

EXAMPLE Stormwater Management Plans w/ CSS BMP Sizing Calculator (v2.1)

The following example Stormwater Management Plans (SMPs) are provided as a reference tool for the Project Team to create clear, legible, and accurate SMPs to help expedite review and approval by SFPUC. It is up to the Project Team to produce an SMP that is customized to clearly communicate their proposed stormwater management approach. SMPs will be recorded on the property title as part of the Maintenance Agreement. NOTE: These examples use the *Combined Sewer System (CSS) BMP Sizing Calculator, Version 2.1* (June 2017).

Example 1: Standard SMR Compliance (25% Retention / 25% Detention)

This example site has one connection to the Combined Sewer System. The stormwater management approach for this example site consists of a lined Flow-Through Planter, Vegetated Roof, Permeable Pavers, and Rainwater Harvesting for use in toilets.

Example 2: Modified SMR Compliance (10% Retention / 40% Detention)

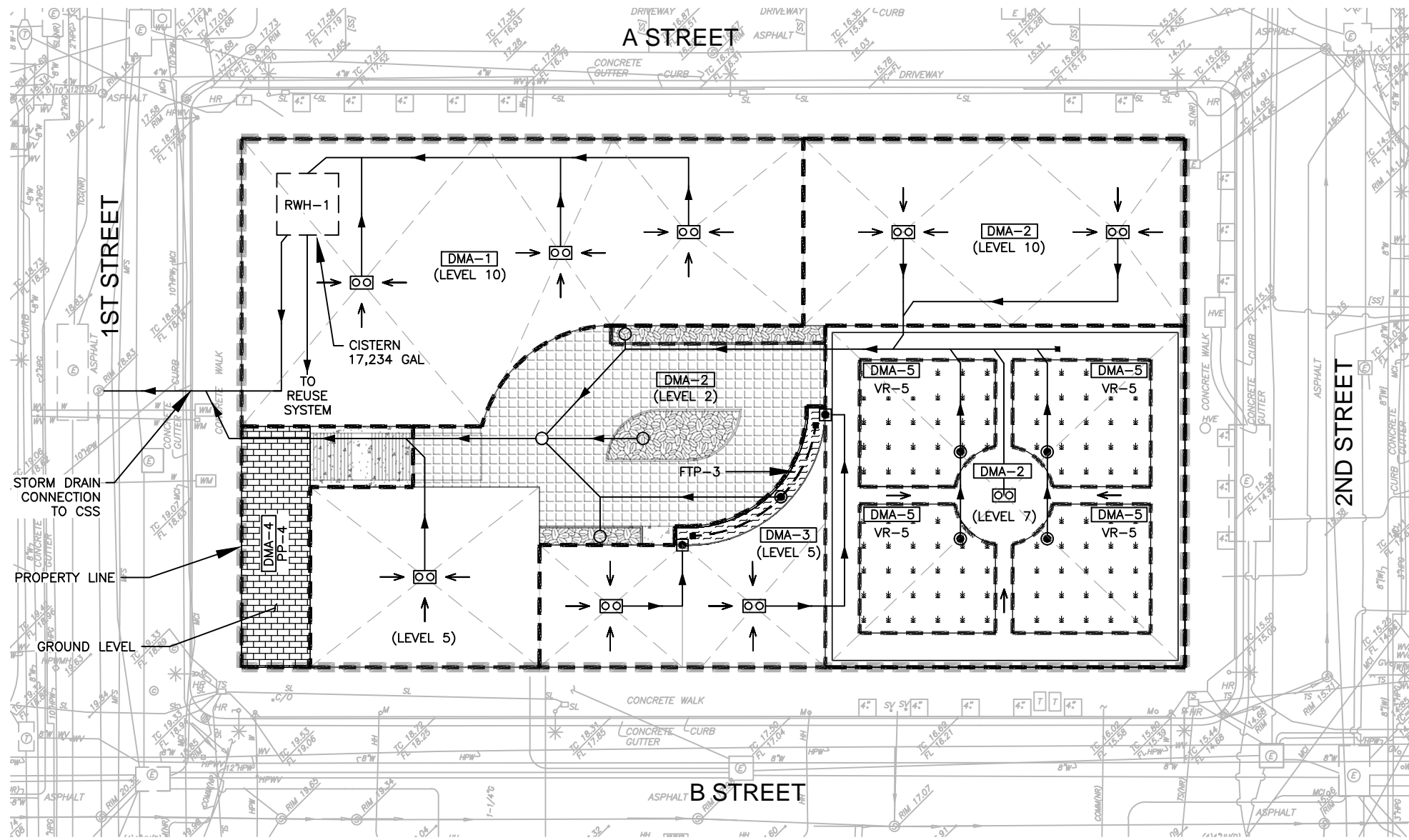
This example site has two separate connections to the Combined Sewer System, thus two sub-watersheds. The stormwater management approach for this example site consists of a Detention Vault, Flow-Through Planters, Vegetated Roof, and on-grade Permeable Pavers.

