REVISED
DRAINAGE REPORT

for

Sam's Club Albuquerque
Store #4703

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Map Pocket

PURPOSE

The purpose of this report is to prove the development of the subject +/- 11.1 acre property, located at the southeast quadrant of the intersection on NM 528 and the Coors Bypass (for the use as a Sam's Club) is in accordance with the DPM Chapter 22. This report will analyze the existing and proposed conditions and demonstrate the proposed improvements do not adversely effect the surrounding properties, nor the upstream or downstream facilities.

INTRODUCTION

The subject of this report is a +/- 11.1 acre parcel of land located on the southeast quadrant of the intersection of NM 528 Alameda Boulevard and the Coors Bypass. The site is located on Zone Atlas page A-14 and shown on Exhibit A. This site is a portion of the Cottonwood Corners Subdivision. The site is currently being subdivided out of a 28.8 acre parcel bound by Ellison, NM 528, Coors Bypass and Cottonwood Drive. EPC approved the site plan for Subdivision under case Z-99-115. The legal description of the property is proposed to be Tract B-1 of Cottonwood Corners. The site is currently a vacant lot that was rough graded during the development of the Cottonwood Corners Shopping Center. As shown on FIRM map 35001C0108D, the southeast corner of the site lies with flood zone A0 with a depth of one foot, while the remaining site does not lie within any flood hazard zone

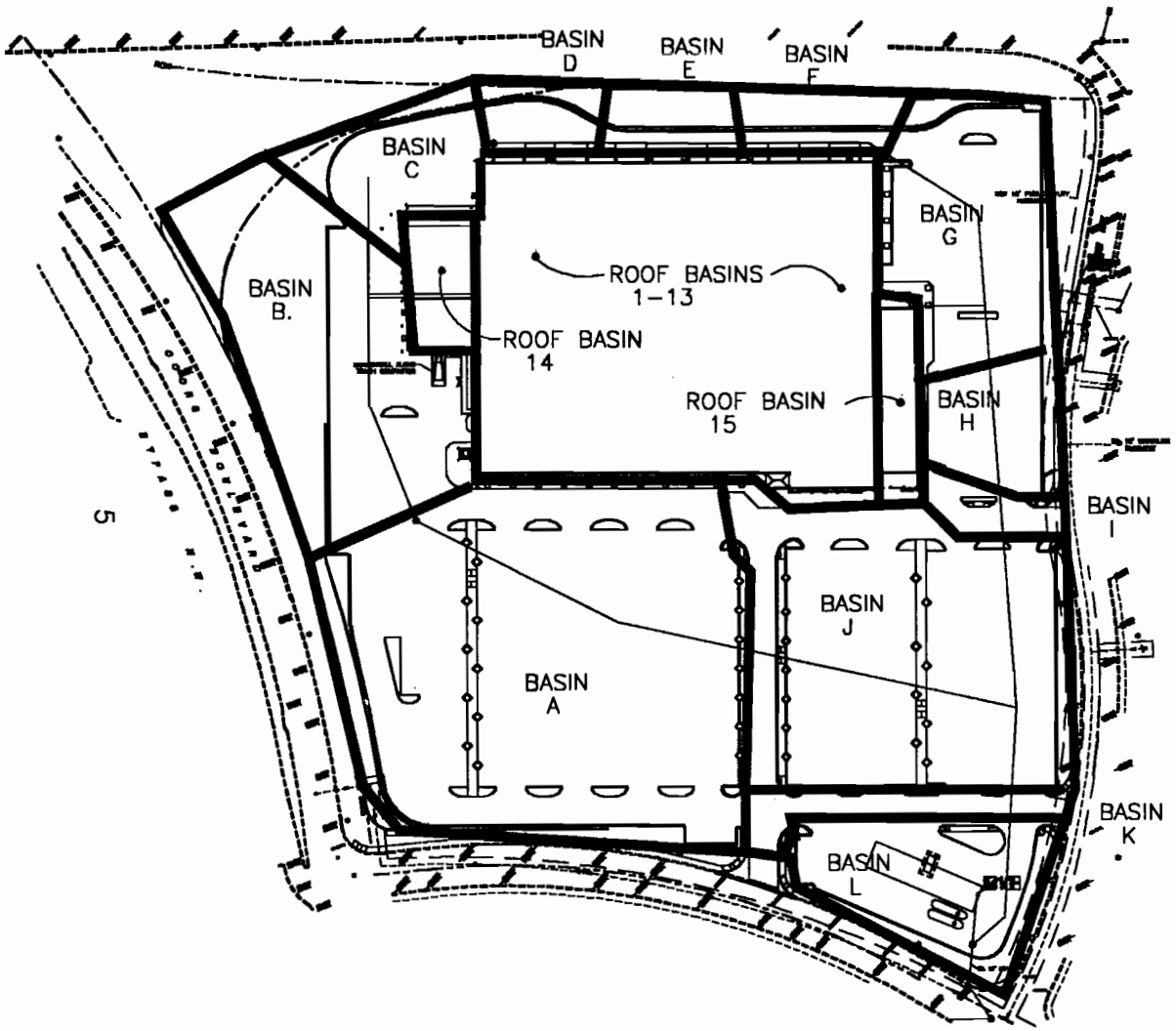
This site hydrology is governed by the Master Drainage Plan for Cottonwood Corners Shopping Center. The Master Drainage Plan was for this subdivision was approved and analyzed within the Hydrology and Hydraulic Report for the Cottonwood Corners shopping center (A14D07), prepared by EKN Engineering, with a stamp date of 2/5/96. Based upon this report the site has an allowable 100-year storm discharge of 6.9 cfs.

