drainage Basin A
10-year and 100-year storm event

M.A.P. 19.5
 Hydro Soil: C

Determine PRE Development Runoff Coefficient: C

Feature	Area (sf)	Area (acres)	C	AxC
Pervious	519,800	11.93	0.35	4.18
Permeable Paving	13,000	0.30	0.60	0.18
Impervious	-	-	0.85	-
Totals:	532,800	12.23		4.36

Pre Development $C_{AVERAGE} = 0.36$
 Time of Concentration: **Pre- Tc = 22 mins**

Determine Pre Developed Q for a 10-year and 100-year storm.

	10-year	100-year
Pre- I (in/hr)*=	1.23	1.76
Q Pre Developed (cfs)=	5.34	7.67

Determine POST Development Runoff Coefficient: C

Feature	Area (sf)	Area (acres)	C	AxC
Pervious	380,790	8.74	0.35	3.06
Permeable Paving	25,110	0.58	0.60	0.35
Impervious	126,900	2.91	0.85	2.48
Total	532,800	12.23		5.88

Post Development $C_{AVERAGE} = 0.48$
 Time of Concentration: **Post- Tc = 17 mins**

Determine Post Developed Q for 10-year and 100-year storm.

	10-year	100-year
Post- I (in/hr)*=	1.43	2.05
Q Post Developed (cfs)=	8.40	12.09
ΔQ (cfs)=	3.06	4.42

* from Santa Clara County 2007 Drainage Manual (Fig. B-5: IDF from M.A.P.)

Table 2

Detention Calculation - BASIN A
10-year Storm Event



Q10 Predevelopment = 5.34 cfs
 Release Rate from Orifice Design = 5.34 cfs
 Post Developed Area (acres) = 12.23
 Cpost (Developed Site) = 0.48
 Developed Tc = 17.00 min

Modified Rational Method - Determine Initial Storage (Cubic Feet)

Duration	Intensity I (in/hr)	Q	Runoff Volume	Bottom	Top	Release Volume	Initial Storage
10	1.97	11.59	6951.00	20.00	0.00	3206.26	3745
12	1.76	10.34	7445.43	22.00	2.00	3847.51	3598
15	1.55	9.10	8187.06	25.00	5.00	4809.39	3378
17	1.43	8.40	8567.77	27.00	7.00	5450.64	3117
30	1.04	6.13	11042.36	40.00	20.00	9618.77	1424
60	0.72	4.21	15168.37	70.00	50.00	19237.55	-4069
120	0.53	3.11	22402.69	130.00	110.00	38475.09	-16072
180	0.45	2.65	28607.75	190.00	170.00	57712.64	-29105

Required Storage = **3745** Cubic Feet.

100-year Storm Event

Q100 Predevelopment = 7.67 cfs
 Release Rate from Orifice Design = 7.67 cfs

Modified Rational Method - Determine Initial Storage (Cubic Feet)

Duration	Intensity I (in/hr)	Q	Runoff Volume	Bottom	Top	Release Volume	Initial Storage
10	2.75	16.16	9694.53	20.00	0.00	4599.13	5095
12	2.49	14.63	10534.51	22.00	2.00	5518.96	5016
15	2.23	13.10	11794.47	25.00	5.00	6898.70	4896
17	2.05	12.09	12328.41	27.00	7.00	7818.52	4510
30	1.49	8.78	15799.01	40.00	20.00	13797.39	2002
60	1.00	5.89	21195.93	70.00	50.00	27594.78	-6399
120	0.72	4.23	30463.44	130.00	110.00	55189.57	-24726

Required Storage = **5095** Cubic Feet.

Table 3

Lands of New Cordoba Center
Monterey Road
Santa Clara County, CA
APN 779-06-02



BASIN A
Design Orifice to Discharge Allowable Q

Orifice Equation: $Q = Cd \cdot Ao \cdot (2 \cdot g \cdot h)^{.5}$

Size Orifice for 10 yr storm event:

Q Allowable release: **5.34 cfs** 10-yr Storm Event
 Cd= 0.62
 head, h = 1.50 @ 10 year storage elevation

Orifice Diameter (in)	Area (Ao) (sf)	Q (cfs)
12.68	0.877	5.34

Size Upper orifice for 100 yr storm event:

Q Allowable release: **7.67 cfs** 100-yr Storm Event

Flow through lower orifice:

Cd= 0.62
 head, h = 1.50

Orifice Diameter (in)	Area (Ao) (sf)	Q (cfs)
12.7	0.877	5.34

Flow through upper orifice:

Cd= 0.62
 head, h = 0.50

Orifice Diameter (in)	Area (Ao) (sf)	Q (cfs)
11.00	0.660	2.32

Total Q:

7.67 cfs

Table 4

Lands of New Cordoba Center
 Monterey Road
 Santa Clara County, CA
 APN 779-06-02



BASIN B - Existing Time of Concentration Calculation

Reach	Flow Length	Elevation 1	Elevation 2	Drop	Slope	Ground Cover	Velocity (fps)*	Travel Time (mins)	
1	133	348.0	308.0	40.00	30.1%	SHORT GRASS PASTURE	3.9	0.6	
2	246	308.0	304.0	4.00	1.6%	SHORT GRASS PASTURE	0.8	5.1	
3	212.0	304.0	301.5	2.50	1.2%	NEARLY BARE (roadside ditch)	1.1	3.2	
Total Tc overland:								8.9	

Initial Overland Flow **: 10 mins
 Overland Flow : 9 mins
 Existing Tc : 19 mins

BASIN B - Post-Developed Time of Concentration Calculation

Reach	Flow Length	Elevation 1	Elevation 2	Drop (ft)	Slope	Ground Cover	Velocity (fps)*	Travel Time (mins)	
1	133	348.0	308.0	40.00	30.1%	SHORT GRASS PASTURE	3.9	0.6	
2	413	308.0	302.4	5.60	1.4%	SHORT GRASS PASTURE	0.8	8.6	
3	34	302.4	301.7	0.68	2.0%	PAVED AREA	2.9	0.2	
4	34	301.7	301.5	0.22	0.6%	NEARLY BARE (roadside ditch)	1.2	0.5	
Total Tc overland:								9.8	

Initial Overland Flow **: 10 mins
 Overland Flow : 10 mins
 Proposed Tc : 20 mins

Table 5

* Velocity from Santa Clara Drainage Manual Figure A-1

** Initial Overland flow = 10 minutes, or 5 minutes if only street or parking lot drainage from Drainage Manual Sect. 3.4.2 #1

