HYDROLOGY STUDY

FOR

BONITA CANYON GATEWAY

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DEVELOPMENT SERVICES

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PURPOSE

The purpose of this report is to develop a hydrologic and hydraulic analysis of the proposed conditions, to determine the impact of the 50-year storm event on the proposed project site.

EXISTING SITE DESCRIPTION

The project site is located in the City of San Dimas, County of Los Angeles. It is bordered by a multi-family residential development to the north, condominiums to the west, Bonita Avenue to the south and San Dimas Canyon Road to the east. The site is currently developed and drains southeast to northwest on to existing Puddingstone Reservoir which is tributary to the San Gabriel River.

PROPOSED SITE DESCRIPTION

The proposed development Bonita Canyon Gateway project site is an approximate 8.53-acre parcel located in the City of San Dimas, CA. The project will be a mix used development with a multi-family residential development to the north and a commercial development to the southeast. The on site runoff will be collected by the proposed storm drain system and discharged onto three different CMPs (Corrugated Metal Pipe) located throughout the site and two Earthen-Swales located along the north and northwest corner where it will be treated and convey onto and existing storm drain system located on Dalancey Avenue which then spills onto Puddingstone Reservoir.

HYDROLOGIC METHODOLOGY

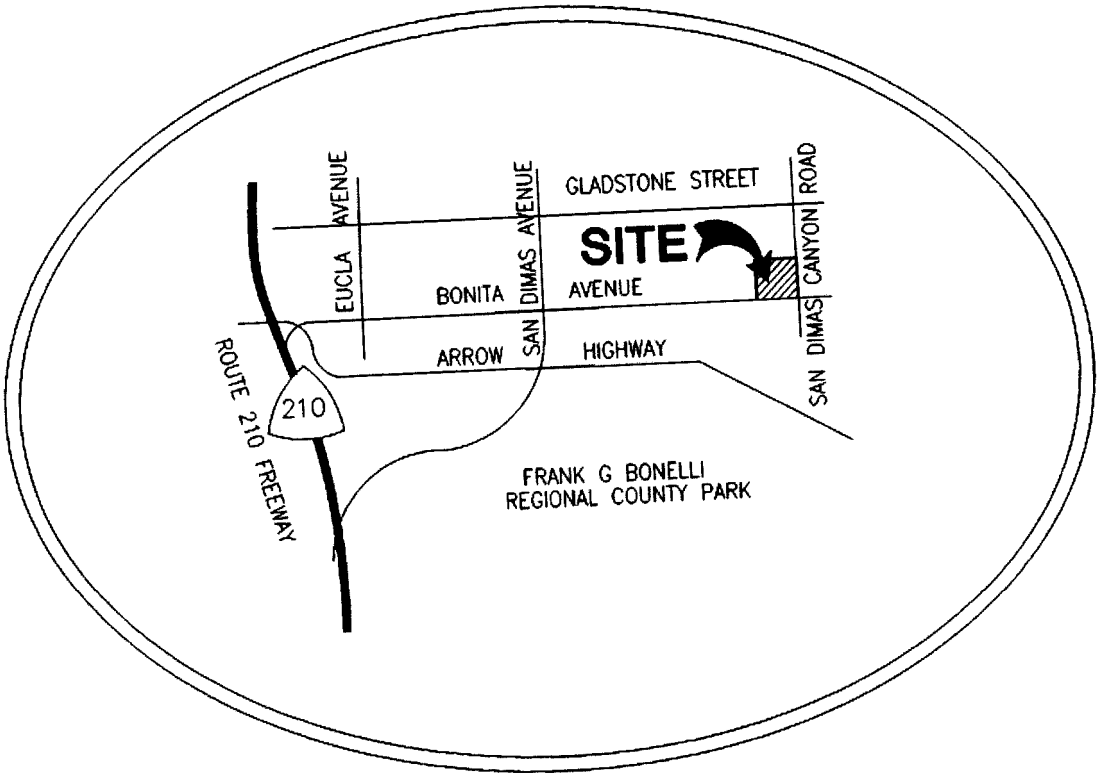
Peak run-off rates were developed using TC-Calculator. Methodology and supportive data for the hydrologic calculations may be found in this report, and in the "Los Angeles County Hydrology Manual", dated January 2006.

RESULTS AND CONCLUSIONS

Based upon our calculations, it has been determined that the proposed storm drain system will successfully mitigate 50-year event and successfully mitigate any potential flooding.

By using the Tc-Calculator, the existing site has yield an estimate onsite runoff of 23.49 cfs, while the proposed site has yield a 4.5% decrease onsite runoff of 21.57 cfs. An estimated 20.2% or 4.39 cfs will flow through earthen-swales be for being discharged on to an existing storm drain system located in the northwest corner of the site. The remaining 79.8% or 17.18 cfs will be conveyed and treated by underground CMPs located throughout the site.

Calculations for all analysis may be found in there respective appendices as listed in the Table of Contents.



VICINITY MAP

NTS

RATIONAL METHOD NODE TABLE:
UNDEVELOPED

FUSCOE ENGINEERING

JOB : 3007.01 BONITA CANYON GATEWAY
CALCULATED BY : JS DATE: 5/14/2009
CHECKED BY : SE DATE: 5/14/2009

DEVELOPED CONDITIONS

Project	Subarea	Area	%imp	Frequency	Soil Type	Length	Slope	Isohyet	Fire Factor
Bonita Canyon Gateway	1ex	8.53	0.95	50	13	910	0.0071	7.2	0

TC-CALCULATOR:
EXISTING CONDITIONS (Q_{50})

EXISTING CONDITIONS

Project	Subarea	Area (acres)	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.)	Tc-calculated (min.)	Intensity (in./hr)	Cu	Cd	Flow rate (cfs)	Tc Equation	Fire Factor	Burned flow rate (cfs)	Volume (acre-ft)
Bonita Canyon Gateway	Tex	8.53	0.95	50	13	910	0.0071	7.2	10	2.1	0.9	0.9	23.8	Tc=(10)^0.507*(Cd)^0.519*(L)^0.483*(S)^-0.135	0	n/a	4.39
												Total Flow=	23.8			Total Volume=	4.39