EXISTING CONDITIONS

The site slopes from west to east with the general grades between 2-4 % with 3:1 slopes along the western boundary. The site was rough graded and a detention pond exists at the southeast corner of the site where the storm runoff is captured by a single 18" CMP pipe. This outlet pipe has a slope of .4% which limits the discharge to 6.9 CFS. This 18" CMP pipe is connected to the shopping centers existing storm drain system located within the private roadways. This system conveys the developed flow to the northeast and ultimately discharges under NM 528 to the Cabezon Channel. Map Pocket A contains the approved overall drainage management plan for the Center. Due to the existing roadways bounding the site, NM 528 on the north, Coors Bypass on the west, an unnamed private access road to the south and Cottonwood Drive to the east, there are no offsite flows entering the site. The remaining parcel to the south, which is also part of this entire tract, is being developed by others and will require an analysis and drainage management plan to be submitted separately prior to building permit.

PROPOSED CONDITIONS

The proposed improvements consist of a 131,000 square foot commercial building and service station with supporting parking. The storm runoff generated by the site will be collected by multiple type D single grate inlets and routed to the existing 18" CMP located at the southeast corner of the site. The discharge rate leaving the site will be controlled by constructing orifice plates within each of the inlets. The parking lot will contain several detention basins during the 10 and 100 year storm event. As shown on Exhibit B, the site will contain 27 basins, including 15 roof basins. A summary table of the flow rates and discharge rates for these basins are shown in Appendix A. Each basins discharge rate is controlled by a sized orifice plate inserted into each inlet. These plates where designed to have each inlet



DRAINAGE BASIN MAP

pond more than 1 foot of water during the predicted 100-year storm event . A tabular listing of the required orifice sizes are shown in Appendix B. The calculation of pond sizes and orifice discharge rates and the verification of inlet and pipe capacities are also included in Appendix B. The AYHMO Hydrological model program, Appendix C, was used to route each pond and inlet to determine maximum water surface elevations and predicted discharge rates. As shown within the Ahymo output, the site will have a peak discharge of 6.86 CFS during the 100 year storm event.

The site grading plan is located in Map Pocket B. The site was graded so that during emergencies and storm events with magnitudes greater than the predicted 100 year storm, the site will overflow to Cottonwood Drive through the proposed driveway located at the mid point of the site. Since the proposed improvements are to take place within private property no Infrastructure List is required for this project.

SUMMARY AND RECOMMENDATIONS

This site is a tract within an existing subdivision. The site hydrology is governed by the Master Drainage Management Plan for the Cottonwood Corners Shopping Center. This plan was approved with the original site plan for subdivision. The allowable peak 100-year storm event discharge for the site is 6.9 CFS. The Drainage Management Plan for this site in compliance with the governing Master Drainage Plan for the Cottonwood Corners Shopping Center and the DPM, chapter 22. Since this site encompassed more than 5 acres, a NPDES permit is required prior to any construction activity. It is recommended this development be approved for rough grading, Site Plan for Subdivision, Site Plan for Building Permit and Final Plat approval.