Example 1: Standard SMR Compliance

- Calculation Summary Table summarizing the stormwater management performance
- SMP 1 (Plan View) & SMP 2 (Details)
- Completed 'CSS BMP Sizing Calculator' and 'Rainwater Harvesting' calculations. (Note: Example 1 calculations can be viewed within the CSS BMP Sizing Calculator V2.1 by activating the Macro Button labeled "Example 1: Sample Calculations")

Calculation Summary Table:

Sub-Watershed	Total Area (sf)	Flow Rate (cfs)			Volume (cf)		
		Existing	Proposed	% Reduction	Existing	Proposed	% Reduction
1	10,444	1.799	0.995	45%	9,256	6,005	35%
REQUIRED % REDUCTION		-	-	25%	-	-	25%



PLAN VIEW

LEGEND SMP DETAIL

- LINED FLOW-THROUGH PLANTER (FTP)
 - PERMEABLE PAVERS ON GRADE (PP)
 - VEGETATED/GREEN ROOF (VR)
 - CISTERN (RWH)
 - ROOF
 - PEDESTAL PAVERS ON PODIUM (PAVEMENT)
 - CONCRETE (PAVEMENT)
 - TRADITIONAL PLANTER
 - SUB WATERSHED BOUNDARY
 - DMA BOUNDARY
 - ROOF SLOPE BREAK LINE
 - SCHEMATIC PIPE WITH FLOW DIRECTION
 - SLOTTED UNDERDRAIN
 - SURFACE FLOW
 - ROOF DRAIN
 - OVER-FLOW DRAIN
 - AREA DRAIN
 - DOWNSPOUT
 - CLEAN-OUT
- SMP-2 A
SMP-2 B
SMP-2 C
SMP-2 D1
SMP-2 D2

THIS EXAMPLE SMP IS FOR REFERENCE ONLY

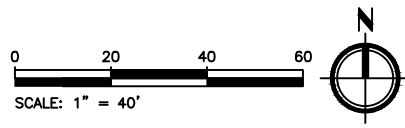
AREA SUMMARY TABLE:

BOUNDARY	BMP-ID	CONVENTIONAL SURFACES (SF)			LID/BMPs (SF)			TOTAL (SF)
		ROOF	PAVEMENT	TRAD. PLANTER	FTP	PP	VR	
DMA-1	RWH-1 *	11,269	-	-	-	-	-	11,269
DMA-2	UNCAPTURED	14,548	4,600	900	-	-	-	20,048
DMA-3	FTP-3	3,313	34	-	311	-	-	3,658
DMA-4	PP-4	-	529	-	-	1,404	-	1,933
DMA-5	VR-5	-	-	-	-	-	5,468	5,468
TOTAL (SF)		29,130	5,163	900	311	1,404	5,468	42,376

* RAINWATER HARVESTING (RWH) FOR REUSE IN TOILETS (17,234 GALLON CISTERN LOCATED LEVEL B1)

CALCULATION SUMMARY TABLE:

	2-YR, 24HR STORM	EXISTING	PROPOSED	%REDUCTION ACHIEVED	%REDUCTION REQUIRED
PEAK FLOW (CFS)		1.799	0.995	45%	25%
VOLUME (FT ³)		9,256	6,005	35%	25%



SMP NOTE:

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PROJECT NAME

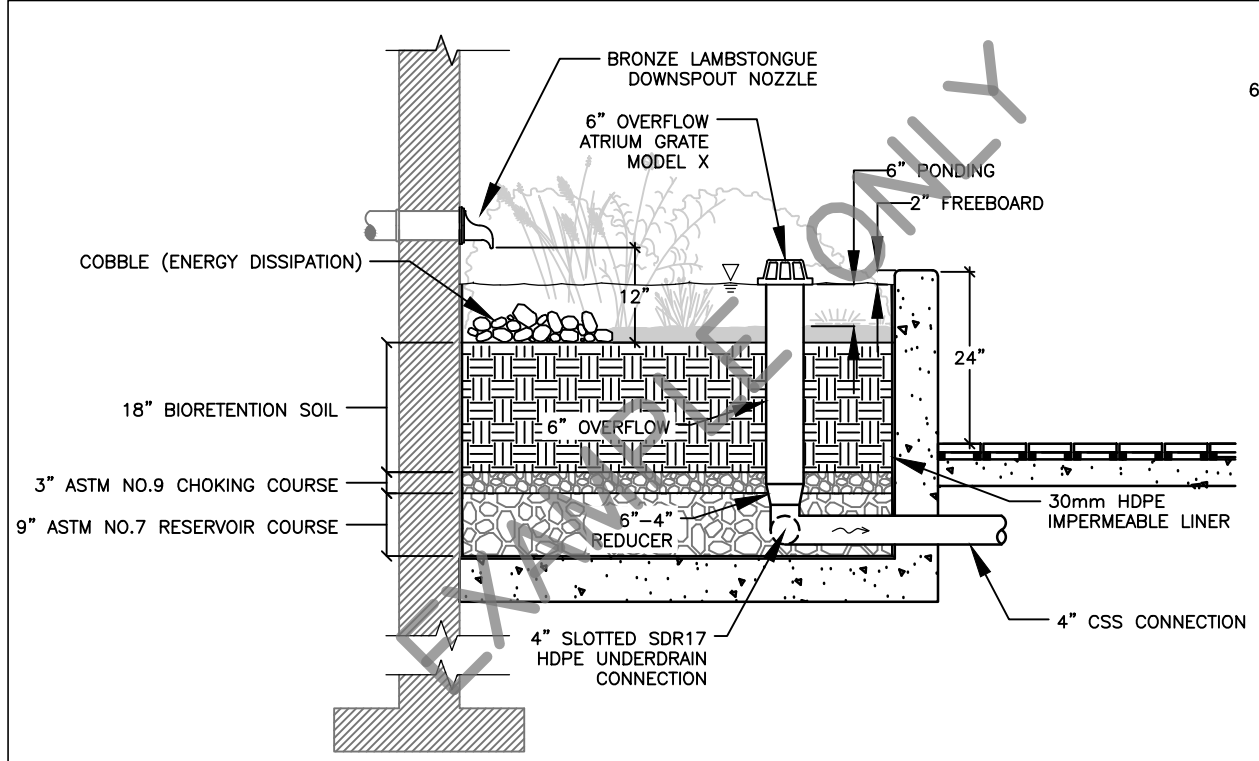
PROJECT ADDRESS
SAN FRANCISCO, CALIFORNIA

DATE: JUNE, 2017
SCALE: 1" = 40'