RATIONAL METHOD NODE TABLE: DEVELOPED

FUSCOE ENGINEERING

JOB : 3007.01 BONITA CANYON GATEWAY
CALCULATED BY : JS DATE: 5/14/2009
CHECKED BY : SE DATE: 5/14/2009

DEVELOPED CONDITIONS

Project	Subarea	Area	%imp	Frequency	Soil Type	Length	Slope	Isohyet	Fire Factor
Bonita Canyon Gateway	1a	0.36	0.95	50	13	113	0.0363	7.2	0
Bonita Canyon Gateway	2a	0.19	0.95	50	13	42	0.0667	7.2	0
Bonita Canyon Gateway	3a	0.14	0.95	50	13	69	0.0667	7.2	0
Bonita Canyon Gateway	4a	0.31	0.95	50	13	115	0.0465	7.2	0
Bonita Canyon Gateway	5a	0.3	0.95	50	13	105	0.0382	7.2	0
Bonita Canyon Gateway	6a	0.26	0.95	50	13	125	0.0400	7.2	0
Bonita Canyon Gateway	7a	0.31	0.95	50	13	36	0.0778	7.2	0
Bonita Canyon Gateway	8a	0.22	0.95	50	13	168	0.0399	7.2	0
Bonita Canyon Gateway	9a	0.32	0.95	50	13	25	0.0912	7.2	0
Bonita Canyon Gateway	10a	0.09	0.95	50	13	33	0.1061	7.2	0
Bonita Canyon Gateway	11a	0.38	0.95	50	13	30	0.0690	7.2	0
Bonita Canyon Gateway	12a	0.47	0.95	50	13	374	0.0217	7.2	0
Bonita Canyon Gateway	13a	0.29	0.95	50	13	214	0.0189	7.2	0
Bonita Canyon Gateway	14a	0.29	0.95	50	13	66	0.0955	7.2	0
Bonita Canyon Gateway	15a	0.84	0.95	50	13	226	0.0185	7.2	0
Bonita Canyon Gateway	16a	1.04	0.95	50	13	356	0.0133	7.2	0
Bonita Canyon Gateway	17a	0.61	0.95	50	13	30	0.0833	7.2	0
Bonita Canyon Gateway	18a	0.63	0.95	50	13	197	0.0157	7.2	0
Bonita Canyon Gateway	19a	0.32	0.95	50	13	104	0.0250	7.2	0
Bonita Canyon Gateway	20a	0.48	0.95	50	13	318	0.0167	7.2	0
Bonita Canyon Gateway	21a	0.06	0.95	50	13	21	0.0086	7.2	0
Bonita Canyon Gateway	22a	0.47	0.1	50	13	70	0.1154	7.2	0
Bonita Canyon Gateway	23a	0.15	0.1	50	13	42	0.1976	7.2	0

TC-CALCULATOR:
PROPOSED CONDITIONS (Q_{50})

DEVELOPED CONDITIONS

Project	Subarea	Area (acres)	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.)	Tc-calculated (min)	Intensity (in./hr)	Cu	Cd	Flow rate (cfs)	Tc Equation	Fire Factor	Burned flow rate (cfs)	Volume (acre-ft)
Bonita Canyon Gateway	1a	0.36	0.95	50	13	113	0.0363	7.2	5	4.3	0.9	0.9	1.39	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.19
Bonita Canyon Gateway	2a	0.19	0.95	50	13	42	0.0667	7.2	5	4.3	0.9	0.9	0.74	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.1
Bonita Canyon Gateway	3a	0.14	0.95	50	13	69	0.0667	7.2	5	4.3	0.9	0.9	0.54	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.07
Bonita Canyon Gateway	4a	0.31	0.95	50	13	115	0.0455	7.2	5	4.3	0.9	0.9	1.2	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.16
Bonita Canyon Gateway	5a	0.3	0.95	50	13	165	0.0382	7.2	5	4.3	0.9	0.9	1.16	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.15
Bonita Canyon Gateway	6a	0.26	0.95	50	13	125	0.04	7.2	5	4.3	0.9	0.9	1.01	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.13
Bonita Canyon Gateway	7a	0.31	0.95	50	13	36	0.0778	7.2	5	4.3	0.9	0.9	1.2	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.16
Bonita Canyon Gateway	8a	0.22	0.95	50	13	168	0.0399	7.2	5	4.3	0.9	0.9	0.85	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.11
Bonita Canyon Gateway	9a	0.32	0.95	50	13	25	0.0912	7.2	5	4.3	0.9	0.9	1.24	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.16
Bonita Canyon Gateway	10a	0.09	0.95	50	13	33	0.1061	7.2	5	4.3	0.9	0.9	0.35	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.05
Bonita Canyon Gateway	11a	0.38	0.95	50	13	30	0.069	7.2	5	4.3	0.9	0.9	1.47	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.2
Bonita Canyon Gateway	12a	0.47	0.95	50	13	374	0.0217	7.2	5	4.3	0.9	0.9	1.82	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.24
Bonita Canyon Gateway	13a	0.29	0.95	50	13	214	0.0189	7.2	5	4.3	0.9	0.9	1.12	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.15
Bonita Canyon Gateway	14a	0.29	0.95	50	13	66	0.0955	7.2	5	4.3	0.9	0.9	1.12	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.15
Bonita Canyon Gateway	15a	0.84	0.95	50	13	226	0.0185	7.2	5	4.3	0.9	0.9	3.25	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.43
Bonita Canyon Gateway	16a	1.04	0.95	50	13	356	0.0133	7.2	5	4.3	0.9	0.9	4.02	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.54
Bonita Canyon Gateway	17a	0.61	0.95	50	13	30	0.0833	7.2	5	4.3	0.9	0.9	2.36	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.31
Bonita Canyon Gateway	18a	0.63	0.95	50	13	197	0.0167	7.2	5	4.3	0.9	0.9	2.44	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.32
Bonita Canyon Gateway	19a	0.32	0.95	50	13	104	0.005	7.2	5	4.3	0.9	0.9	1.24	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.16
Bonita Canyon Gateway	20a	0.48	0.95	50	13	318	0.0167	7.2	5	4.3	0.9	0.9	1.86	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.25
Bonita Canyon Gateway	21a	0.06	0.95	50	13	21	0.0606	7.2	5	4.3	0.9	0.9	0.23	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	n/a	0.03
Bonita Canyon Gateway	22a	0.47	0.1	50	13	70	0.1154	7.2	5	4.3	0.9	0.9	1.82	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	1.82	0.08
Bonita Canyon Gateway	23a	0.16	0.1	50	13	42	0.1976	7.2	5	4.3	0.9	0.9	0.58	Tc=(10)^0.507*(Cd)^-0.519*(L)*0.483*(S)^-0.135	0	0.58	0.02
											Total Flow=		33.91			Total Volume=	4.16