Drainage Basins

Proposed

BASIN	AREA (SF)	AREA (AC)	AREA (MI^2)
A	89856.000	2.0628	0.003223
B	67187.000	1.5424	0.002410
C	28250.000	0.6485	0.001013
D	9700.000	0.2227	0.000348
E	13200.000	0.3030	0.000473
F	8125.000	0.1865	0.000291
G	32300.000	0.7415	0.001159
H	17250.000	0.3960	0.000619
I	4675.000	0.1073	0.000168
J	77175.000	1.7717	0.002768
K	11931.000	0.2739	0.000428
L	21750.000	0.4993	0.000780
ROOF 1-13	118149.000	2.7123	0.004238
ROOF 14	9090.000	0.2087	0.000326
ROOF 15	6385.000	0.1466	0.000229
Total	515023.000	11.8233	0.018474

Existing

BASIN	AREA (SF)	AREA (AC)	AREA (MI^2)
1	515023.000	11.8233	0.018474

Land Treatments

Proposed

BASIN	TYPE A	TYPE B	TYPE C	TYPE D
A	0.000	0.05	0.050	0.900
B	0.000	0.10	0.250	0.650
C	0.000	0.15	0.400	0.450
D	0.000	0.10	0.300	0.600
E	0.000	.10	0.550	0.350
F	0.000	0.40	0.100	0.500
G	0.000	0.08	0.000	0.920
H	0.000	0.00	0.000	1.000
I	0.000	0.10	0.000	0.900
J	0.000	0.10	0.050	0.850
K	0.000	0.05	0.000	0.950
L	0.000	0.05	0.100	0.850
ROOF	0.000	0.00	0.000	1.000

Existing

BASIN	TYPE A	TYPE B	TYPE C	TYPE D
1	0.850	0.10	0.050	0.000

Runoff Calculation Results

Proposed

BASIN	Q-100 CFS		V-100 AC-FT	
A	11.710		0.433	
B	6.280		0.222	
C	2.420		0.082	
D	0.900		0.031	
E	1.110		0.036	
F	0.680		0.023	
G	3.360		0.124	
H	1.870		0.698	
I	0.490		0.178	
J	7.770		0.285	
K	1.270		0.047	
L	2.200		0.080	
ROOF 1-13	12.870		0.478	
ROOF 14	0.990		0.037	
ROOF 15	0.700		0.026	
Total	54.620		2.780	

Existing

BASIN	Q-100 CFS		V-100 AC-FT	
1	15.870		0.443	

DROP INLET CALCULATIONS

ORIFICE EQUATION

Q = CA sqrt(2gH)
C = 0.6
g = 32.2

INLET	BASIN	TYPE OF INLET	AREA (SF)	Q (CFS)	H (FT)	H ALLOW (FT)
1	L	Single 'D'	2.30	5.187	0.2194	1
2	J	Single 'D'	2.30	4.386	0.1569	1
3	H	Single 'D'	2.30	1.826	0.0272	1
4	G	Single 'D'	2.30	2.871	0.0672	1
5	F	Single 'D'	2.30	8.615	0.6052	1
6	E	Single 'D'	2.30	3.878	0.1226	1
7	D	Single 'D'	2.30	0.96	0.0075	1
8	A	Single 'D'	2.30	1.124	0.0103	1
9	B	Single 'D'	2.30	2.495	0.0508	1
10	C	Single 'D'	2.30	1.704	0.0237	1

Sample Problem
Pond 1:
H = (Q/CA)^2 / (2g)
H = (5.187/0.6*2.30) ^ 2 / (2*32.2)
H = 0.2194

Depth of Pond = 1', therefore height of water on top of inlet of 0.3487' is okay.

Storm Drain Inlet Grate Capacity

Single 'D'

Area of Grate

Double 'D' Length = 6 ft- 4.75 in
= 6.395833' / 2

Single 'D' Length = 3.20 ft

Width = 2 ft-1.5 in
= 2.125'

Area = 2.125 x 3.20
= 6.80 ft^2

Effective Area of Grate

Length = 38.375" - 7(1/2" $_{\text{middle bars}}$)
= 34.875"
= 2.906'

Width = 25.5" - 13(1/2" $_{\text{middle bars}}$)
= 19"
= 1.583'

Area = 1.583 x 2.906
= 4.601 ft^2

Effective Area = 4.601 - 0.5(4.601) $_{\text{Clogging Factor}}$
= 2.30 ft^2 at the grate

Pipe Capacity

Manning's Equation:

Q = 1.49/n * A * R^(2/3) * S^(1/2)