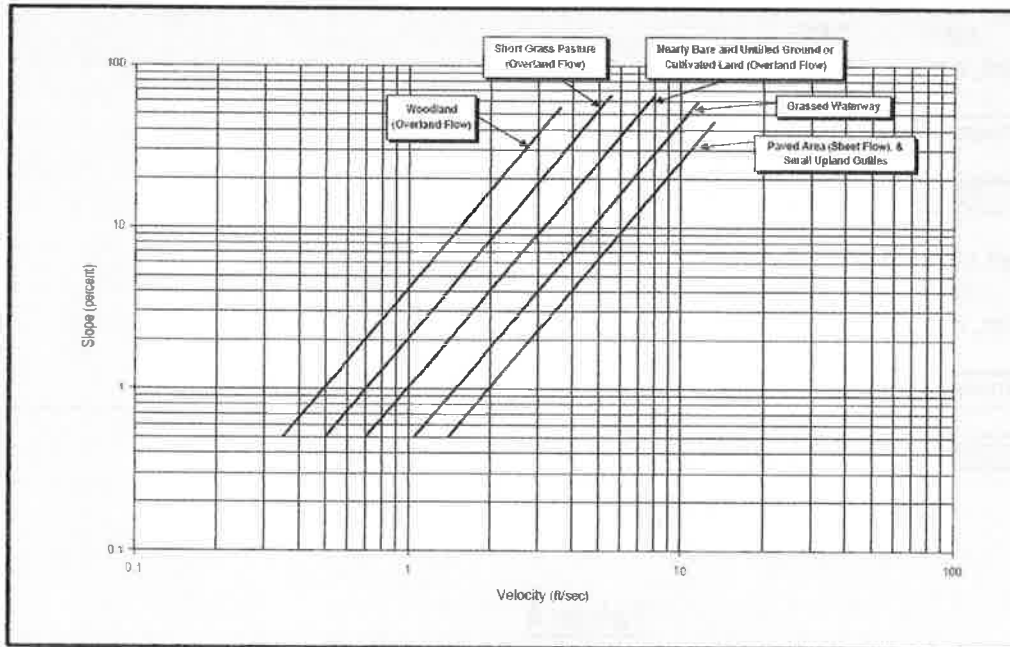


Figure A-1: Overland Flow Velocity

**Lands of New Cordoba Center
 Monterey Road
 Santa Clara County, CA
 APN 779-06-02**



HYDROLOGY for Drainage Basin B
10-year and 100-year storm event

M.A.P. 19.5
 Hydro Soil: B

Determine PRE Development Runoff Coefficient: C

Feature	Area (sf)	Area (acres)	C	AxC
Pervious	61,900	1.42	0.15	0.21
Gravel	1,600	0.04	0.50	0.02
Impervious	-	-	0.85	-
Totals:	63,500	1.46		0.23

Pre Development $C_{AVERAGE} = 0.16$
 Time of Concentration: **Pre- Tc = 19 mins**

Determine Pre Developed Q for a 10-year and 100-year storm.

	10-year	100-year
Pre- I (in/hr)*=	1.33	1.92
Q Pre Developed (cfs)=	0.31	0.44

Determine POST Development Runoff Coefficient: C

Feature	Area (sf)	Area (acres)	C	AxC
Pervious	50,850	1.17	0.15	0.18
Gravel	3,960	0.09	0.50	0.05
Impervious	8,690	0.20	0.85	0.17
Total	63,500	1.46		0.39

Post Development $C_{AVERAGE} = 0.27$
 Time of Concentration: **Post- Tc = 20 mins**

Determine Post Developed Q for 10-year and 100-year storm.

	10-year	100-year
Post- I (in/hr)*=	1.29	1.86
Q Post Developed (cfs)=	0.51	0.73
ΔQ (cfs)=	0.20	0.28

* from Santa Clara County 2007 Drainage Manual (Fig. B-5: IDF from M.A.P.)

Table 6

Detention Calculation - BASIN B
10-year Storm Event



Q10 Predevelopment = 0.31 cfs
 Release Rate from Orifice Design = 0.31 cfs
 Post Developed Area (acres) = 1.46
 Cpost (Developed Site) = 0.27
 Developed Tc = 20.00 min

Modified Rational Method - Determine Initial Storage (Cubic Feet)

Duration	Intensity I (in/hr)	Q	Runoff Volume	Bottom	Top	Release Volume	Initial Storage
10	1.97	0.77	461.05	20.00	0.00	185.39	276
12	1.76	0.69	493.85	22.00	2.00	222.46	271
15	1.55	0.60	543.04	25.00	5.00	278.08	265
20	1.29	0.51	606.17	30.00	10.00	370.77	235
30	1.04	0.41	732.43	40.00	20.00	556.16	176
60	0.72	0.28	1006.10	70.00	50.00	1112.32	-106
120	0.53	0.21	1485.95	130.00	110.00	2224.64	-739
180	0.45	0.18	1897.52	190.00	170.00	3336.97	-1439
360	0.33	0.13	2814.54	370.00	350.00	6673.93	-3859

Required Storage = **276** Cubic Feet.