SUSMP APPENDIX 3:
CMP V_{BMP} CALCULATION

APPENDIX 3

VOLUME FLOW RATE CALCULATIONS

PROVIDE PROPOSED PROJECT CHARACTERISTICS

A_{Total} - CMP 1	3.44	Acres
Type of Development	MIX-USE	
Predominant Soil Type#	13	
% of Project Impervious	90.00%	
% of Project Pervious	10.00%	
% of Project Contributing	0.00%	
A_I	3.096	Acres
A_P	0.344	Acres
A_U	0	Acres

APPENDIX 3 VOLUME FLOW RATE CALCULATIONS

CALCULATION STEPS

1. Assume and initial T_c Value between 5 and 30 Minutes

T_c = 5 minutes

2. Using Table 1, look up the assumed T_c Value and select the corresponding I_x intensity in in,

I_x = 0.447 in/hr

3. Determine the value for the Undeveloped Runoff Coefficient, C_u using the Runoff Coefficient Curve corresponding to the predominant soil type.

C_u = 0.1

4. Calculate the Developed Runoff Coefficient, $C_D = (0.9*Imp)+(1.0- Imp)*C_u$

C_D = **0.82**

5. Calculate the Value for $C_D * I_x$

$C_D * I_x$ = **0.36654**

6. Calculate the time of concentration, $Tc = 10^{-0.507} * (C_D * I_x)^{-0.519} * Length^{0.483} * Slope^{-0.135}$

Length = 608 ft
Slope = 0.004 ft/ft

Tc = 24.41 min

7. Calculate the difference between the initially assumed Tc and the calculated Tc, if the difference is greater than 0.5 min. Use the Calculated Tc as the assumed initial Tc in the second iteration. If the Tc value is within 0.5 min, round the acceptable Tc value to the nearest minute.

8. Calculate the Peak Mitigation Flow Rate,
$Q_{PM}= C_D * I_x * A_{total} *$(1.008333 ft3-hour/acre-inches seconds)

C_D = **0.908**
I_x = **0.98**
A_{Total} = **3.44** Acres

Q_{PM} = 3.09 CFS

VOLUME CALCULATION

$V_M = (2722.5\ ft^3/acre) * [(A_i)(0.9)+(A_p+A_u)*(C_u)]$

V_M = 7679.6 ft^3

APPENDIX 3

VOLUME FLOW RATE CALCULATIONS

TABLE FOR ITERATIONS

Iteration No.	Initial Tc (min)	I_x (in/hr)	C_U	C_D	$C_D * I_X$	Calculated T_c (min)	Difference (min)
1	5	0.447	0.1	**0.82**	**0.36654**	**24.41**	**19.41**
2	24.41	0.212	0.1	**0.82**	**0.174135**	**35.92**	**11.51**
3	30	0.193	0.98	**0.908**	**0.175244**	**35.80**	**5.80**
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							

Tc = **30.00** **min**

C_D = **0.908**

I_x = **0.98**

*NOTE: Iteration exceeds max Tc of 30 minutes allowed, therefore values for Tc=30min will be used

APPENDIX 3

VOLUME FLOW RATE CALCULATIONS

PROVIDE PROPOSED PROJECT CHARACTERISTICS

A_{Total} - CMP 2	2.09	Acres
Type of Development	MIX-USE	
Predominant Soil Type#	13	
% of Project Impervious	90.00%	
% of Project Pervious	10.00%	
% of Project Contributing	0.00%	
A_I	1.881	Acres
A_P	0.209	Acres
A_U	0	Acres

APPENDIX 3 VOLUME FLOW RATE CALCULATIONS

CALCULATION STEPS

1. Assume and initial T_c Value between 5 and 30 Minutes

T_c = 5 minutes

2. Using Table 1, look up the assumed T_c Value and select the corresponding I_x intensity in in,

I_x = 0.447 in/hr

3. Determine the value for the Undeveloped Runoff Coefficient, C_u using the Runoff Coefficient Curve corresponding to the predominant soil type.

C_u = 0.1

4. Calculate the Developed Runoff Coefficient, $C_D = (0.9*Imp)+(1.0- Imp)*C_u$

C_D = **0.82**

5. Calculate the Value for $C_D * I_x$

$C_D * I_x$ = **0.36654**

6. Calculate the time of concentration, $Tc = 10^{-0.507} * (C_D * I_x)^{-0.519} * Length^{0.483} * Slope^{-0.135}$

Length = 583 ft
Slope = 0.004 ft/ft

Tc = 23.92 min

7. Calculate the difference between the initially assumed Tc and the calculated Tc, if the difference is greater than 0.5 min. Use the Calculated Tc as the assumed initial Tc in the second iteration. If the Tc value is within 0.5 min, round the acceptable Tc value to the nearest minute.