A = Area

R = D/4

S = Slope

n = 0.013

STORM SEWER SAMS CLUB

Pipe	D	Slope	Area	R	Q Provided	Q Required	Velocity
	(in)	(%)	(ft^2)		(cfs)	(cfs)	(ft/s)
EXST TO IN1	12	8.37	0.79	0.25	10.34	5.19	6.60
IN1 TO IN2	15	1	1.23	0.3125	6.48	4.39	3.57
IN2 TO MH2	18	0.5	1.77	0.375	7.45	4.70	2.66
IN3 TO MH2	12	3.57	0.79	0.25	6.75	1.83	2.32
MH2TO IN4	15	0.5	1.23	0.3125	4.58	2.87	2.34
IN4 TO IN5	18	1	1.77	0.375	10.53	8.62	4.88
IN5 TO IN6	18	0.9	1.77	0.375	9.99	3.88	2.19
IN6 TO IN7	18	0.9	1.77	0.375	9.99	0.96	0.54
IN2 TO IN 8	12	0.98	0.79	0.25	3.54	1.12	1.43
IN8 TO MH4	12	0.5	0.79	0.25	2.53	2.50	3.18
MH4 TO IN 9	12	0.5	0.79	0.25	2.53	2.50	3.18
IN9 TO IN10	12	0.5	0.79	0.25	2.53	1.70	2.17

ORIFACE PLATE TABLE

Proposed

INLET	ORIFACE SIZE (INCHES)
1.000	8.667
2.000	8.750
3.000	5.750
4.000	6.083
5.000	10.833
6.000	7.667
7.000	4.125
8.000	4.000
9.000	6.500
10.000	5.675

VOLUME CALCULATIO

POND 1-BASIN L

Ab - Bottom Of The Pond Surface Area
At - Top Of The Pond Surface Area
D - Water Depth
Dt - Total Pond Depth
C - Change In Surface Area / Water Depth

Volume = Ab * D + 0.5 * C * D^2
C = (At - Ab) / Dt

Ab =	6.80
At =	4,200.00
Dt =	1.00
C =	4193.20

ACTUAL ELEV.	DEPTH (FT)	VOLUME (AC-FT)	Q (CFS)
39.51	0	0	0.0000
46.15	6.64	0.0010	4.9352
46.35	6.84	0.0030	5.0132
46.55	7.04	0.0088	5.0900
46.75	7.24	0.0185	5.1657
46.95	7.44	0.0320	5.2402
47.15	7.64	0.0493	5.3137

Orifice Equation
Q = CA SQRT(2gH)

C =	0.6
Diameter (in	8.66
Area (ft^2)=	0.409038
g =	32.2
H (Ft) =	Depth of water above center of orifice
Q (CFS)=	Flow

VOLUME CALCULATION

POND 2- BASIN J

Ab - Bottom Of The Pond Surface Area
At - Top Of The Pond Surface Area
D - Water Depth
Dt - Total Pond Depth
C - Change In Surface Area / Water Depth

Volume = $Ab * D + 0.5 * C * D^2$
C = (At - Ab) / Dt

Ab =	13.59
At =	11,200.00
Dt =	1.00
C =	11186.41

ACTUAL ELEV.	DEPTH (FT)	VOLUME (AC-FT)	Q (CFS)
41.53	0	0	0.0000
46.00	4.47	0.0014	4.0740
46.20	4.67	0.0066	4.1720
46.40	4.87	0.0221	4.2678
46.60	5.07	0.0478	4.3615
46.80	5.27	0.0838	4.4532
47.00	5.47	0.1301	4.5431

Orifice Equation
Q = CA SQRT(2gH)

C =	0.6
Diameter (in	8.75
Area (ft^2)=	0.417584
g =	32.2
H (Ft) =	Depth of water above center of orifice
Q (CFS)=	Flow

VOLUME CALCULATION

POND 2- BASIN J

Ab - Bottom Of The Pond Surface Area
At - Top Of The Pond Surface Area
D - Water Depth
Dt - Total Pond Depth
C - Change In Surface Area / Water Depth

Volume = Ab * D + 0.5 * C * D^2
C = (At - Ab) / Dt

Ab =	13.59
At =	11,200.00
Dt =	1.00
C =	11186.41

ACTUAL ELEV.	DEPTH (FT)	VOLUME (AC-FT)	Q (CFS)
41.53	0	0	0.0000
46.00	4.47	0.0014	4.5413
46.20	4.67	0.0066	4.6511
46.40	4.87	0.0221	4.7585
46.60	5.07	0.0478	4.8634
46.80	5.27	0.0838	4.9661
47.00	5.47	0.1301	5.0668