100-year Storm Event

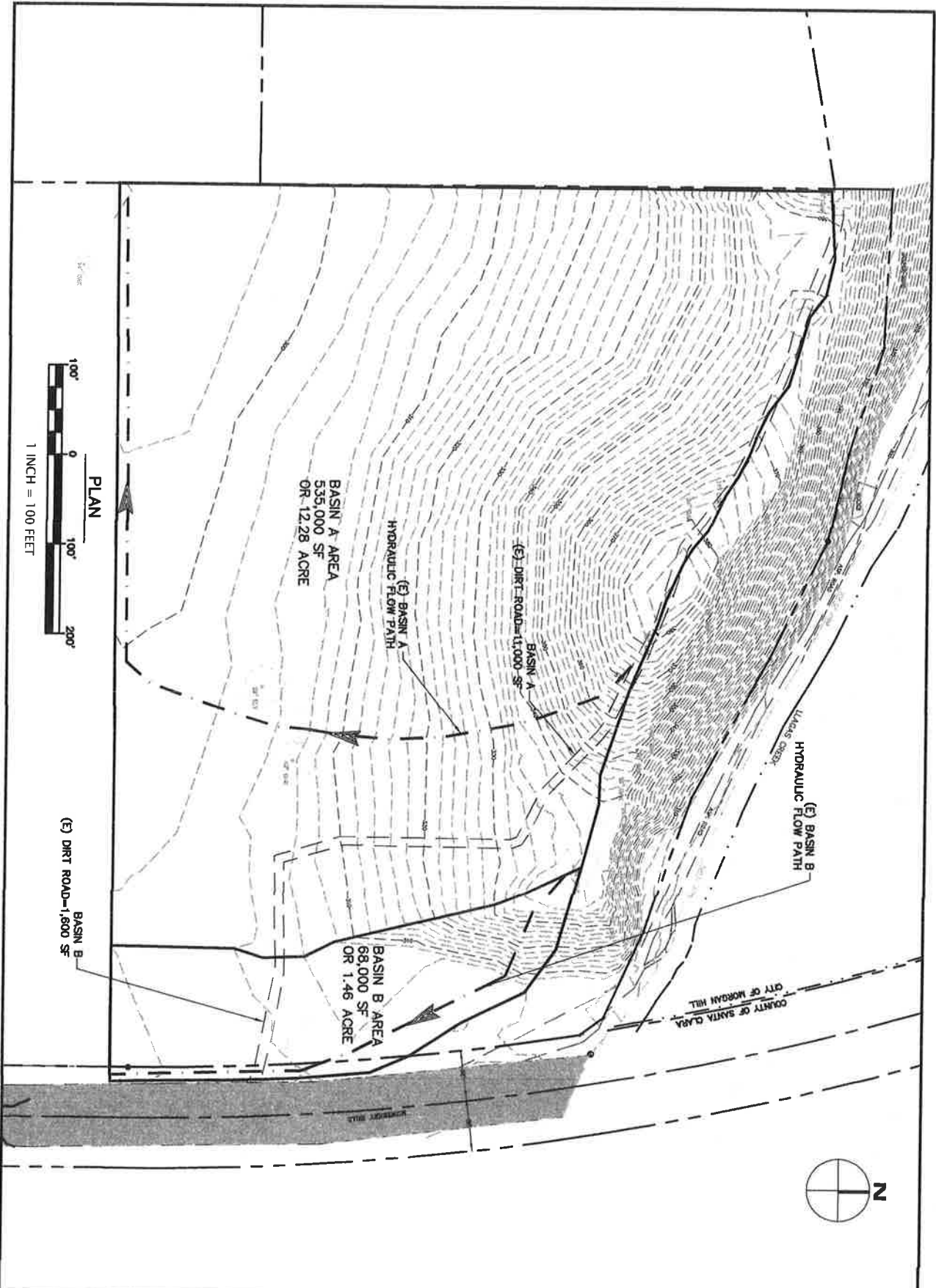
Q100 Predevelopment = 0.44 cfs
 Release Rate from Orifice Design = 0.44 cfs

Modified Rational Method - Determine Initial Storage (Cubic Feet)

Duration	Intensity I (in/hr)	Q	Runoff Volume	Bottom	Top	Release Volume	Initial Storage
10	2.75	1.07	643.03	20.00	0.00	266.47	377
12	2.49	0.97	698.74	22.00	2.00	319.77	379
15	2.23	0.87	782.32	25.00	5.00	399.71	383
20	1.86	0.73	870.86	30.00	10.00	532.94	338
30	1.49	0.58	1047.93	40.00	20.00	799.41	249
60	1.00	0.39	1405.91	70.00	50.00	1598.83	-193
120	0.72	0.28	2020.61	130.00	110.00	3197.66	-1177
180	0.61	0.24	2570.31	190.00	170.00	4796.49	-2226
360	0.46	0.18	3858.35	370.00	350.00	9592.97	-5735

Required Storage = **383** Cubic Feet.