8. Calculate the Peak Mitigation Flow Rate,
$Q_{PM}= C_D * I_x * A_{total} *$(1.008333 ft3-hour/acre-inches seconds)

C_D = **0.908**
I_x = **0.98**
A_{Total} = **2.09** Acres

Q_{PM} = 1.88 CFS

VOLUME CALCULATION

$V_M = (2722.5\ ft^3/acre) * [(A_i)(0.9)+(A_p+A_u)*(C_u)]$

V_M = 4665.8 ft^3

TABLE FOR ITERATIONS

Iteration No.	Initial Tc (min)	I_x (in/hr)	C_U	C_D	$C_D * I_X$	Calculated T_c (min)	Difference (min)
1	5	0.447	0.1	**0.82**	**0.36654**	**23.92**	**18.92**
2	23.92	0.214	0.1	**0.82**	**0.175742**	**35.03**	**11.11**
3	30	0.193	0.98	**0.908**	**0.175244**	**35.08**	**5.08**
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							

Tc = **30.00** **min**

C_D = **0.908**

I_x = **0.98**

*NOTE: Iteration exceeds max Tc of 30 minutes allowed, therefore values for Tc=30min will be used

APPENDIX 3 VOLUME FLOW RATE CALCULATIONS

PROVIDE PROPOSED PROJECT CHARACTERISTICS

A_{Total} - CMP 3	1.26	Acres
Type of Development	MIX-USE	
Predominant Soil Type#	13	
% of Project Impervious	90.00%	
% of Project Pervious	10.00%	
% of Project Contributing	0.00%	
A_I	1.134	Acres
A_P	0.126	Acres
A_U	0	Acres

APPENDIX 3 VOLUME FLOW RATE CALCULATIONS

CALCULATION STEPS

1. Assume and initial T_c Value between 5 and 30 Minutes

T_c = 5 minutes

2. Using Table 1, look up the assumed T_c Value and select the corresponding I_x intensity in in,

I_x = 0.447 in/hr

3. Determine the value for the Undeveloped Runoff Coefficient, C_u using the Runoff Coefficient Curve corresponding to the predominant soil type.

C_u = 0.1

4. Calculate the Developed Runoff Coefficient, $C_D = (0.9*Imp)+(1.0- Imp)*C_u$

C_D = **0.82**

5. Calculate the Value for $C_D * I_x$

$C_D * I_x$ = **0.36654**

6. Calculate the time of concentration, $Tc = 10^{-0.507} * (C_D * I_x)^{-0.519} * Length^{0.483} * Slope^{-0.135}$

Length = 528 ft
Slope = 0.004 ft/ft

Tc = 22.80 min

7. Calculate the difference between the initially assumed Tc and the calculated Tc, if the difference is greater than 0.5 min. Use the Calculated Tc as the assumed initial Tc in the second iteration. If the Tc value is within 0.5 min, round the acceptable Tc value to the nearest minute.

8. Calculate the Peak Mitigation Flow Rate,
$Q_{PM} = C_D * I_x * A_{total} *$(1.008333 ft3-hour/acre-inches seconds)

C_D = **0.82**
I_x = **0.193**
A_{Total} = **1.26** Acres

Q_{PM} = 0.20 CFS

VOLUME CALCULATION

$V_M = (2722.5\ ft^3/acre) * [(A_i)(0.9)+(A_p+A_u)*(C_u)]$

V_M = 2812.9 ft^3

TABLE FOR ITERATIONS

Iteration No.	Initial Tc (min)	I_x (in/hr)	C_U	C_D	$C_D * I_X$	Calculated T_c (min)	Difference (min)
1	5	0.447	0.1	**0.82**	**0.36654**	**22.80**	**17.80**
2	22.80	0.219	0.1	**0.82**	**0.17958**	**33.02**	**10.22**
3	30.00	0.193	0.1	**0.82**	**0.15826**	**35.26**	**5.26**
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							

Tc = 30.00 min

C_D = 0.82

I_x = 0.193

*NOTE: Iteration exceeds max Tc of 30 minutes allowed, therefore values for Tc=30min will be used

APPENDIX 3 VOLUME FLOW RATE CALCULATIONS

PROVIDE PROPOSED PROJECT CHARACTERISTICS

A_{Total} - Basin 1	1.01	Acres
Type of Development	MIX-USE	
Predominant Soil Type#	13	
% of Project Impervious	85.00%	
% of Project Pervious	15.00%	
% of Project Contributing	0.00%	
A_I	0.8585	Acres
A_P	0.1515	Acres
A_U	0	Acres

APPENDIX 3 VOLUME FLOW RATE CALCULATIONS

CALCULATION STEPS

1. Assume and initial T_c Value between 5 and 30 Minutes

T_c = 5 minutes

2. Using Table 1, look up the assumed T_c Value and select the corresponding I_x intensity in in,

I_x = 0.447 in/hr

3. Determine the value for the Undeveloped Runoff Coefficient, C_u using the Runoff Coefficient Curve corresponding to the predominant soil type.

C_u = 0.1

4. Calculate the Developed Runoff Coefficient, $C_D = (0.9*Imp)+(1.0- Imp)*C_u$

C_D = **0.78**

5. Calculate the Value for $C_D * I_x$

$C_D * I_x$ = **0.34866**

6. Calculate the time of concentration, $Tc = 10^{-0.507} * (C_D * I_x)^{-0.519} * Length^{0.483} * Slope^{-0.135}$

Length = 621 ft
Slope = 0.015 ft/ft

Tc = 21.17 min

7. Calculate the difference between the initially assumed Tc and the calculated Tc, if the difference is greater than 0.5 min. Use the Calculated Tc as the assumed initial Tc in the second iteration. If the Tc value is within 0.5 min, round the acceptable Tc value to the nearest minute.