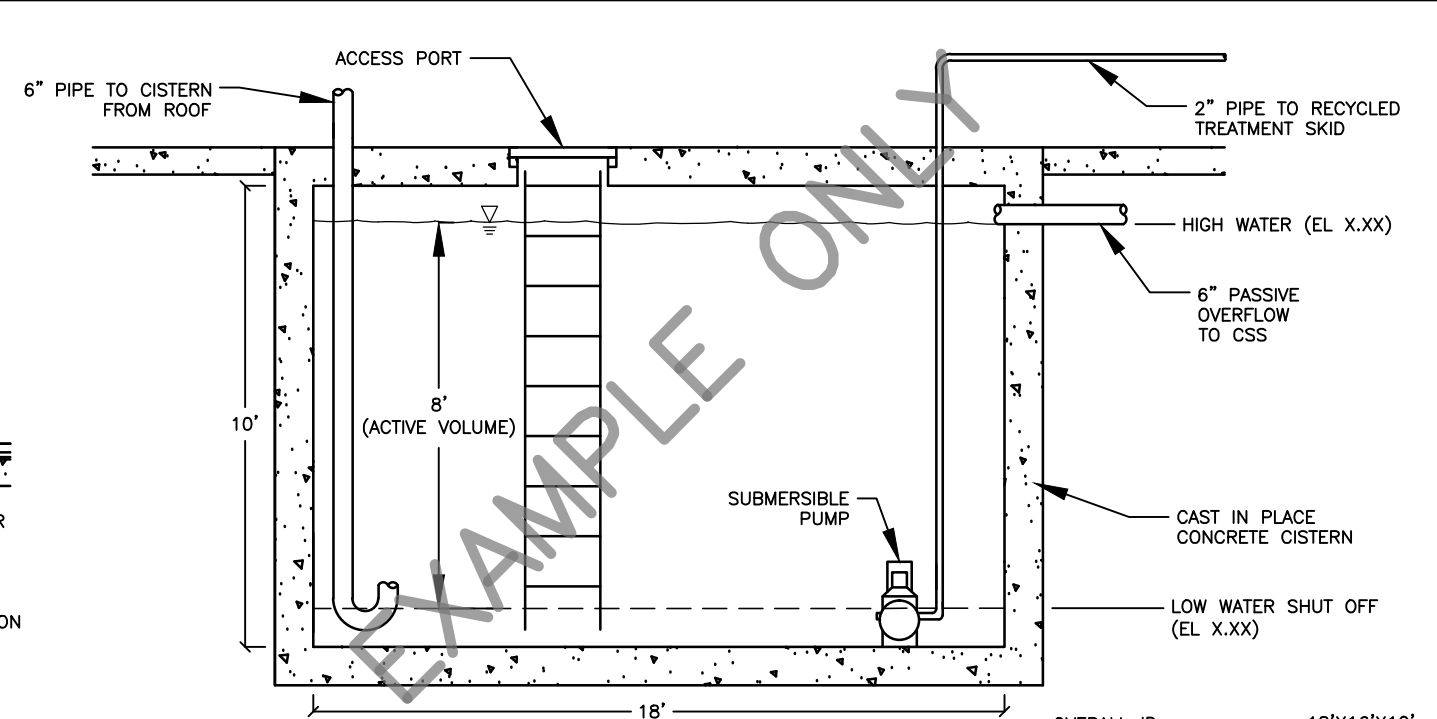
**EXAMPLE 1
STORMWATER
MANAGEMENT PLAN**

DRAWING NUMBER:

SMP-1

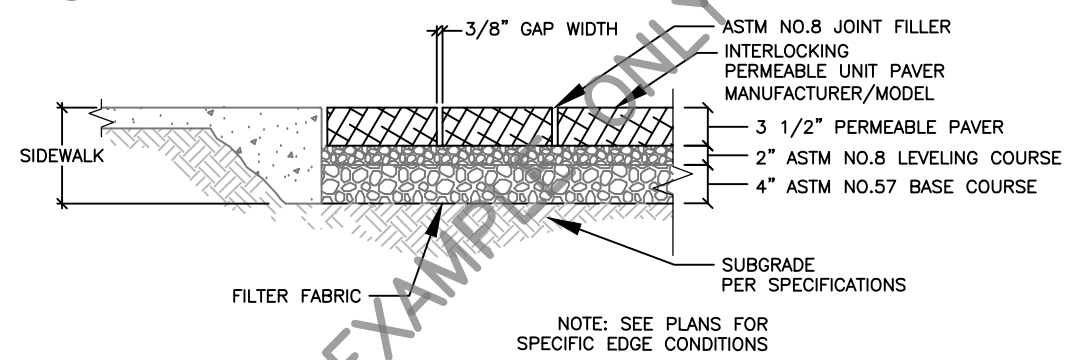


A LINED FLOW-THROUGH PLANTER (FTP)
 (CD DETAIL X/L-XX) SCALE: NTS

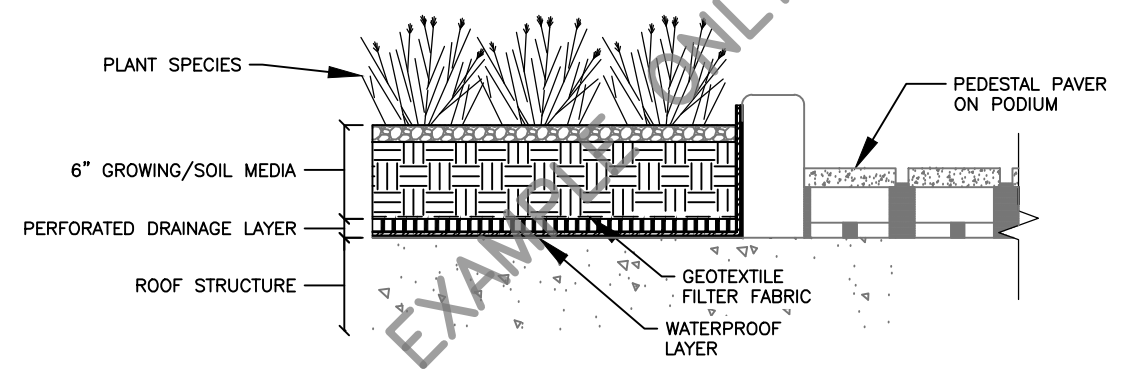


OVERALL ID: 18'x16'x10'
 OVERALL VOLUME: 21,500 GAL
 ACTIVE "USABLE" ID: 18'x16'x8'
 ACTIVE "USABLE" VOLUME: 17,234 GAL

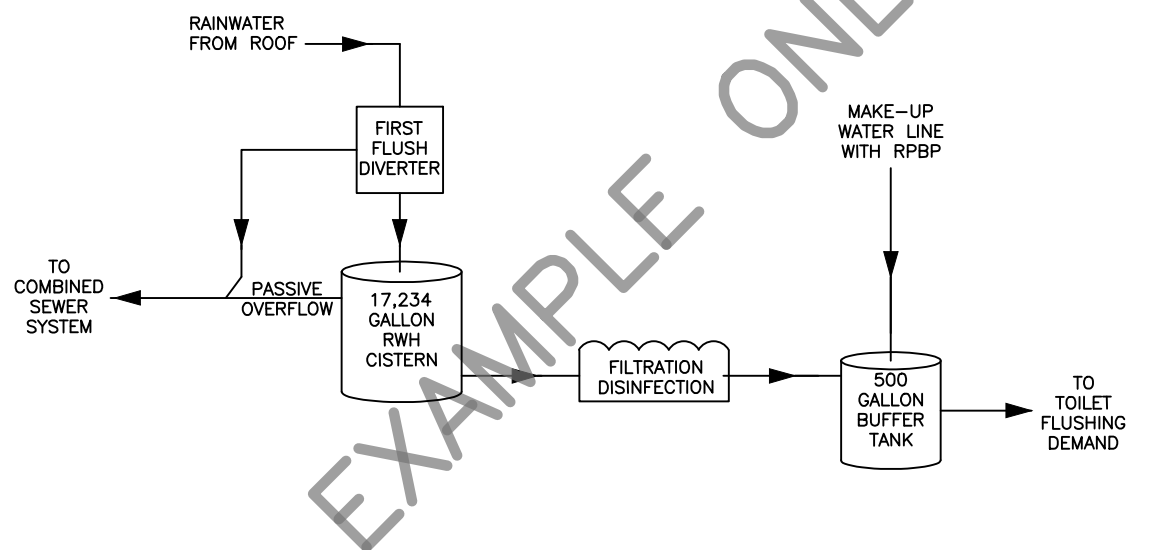
D1 RAIN WATER HARVESTING (RWH) CISTERN
 (CD DETAIL X/P-XX) SCALE: NTS



B PERMEABLE PAVERS (PP)
 (CD DETAIL X/C-XX) SCALE: NTS



C VEGETATED ROOF (VR)
 (REF: CD DETAIL X/A-XX) SCALE: NTS



D2 RWH FLOW DIAGRAM
 (CD DETAIL X/P-XX) SCALE: NTS

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PROJECT NAME

PROJECT ADDRESS
 SAN FRANCISCO, CALIFORNIA

SCALE: NTS DATE: JUNE, 2017

**EXAMPLE 1
 STORMWATER
 MANAGEMENT PLAN**

DRAWING NUMBER:

SMP-2



SAN FRANCISCO PUBLIC UTILITIES COMMISSION - URBAN WATERSHED MANAGEMENT PROGRAM

COMBINED SEWER SYSTEM BMP SIZING CALCULATOR

for QUANTITY CONTROL

525 Golden Gate, 11th Floor
San Francisco, CA 94102

CSS BMP SIZING CALCULATOR - Only use for subwatersheds less than 2 acres, and sites less than 5 acres.