Orifice Equation
Q = CA SQRT(2gH)

C =	0.6
Diameter (in	9.25
Area (ft^2)=	0.466671
g =	32.2
H (Ft) =	Depth of water above center of orifice
Q (CFS)=	Flow

VOLUME CALCULATION

POND 3- BASIN H

Ab - Bottom Of The Pond Surface Area
At - Top Of The Pond Surface Area
D - Water Depth
Dt - Total Pond Depth
C - Change In Surface Area / Water Depth

Volume = $Ab * D + 0.5 * C * D^2$
C = (At - Ab) / Dt

Ab =	6.80
At =	135.00
Dt =	0.80
C =	160.25

ACTUAL ELEV.	DEPTH (FT)	VOLUME (AC-FT)	Q (CFS)
44.15	0	0	0.0000
48.67	4.52	0.0007	1.7964
48.87	4.72	0.0008	1.8379
49.07	4.92	0.0011	1.8784
49.27	5.12	0.0015	1.9182
49.47	5.32	0.0020	1.9571
49.67	5.52	0.0027	1.9952

Orifice Equation
Q = CA SQRT(2gH)

C =	0.6
Diameter (in	5.75
Area (ft^2)=	0.180328
g =	32.2
H (Ft) =	Depth of water above center of orifice
Q (CFS)=	Flow

VOLUME CALCULATION

POND 4

Ab - Bottom Of The Pond Surface Area
At - Top Of The Pond Surface Area
D - Water Depth
Dt - Total Pond Depth
C - Change In Surface Area / Water Depth

Volume = Ab * D + 0.5 * C * D^2
C = (At - Ab) / Dt

Ab =	6.80
At =	33,672.00
Dt =	1.00
C =	33665.20

ACTUAL ELEV.	DEPTH (FT)	VOLUME (AC-FT)	Q (CFS)
44.01	0	0	0.0000
52.00	7.99	0.0012	2.7029
52.20	8.19	0.0167	2.7376
52.40	8.39	0.0631	2.7719
52.60	8.59	0.1405	2.8058
52.80	8.79	0.2487	2.8392
53.00	8.99	0.3878	2.8723

Orifice Equation
Q = CA SQRT(2gH)

C =	0.6
Diameter (in	6.083
Area (ft^2)=	0.201819
g =	32.2
H (Ft) =	Depth of water above center of orifice
Q (CFS)=	Flow

VOLUME CALCULATION

POND 5- BASIN F

Ab - Bottom Of The Pond Surface Area
At - Top Of The Pond Surface Area
D - Water Depth
Dt - Total Pond Depth
C - Change In Surface Area / Water Depth

Volume = Ab * D + 0.5 * C * D^2
C = (At - Ab) / Dt

Ab =	6.80
At =	1,750.00
Dt =	1.00
C =	1743.20

ACTUAL ELEV.	DEPTH (FT)	VOLUME (AC-FT)	Q (CFS)
45.37	0	0	0.0000
52.74	7.37	0.0012	8.1064
52.94	7.57	0.0020	8.2228
53.14	7.77	0.0044	8.3375
53.34	7.97	0.0084	8.4506
53.54	8.17	0.0141	8.5623
53.74	8.37	0.0213	8.6725

Orifice Equation
Q = CA SQRT(2gH)

C =	0.6
Diameter (in	10.833
Area (ft^2)=	0.640066
g =	32.2
H (Ft) =	Depth of water above center of orifice
Q (CFS)=	Flow

VOLUME CALCULATION

POND 6-BASIN E

Ab - Bottom Of The Pond Surface Area
At - Top Of The Pond Surface Area
D - Water Depth
Dt - Total Pond Depth
C - Change In Surface Area / Water Depth

Volume = Ab * D + 0.5 * C * D^2
C = (At - Ab) / Dt

Ab =	6.80
At =	3,900.00
Dt =	1.00
C =	3893.20

ACTUAL ELEV.	DEPTH (FT)	VOLUME (AC-FT)	Q (CFS)
47.09	0	0	0.0000
52.74	5.65	0.0009	3.5669
52.94	5.85	0.0027	3.6332
53.14	6.05	0.0081	3.6983
53.34	6.25	0.0171	3.7623
53.54	6.45	0.0296	3.8252
53.74	6.65	0.0457	3.8871

Orifice Equation
Q = CA SQRT(2gH)