8. Calculate the Peak Mitigation Flow Rate,
$Q_{PM}= C_D * I_x * A_{total} *$(1.008333 ft3-hour/acre-inches seconds)

C_D = **0.908**
I_x = **0.98**
A_{Total} = **1.01** Acres

Q_{PM} = 0.91 CFS

VOLUME CALCULATION

$V_M = (2722.5\ ft^3/acre) * [(A_i)(0.9)+(A_p+A_u)*(C_u)]$

V_M = 2144.8 ft^3

APPENDIX 3

VOLUME FLOW RATE CALCULATIONS

TABLE FOR ITERATIONS

Iteration No.	Initial Tc (min)	I_x (in/hr)	C_U	C_D	$C_D * I_X$	Calculated T_c (min)	Difference (min)
1	5	0.447	0.1	**0.78**	**0.34866**	**21.17**	**16.17**
2	21.17	0.227	0.1	**0.78**	**0.177177**	**30.09**	**8.91**
3	30	0.193	0.98	**0.912**	**0.176016**	**30.19**	**0.19**
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							

Tc = 30.00 min

C_D = 0.908

I_x = 0.98

*NOTE: Iteration exceeds max Tc of 30 minutes allowed, therefore values for Tc=30min will be used

APPENDIX 3

VOLUME FLOW RATE CALCULATIONS

PROVIDE PROPOSED PROJECT CHARACTERISTICS

A_{Total} - Basin 2	0.73	Acres
Type of Development	MIX-USE	
Predominant Soil Type#	13	
% of Project Impervious	85.00%	
% of Project Pervious	15.00%	
% of Project Contributing	0.00%	
A_I	0.6205	Acres
A_P	0.1095	Acres
A_U	0	Acres

APPENDIX 3 VOLUME FLOW RATE CALCULATIONS

CALCULATION STEPS

1. Assume and initial T_c Value between 5 and 30 Minutes

T_c = 5 minutes

2. Using Table 1, look up the assumed T_c Value and select the corresponding I_x intensity in in,

I_x = 0.447 in/hr

3. Determine the value for the Undeveloped Runoff Coefficient, C_u using the Runoff Coefficient Curve corresponding to the predominant soil type.

C_u = 0.1

4. Calculate the Developed Runoff Coefficient, $C_D = (0.9*Imp)+(1.0- Imp)*C_u$

C_D = **0.78**

5. Calculate the Value for $C_D * I_x$

$C_D * I_x$ = **0.34866**

6. Calculate the time of concentration, $Tc = 10^{-0.507} * (C_D * I_x)^{-0.519} * Length^{0.483} * Slope^{-0.135}$

Length = 413 ft
Slope = 0.013 ft/ft

Tc = 17.73 min

7. Calculate the difference between the initially assumed Tc and the calculated Tc, if the difference is greater than 0.5 min. Use the Calculated Tc as the assumed initial Tc in the second iteration. If the Tc value is within 0.5 min, round the acceptable Tc value to the nearest minute.

8. Calculate the Peak Mitigation Flow Rate,
$Q_{PM} = C_D * I_x * A_{total} *$(1.008333 ft3-hour/acre-inches seconds)

C_D = **0.78**
I_x = **0.205**
A_{Total} = **0.73** Acres

Q_{PM} = 0.12 CFS

VOLUME CALCULATION

$V_M = (2722.5\ ft^3/acre) * [(A_i)(0.9)+(A_p+A_u)*(C_u)]$

V_M = 1550.2 ft^3

APPENDIX 3

VOLUME FLOW RATE CALCULATIONS

TABLE FOR ITERATIONS

Iteration No.	Initial Tc (min)	I_x (in/hr)	C_U	C_D	$C_D * I_X$	Calculated T_c (min)	Difference (min)
1	5	0.447	0.1	**0.78**	**0.34866**	**17.73**	**12.73**
2	17.73	0.247	0.1	**0.78**	**0.192574**	**24.12**	**6.40**
3	24.12	0.214	0.1	**0.78**	**0.166546**	**26.01**	**1.89**
4	26.01	0.206	0.1	**0.78**	**0.160657**	**26.50**	**0.49**
5	26.50	0.205	0.1	**0.78**	**0.15951**	**26.60**	**0.10**
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							

Tc = 26.50 min

C_D = 0.78

I_x = 0.205

TABLE 1

INTENSITY - DURATION DATA FOR 0.75-INCHES OF RAINFALL
FOR ALL RAINFALL ZONES

Duration, T_C (min)	Rainfall Intensity, I_X (in/hr)
5	0.447
6	0.411
7	0.382
8	0.359
9	0.339
10	0.323
11	0.309
12	0.297
13	0.286
14	0.276
15	0.267
16	0.259
17	0.252
18	0.245
19	0.239
20	0.233
21	0.228
22	0.223
23	0.218
24	0.214
25	0.210
26	0.206
27	0.203
28	0.199
29	0.196
30	0.193