Project Address:	Standard SMR Compliance	Applicant Name:	
Project Name (Alias):	Example 1	Company:	
Total Project Site Area (ft ²):	42,376	Date:	
Subwatershed Name (if applicable):	NA		

Modified Compliance Application

Modified Compliance approved?	No
	N/A
	N/A

Project Requirement: *Case 2: 25% reduction in peak flow and volume from the 2-yr, 24 hr storm*

LEGEND:

User Input
Default Value
Locked
Comment

STEP 1 - Enter the site's infiltration characteristics

HSG Soil Type:	A
Is Infiltration Feasible or Proposed?	Yes
Measured Infiltration Rate (in/hr):	2.25
Infiltration Testing Method:	Double-Ring Infiltrometer
Infiltration Rate Correction Factor:	0.33
Design Infiltration Rate (in/hr):	0.75

STEP 2 - Enter the site's EXISTING runoff pathway information to estimate the Time of Concentration (Tc)

Existing Means of Conveying Runoff Offsite?	Pipe
Avg. Site Slope in Direction of Flow (%):	2.0%
Maximum Flow Length (ft):	200

STEP 3a - Enter the sites EXISTING and PROPOSED areas of impervious, pervious, and BMP surfaces.

	Surface Type	Existing (ft ²)	Proposed (ft ²)	Curve Number	STEP 3b - Enter stormwater BMP design information AND the conventional areas from Step 3a that drain to each BMP measure.									
					Impervious Area Draining to BMP (ft ²)	Pervious Area Draining to BMP (ft ²)	BMP Ponding Depth (ft)	BMP Media Depth (ft)	Gravel Storage Depth (ft)	Height of Underdrain Above Base (ft)	Storage Volume (gallons)	Outlet or Orifice Diameter (in)	Approx. Drawdown Time (hrs)	
Conventional Surfaces	Impervious	Pavement (Conventional)	12,957	5,163	98									
		Roof (Conventional)	29,419	29,130	98									
		Gravel on Soils			76									
		Other:												
		<i>Impervious Areas Subtotal</i>	<i>42,376</i>	<i>34,293</i>										
	Pervious	Grass/Lawn on Grade			49									
		Landscaping on Grade (Low Density)			39									
		Landscaping on Grade (High Density)			35									
		Tree Well (ROW Only)			35									
		Traditional Planter on Structure		900	74									
	Other:													
	<i>Pervious Areas Subtotal</i>	<i>0</i>	<i>900</i>	<i>--</i>										
Stormwater BMPs	Retention	Bioretention (No Underdrain, No Liner)	--		--	11,269	0	0.5	1.5		--	0	--	0
		Cistern	--	0	--			0.0	--	8.00	--	17,234	0.0	6.3 days
		Infiltration Trench	--		--			--	--	3.00	--	0	--	0
		Dry Well/Infiltration Gallery	--	0	--			0.0	--	4.00	--		--	0
	Detention	Permeable Pavement (No Underdrain)	--	1,404	--		0	--	--	0.50	--	2,100	--	3
		Bioretention/FTP (Underdrain, No Liner)	--		--			0.5	1.5		0.17	0	4.0	0
		Bioretention/FTP (Underdrain, Liner)	--	311	--	3,347		0.5	1.5	1.00	--	3,140	4.0	2
		Vegetated Roof	--	5,468	--			--	0.50	--	--	7,839	4.0	2
		Permeable Pavement (Underdrain)	--		--		0	--	--	1.00	0.17	0	4.0	0
		Detention Vault or Tank	--	0	--			3.0	--	--	--		1.5	0
	<i>BMP Areas Subtotals</i>	<i>--</i>	<i>7,183</i>	<i>--</i>	<i>14,616</i>	<i>0</i>					<i>30,314</i>			
	Total Project Site Areas	42,376	42,376	--	14,616	0					30,314			

BMPs in Series	
Are BMPs in Series Proposed?	No
First BMP in Series	
Receiving BMP in Series	



SAN FRANCISCO PUBLIC UTILITIES COMMISSION - URBAN WATERSHED MANAGEMENT PROGRAM

COMBINED SEWER SYSTEM BMP SIZING CALCULATOR

for QUANTITY CONTROL

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San Francisco, CA 94102

CSS BMP SIZING CALCULATOR - Only use for subwatersheds less than 2 acres, and sites less than 5 acres.