C =	0.6
Diameter (in	7.67
Area (ft^2)=	0.320862
g =	32.2
H (Ft) =	Depth of water above center of orifice
Q (CFS)=	Flow

VOLUME CALCULATION

POND 7- BASIN D

Ab - Bottom Of The Pond Surface Area
At - Top Of The Pond Surface Area
D - Water Depth
Dt - Total Pond Depth
C - Change In Surface Area / Water Depth

Volume = Ab * D + 0.5 * C * D^2
C = (At - Ab) / Dt

Ab =	6.80
At =	4,700.00
Dt =	1.00
C =	4693.20

ACTUAL ELEV.	DEPTH (FT)	VOLUME (AC-FT)	Q (CFS)
48.74	0	0	0.0000
52.74	4	0.0006	0.8743
52.94	4.2	0.0028	0.8969
53.14	4.4	0.0093	0.9188
53.34	4.6	0.0201	0.9403
53.54	4.8	0.0352	0.9613
53.74	5	0.0547	0.9819

Orifice Equation
Q = CA SQRT(2gH)

C =	0.6
Diameter (in	4.125
Area (ft^2)=	0.092806
g =	32.2
H (Ft) =	Depth of water above center of orifice
Q (CFS)=	Flow

VOLUME CALCULATION

POND 8- BASIN A

Ab - Bottom Of The Pond Surface Area
At - Top Of The Pond Surface Area
D - Water Depth
Dt - Total Pond Depth
C - Change In Surface Area / Water Depth

Volume = Ab * D + 0.5 * C * D^2
C = (At - Ab) / Dt

Ab =	13.59
At =	61,415.00
Dt =	1.00
C =	61401.41

ACTUAL ELEV.	DEPTH (FT)	VOLUME (AC-FT)	Q (CFS)
45.57	0	0	0.0000
52.00	6.43	0.0020	1.0516
52.20	6.63	0.0303	1.0682
52.40	6.83	0.1149	1.0846
52.60	7.03	0.2559	1.1008
52.80	7.23	0.4533	1.1167
53.00	7.43	0.7071	1.1324

Orifice Equation
Q = CA SQRT(2gH)

C =	0.6
Diameter (in	4
Area (ft^2)=	0.087266
g =	32.2
H (Ft) =	Depth of water above center of orifice
Q (CFS)=	Flow

VOLUME CALCULATION

POND 9- BASIN B

Ab - Bottom Of The Pond Surface Area
At - Top Of The Pond Surface Area
D - Water Depth
Dt - Total Pond Depth
C - Change In Surface Area / Water Depth

Volume = $Ab * D + 0.5 * C * D^2$
C = (At - Ab) / Dt

Ab =	6.80
At =	15,500.00
Dt =	1.00
C =	15493.20

ACTUAL ELEV.	DEPTH (FT)	VOLUME (AC-FT)	Q (CFS)
47.51	0	0	0.0000
52.00	4.49	0.0007	2.2791
52.20	4.69	0.0078	2.3325
52.40	4.89	0.0292	2.3847
52.60	5.09	0.0648	2.4358
52.80	5.29	0.1146	2.4858
53.00	5.49	0.1787	2.5348

Orifice Equation
Q = CA SQRT(2gH)

C =	0.6
Diameter (in	6.5
Area (ft^2)=	0.230438
g =	32.2
H (Ft) =	Depth of water above center of orifice
Q (CFS)=	Flow

VOLUME CALCULATION

POND 10- BASIN C

Ab - Bottom Of The Pond Surface Area
At - Top Of The Pond Surface Area
D - Water Depth
Dt - Total Pond Depth
C - Change In Surface Area / Water Depth

Volume = $Ab * D + 0.5 * C * D^2$
C = (At - Ab) / Dt

Ab =	6.80
At =	7,000.00
Dt =	1.00
C =	5750.00

ACTUAL ELEV.	DEPTH (FT)	VOLUME (AC-FT)	Q (CFS)
48.71	0	0	0.0000
52.71	4	0.0006	1.6408
52.91	4.2	0.0033	1.6838
53.11	4.4	0.0112	1.7258
53.31	4.6	0.0245	1.7667
53.51	4.8	0.0430	1.8068
53.71	5	0.0668	1.8459

Orifice Equation
Q = CA SQRT(2gH)

C =	0.6
Diameter (in	5.675
Area (ft^2)=	0.175654
g =	32.2
H (Ft) =	Depth of water above center of orifice
Q (CFS)=	Flow