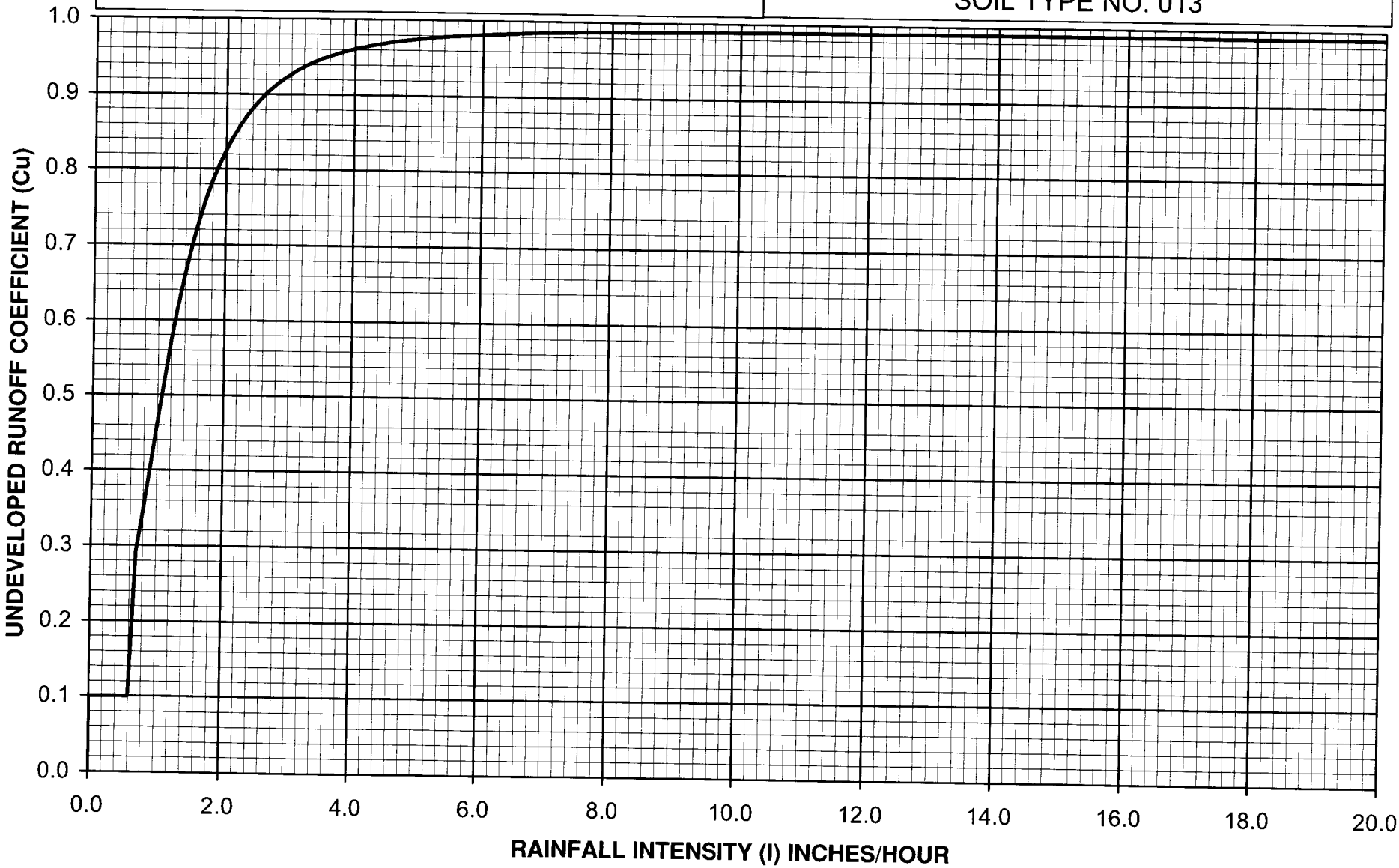
DETERMINING THE VOLUME (V_M)

$C_D = (0.9 * IMP) + (1.0 - IMP) * C_U$

Where: C_D = Developed Runoff Coefficient
IMP = Proportion Impervious
C_U = Undeveloped runoff coefficient

Los Angeles County Department of Public Works

RUNOFF COEFFICIENT CURVE
SOIL TYPE NO. 013



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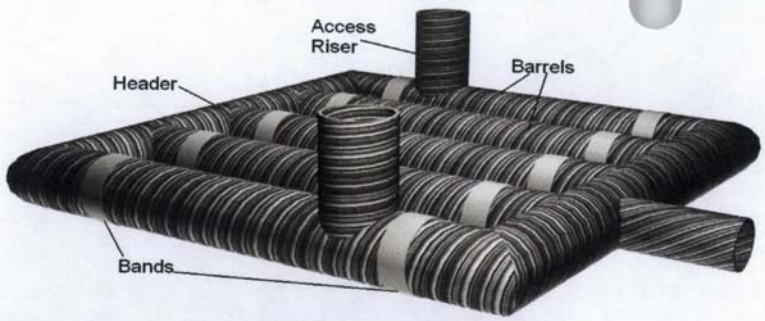


Project Summary

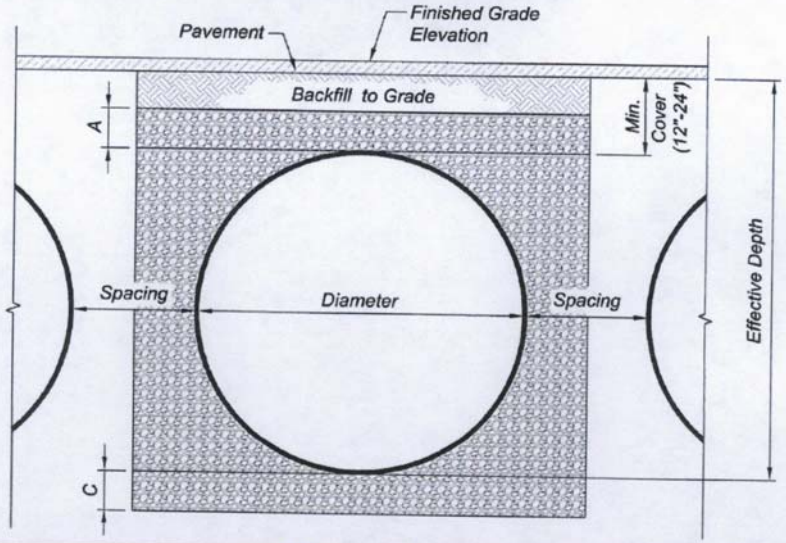
Date:	1/23/2009
Project Name:	Bonita Canyon Gateway-CMP 1
City / County:	San Dimas
State:	CA
Designed By:	Jose Sanchez Jr.
Company:	Fuscoe Engineering Inc
Telephone:	909-581-0676