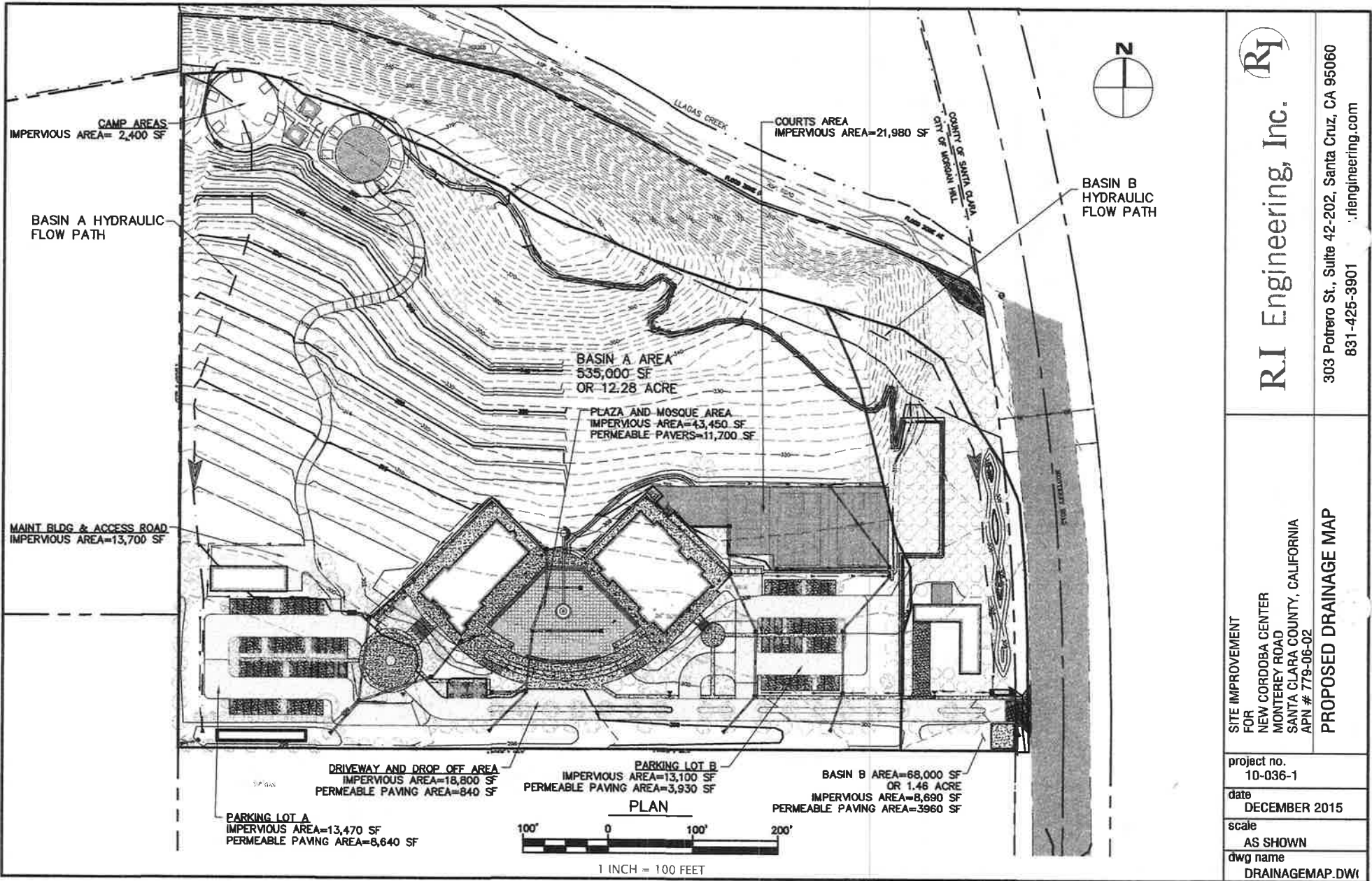
Table 7



SITE IMPROVEMENT
 FOR
 NEW CORDOBA CENTER
 MONTEREY ROAD
 SANTA CLARA COUNTY, CALIFORNIA
 APN # 779-06-02
EXISTING DRAINAGE MAP

R.I Engineering, Inc. 
 303 Potrero St., Suite 42-202, Santa Cruz, CA 95060
 831-425-3000 www.riengineering.com

Project no. 10-036-1
 Date DECEMBER 2015
 Scale AS SHOWN
 Dwg name DRAINAGEMAP DWI



RI Engineering, Inc. 303 Potrero St., Suite 42-202, Santa Cruz, CA 95060 831-425-3901 riengineering.com	
SITE IMPROVEMENT FOR NEW CORDOBA CENTER MONTEREY ROAD SANTA CLARA COUNTY, CALIFORNIA APN # 779-06-02	PROPOSED DRAINAGE MAP
project no. 10-036-1	
date DECEMBER 2015	
scale AS SHOWN	
dwg name DRAINAGEMAP.DWG	