Project Address:	Standard SMR Compliance	Applicant Name:	
Project Name (Alias):	Example 1	Company:	
Total Project Site Area (ft ²):	42,376	Date:	
Subwatershed Name (if applicable):	NA		

Modified Compliance Application

Modified Compliance approved?	No
	N/A
	N/A

Project Requirement: Case 2: 25% reduction in peak flow and volume from the 2-yr, 24 hr storm

LEGEND:

User Input
Default Value
Locked
Comment

STEP 4 - Check that site and drainage management areas are entered correctly. (Note: CSS = Combined Sewer System.)

Project Site Surfaces	Existing Area (ft ²)	Proposed Area (ft ²)	CHECK OF AREAS
Impervious Area Draining to BMP	0	14,616	OK
Impervious Area Draining Directly to CSS	42,376	19,677	
Pervious Area Draining to BMP	0	0	OK
Pervious Area Draining Directly to CSS	0	900	
Stormwater BMP Area	0	7,183	
Total Area	42,376	42,376	OK

STEP 5 - Compare if the SMR runoff reductions to quantity control requirements are met. If not, review BMP performance output in Step 6, then return to Step 3 to adjust stormwater strategies.

Quantity Control Parameter	Existing Conditions	Proposed Conditions	% Reduction From Existing Conditions	Target % Reduction	Requirement Met?
1-yr, 24 hr: Peak Flow (cfs)	1.492	0.850	43%	N/A	N/A
1-yr, 24 hr: Runoff Volume (ft ³)	8,543	5,484	36%	N/A	N/A
2-yr, 24 hr: Peak Flow (cfs)	1.799	0.995	45%	25%	YES
2-yr, 24 hr: Runoff Volume (ft ³)	9,256	6,005	35%	25%	YES

STEP 6 - Review the summary table below to see how each BMP performs during the 2-yr 24 hr storm. The site's hydrographs are shown in the "Rainfall and Hydrographs" tab.

For BMPs in Series Only

Stormwater BMP Measures	Inflows	Outflows		Volume In	Volume Retained			Volume Out to CSS	
	Peak Flow to BMP (cfs)	Peak Rate of Discharged Flow (cfs)	Peak Rate of Overflow (cfs)	Runoff to BMP (ft ³)	Infiltration + E/T (ft ³)	Reuse (ft ³)	Volume Remaining in Storage (ft ³)	Detained Discharge Volume (ft ³)	Overflow Volume (ft ³)
Retention	Bioretention (No Underdrain, No Liner)	0.000	0.000	0.000	0	0	0	0	0
	Cistern	0.477	0.000	0.010	2462	0	1104	1330	27
	Infiltration Trench	0.000	0.000	0.000	0	0	0	0	0
	Dry Well/Infiltration Gallery	0.000	0.000	0.000	0	0	0	0	0
	Permeable Pavement (No Underdrain)	0.059	0.000	0.000	307	307	0	0	0
Detention	Bioretention/FTP (Underdrain, No Liner)	0.000	0.000	0.000	0	0	0	0	0
	Bioretention/FTP (Underdrain, Liner)	0.155	0.028	0.000	799	66	0	733	0
	Vegetated Roof	0.231	0.123	0.000	1195	310	0	885	0
	Permeable Pavement (Underdrain)	0.000	0.000	0.000	0	0	0	0	0
	Detention Vault	0.000	0.000	0.000	0	0	0	0	0
Totals				4,762	683	1,104	1,330	1,618	27

Volume to Receiving BMP	
Detained Discharge Volume (ft ³)	Overflow Volume (ft ³)
--	--
0	0
--	--
--	--
--	--
0	0
0	0
0	0
--	--
0	0
0	0

NOTE: With the exception of Cisterns, BMP measures should not have any "Volume Remaining in Storage". If volume is remaining in any BMP measures other than a Cistern, check and revise STEP 3b for the "Outlet Design" (outlet/orifice diameter) or underdrain such that the "Approx. Drawdown Time" is less than 48 hours, therefore empty for the next storm event.