Enter Information in Blue Cells

Corrugated Metal Pipe Calculator

Storage Volume Required (cf):	7,679
Limiting Width (ft):	30.00
Effective Depth Below Asphalt (ft):	6.00
Solid or Perforated Pipe:	Perforated
Shape Or Diameter:	60
Spacing between Barrels (ft):	2.50
Stone Width Around Perimeter of System (ft):	1.5
Depth A: Porous Stone Above Pipe (in):	12
Depth C: Porous Stone Below Pipe (in):	6
Stone Porosity (0 to 40%):	40

19.63 ft^2 Pipe Area



System Sizing

Use Custom Layout (at right) for layout adjustment

Pipe Storage:	4,712 cf
Porous Stone Storage:	3,078 cf
Total Storage Provided:	7,791 cf
Number of Barrels:	3 barrels
Length Per Barrel:	80.00 ft
Rectangular Footprint (W x L):	23. ft x 83. ft

101.5% Of Required Storage

CONTECH Materials

Total CMP Footage:	240 ft
Approximate Total Pieces:	12 pcs
Approximate Coupling Bands:	9 bands
Approximate Truckloads:	3 trucks

Construction Quantities**

Total Excavation:	425 cy
Porous Stone Backfill For Storage:	285 cy Stone
Backfill to Grade Excluding Stone:	-35 cy Fill

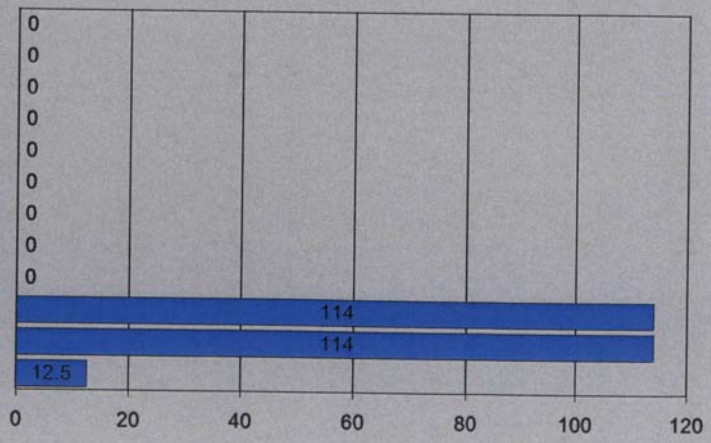
***Construction quantities are approximate and should be verified upon final design*

Custom Layout

To adjust layout, enter desired barrel length in the light blue boxes below.

Excess Footage = 0.5

Barrel 12	0
Barrel 11	0
Barrel 10	0
Barrel 9	0
Barrel 8	0
Barrel 7	0
Barrel 6	0
Barrel 5	0
Barrel 4	0
Barrel 3	114
Barrel 2	114
Barrel 1	12.5



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Project Summary

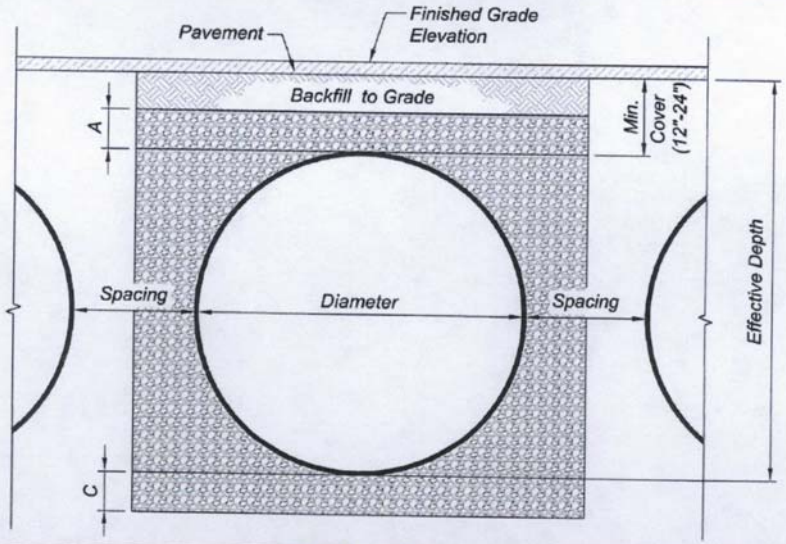
Date:	1/23/2009
Project Name:	Bonita Canyon Gateway-CMP 2
City / County:	San Dimas
State:	CA
Designed By:	Jose Sanchez Jr.
Company:	Fuscoe Engineering Inc
Telephone:	909-581-0676

Enter Information in Blue Cells

Corrugated Metal Pipe Calculator

Storage Volume Required (cf):	4,666
Limiting Width (ft):	30.00
Effective Depth Below Asphalt (ft):	6.00
Solid or Perforated Pipe:	Perforated
Shape Or Diameter:	60
Spacing between Barrels (ft):	2.50
Stone Width Around Perimeter of System (ft):	1.5
Depth A: Porous Stone Above Pipe (in):	12
Depth C: Porous Stone Below Pipe (in):	6
Stone Porosity (0 to 40%):	40

19.63 ft^2 Pipe Area



System Sizing

Use Custom Layout (at right) for layout adjustment

Pipe Storage:	2,886 cf
Porous Stone Storage:	1,955 cf
Total Storage Provided:	4,841 cf
Number of Barrels:	3 barrels
Length Per Barrel:	49.00 ft
Rectangular Footprint (W x L):	23. ft x 52. ft

103.8% Of Required Storage

CONTECH Materials

Total CMP Footage:	147 ft
Approximate Total Pieces:	9 pcs
Approximate Coupling Bands:	6 bands
Approximate Truckloads:	3 trucks

Construction Quantities**

Total Excavation:	266 cy
Porous Stone Backfill For Storage:	181 cy Stone
Backfill to Grade Excluding Stone:	-22 cy Fill

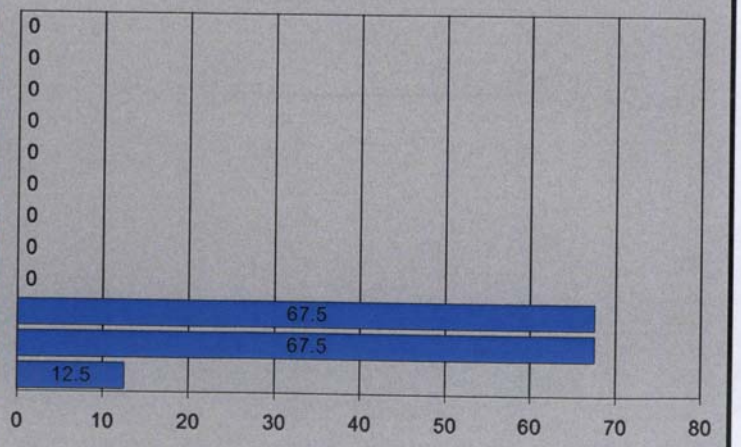
***Construction quantities are approximate and should be verified upon final design*

Custom Layout

To adjust layout, enter desired barrel length in the light blue boxes below.

Excess Footage = 0.5

Barrel 12	0
Barrel 11	0
Barrel 10	0
Barrel 9	0
Barrel 8	0
Barrel 7	0
Barrel 6	0
Barrel 5	0
Barrel 4	0
Barrel 3	67.5
Barrel 2	67.5
Barrel 1	12.5



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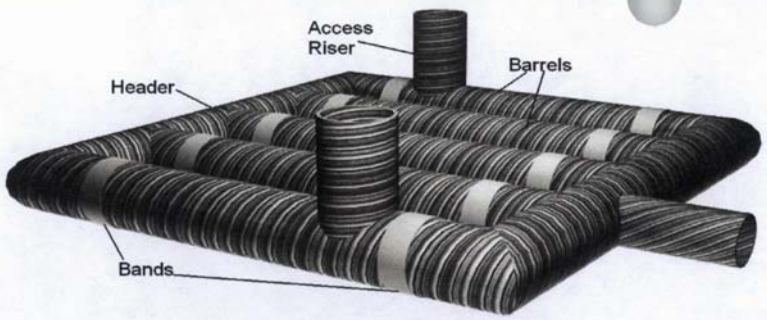


Project Summary

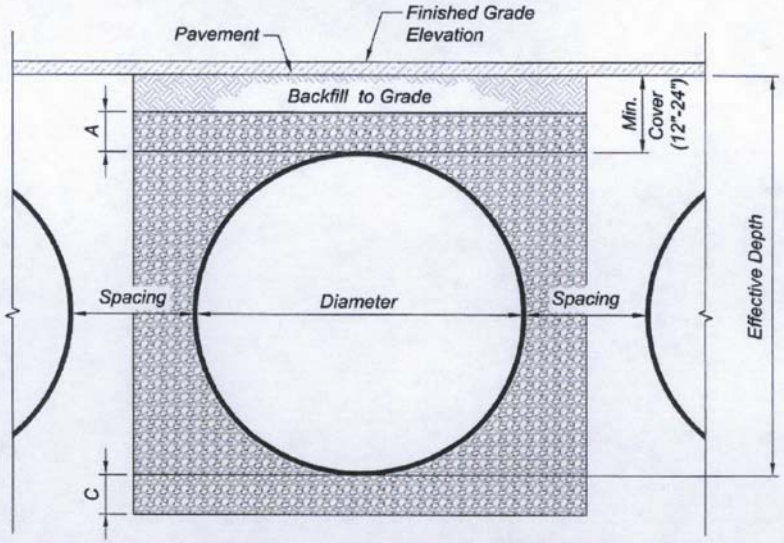
Date:	1/23/2009
Project Name:	Bonita Canyon Gateway-CMP 3
City / County:	San Dimas
State:	CA
Designed By:	Jose Sanchez Jr.
Company:	Fuscoe Engineering Inc
Telephone:	909-581-0676

Enter Information in Blue Cells

Corrugated Metal Pipe Calculator

Storage Volume Required (cf):	2,813
Limiting Width (ft):	30.00
Effective Depth Below Asphalt (ft):	6.00
Solid or Perforated Pipe:	Perforated
Shape Or Diameter:	60
Spacing between Barrels (ft):	2.50
Stone Width Around Perimeter of System (ft):	1.5
Depth A: Porous Stone Above Pipe (in):	12
Depth C: Porous Stone Below Pipe (in):	6
Stone Porosity (0 to 40%):	40

19.63 ft^2 Pipe Area



System Sizing

Use Custom Layout (at right) for layout adjustment

Pipe Storage:	1,708 cf
Porous Stone Storage:	1,230 cf
Total Storage Provided:	2,939 cf
Number of Barrels:	3 barrels
Length Per Barrel:	29.00 ft
Rectangular Footprint (W x L):	23. ft x 32. ft

104.5% Of Required Storage

CONTECH Materials

Total CMP Footage:	87 ft
Approximate Total Pieces:	6 pcs
Approximate Coupling Bands:	3 bands
Approximate Truckloads:	2 trucks

Construction Quantities**

Total Excavation:	164 cy
Porous Stone Backfill For Storage:	114 cy Stone
Backfill to Grade Excluding Stone:	-13 cy Fill

***Construction quantities are approximate and should be verified upon final design*

Custom Layout

To adjust layout, enter desired barrel length in the light blue boxes below.

Excess Footage = 0.5

Barrel 12	0
Barrel 11	0
Barrel 10	0
Barrel 9	0
Barrel 8	0
Barrel 7	0
Barrel 6	0
Barrel 5	0
Barrel 4	22.5
Barrel 3	22.5
Barrel 2	22.5
Barrel 1	20

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HYDROLOGY MAP:
EXISTING 50-YEAR CONDITIONS