RAINWATER HARVESTING CALCULATOR for QUANTITY CONTROL

RAINWATER HARVESTING (RWH) CALCULATOR

The RWH Calculator simulates the performance of a cistern over **10 years** based on the runoff to the cistern, cistern size, and the site's non-potable demand. The RWH's performance is used to calculate the average available volume prior to storm event, which is then input in the CSS BMP Sizing Calculator worksheet. The RWH calculator is intended for **conceptual design** and **determining compliance with the CSS performance measures; construction documents and Stormwater Control Plan shall include further engineering evaluation and system configuration for the cistern design.**

LEGEND:

User Input
Default Value
Locked

PART 1 - Calculate Irrigation Demand

1	Turf/Crop Area to be Irrigated		ft ²
2	Crop Coefficient - K _c		cool season grasses = 0.8, warm season grasses = 0.6. Please see CIMIS publication for more information.
3	Landscape Area to be Irrigated		ft ²
4	Species Factor - k _s		<0.1 for very low, 0.1-0.3 for low, 0.4-0.6 for medium, 0.7-0.9 for high. See p. 62-99 of Guide (DWR 2000).
5	Density Factor - k _d		0.5-0.9 for low, 1 for average, 1.1-1.3 for high. See p. 18 of Guide (DWR 2000).
6	Microclimate Factor - k _{mc}		0.5-0.9 for low, 1 for average, 1.1-1.4 for high. See p. 19 of Guide (DWR 2000).
7	Landscape Coefficient - K _L	0.0	$K_L = k_s * k_d * k_{mc}$
	Total Irrigation Area	0	ft ²
	Average Coefficient	0.00	
8	Irrigation Efficiency		Estimated efficiencies are 0.70 to 0.85 for spray, 0.9 for drip, 0.95 for subsurface drip.
9	Site Location (ETO Zone)		Select Western if located in the Richmond, Sunset, or Lake Merced areas of San Francisco

10	Month	Avg. Monthly Rainfall in/month	Reference Evapotranspiration ETo	Actual Evapotranspiration ET _L	Irrigation Demand			
					ft ³ /month	gal/mo	gpd	% of annual
	January	3.66	1.24	0.00	0	0	0	#DIV/0!
	February	4.38	1.69	0.00	0	0	0	#DIV/0!
	March	2.57	3.10	0.00	0	0	0	#DIV/0!
	April	1.44	3.90	0.00	0	0	0	#DIV/0!
	May	0.49	4.65	0.00	0	0	0	#DIV/0!
	June	0.12	5.10	0.00	0	0	0	#DIV/0!
	July	0.01	4.96	0.00	0	0	0	#DIV/0!
	August	0.01	4.65	0.00	0	0	0	#DIV/0!
	September	0.06	3.90	0.00	0	0	0	#DIV/0!
	October	1.15	2.79	0.00	0	0	0	#DIV/0!
	November	2.35	1.80	0.00	0	0	0	#DIV/0!
	December	7.04	1.24	0.00	0	0	0	#DIV/0!
	Totals	23.27	39.02	0.00	0	0	0	

PART 2 - Calculate Indoor Non-Potable Demand

11	No. of Residential Units	165		
	Persons per Unit	2.0	<i>Recommend 2.0 for multi-family, 3.1 for single family. See SFPUC Urban Water Management Plan (SFPUC UWMP), Appendix D. Use for commercial and industrial facilities. A 40-hrs per week employee has an FTE of 1. Use for schools, museums, libraries, etc. Enter the average number of student/visitors per day. Use for retail stores. Enter the average number of customers per day. See SFPUC UWMP See SFPUC UWMP See SFPUC UWMP See SFPUC UWMP See California Green Building Standards Code 5.303.2. See SFPUC UWMP Additional non-potable demand (e.g. cooling water, industrial) per supporting documentation</i>	
12	Number of Full Time Equivalents	420		
13	Number of Students/Visitors			
14	Number of Retail Customers	100		
15	Freq. of Residential Toilet Use	4.75		flush/person/day
	Freq. of FTE Toilet Use	1.74		flush/person/day
	Freq. of Student/Visitor Toilet Use	0.5		flush/person/day
	Freq. of Customer Toilet Use	0.5		flush/person/day
16	Volume per Flush	1.28		gal/flush
17	Washing Machine Use			cycles/person/day
	Volume per Load	36.9		gal/cycle
18	Other Non-Potable Demand			gal/day
19	Daily Reuse Demand	2749		gal/day
	Monthly Reuse Demand	83,603		gal/month
	Annual Reuse Demand	1.00		MG/yr

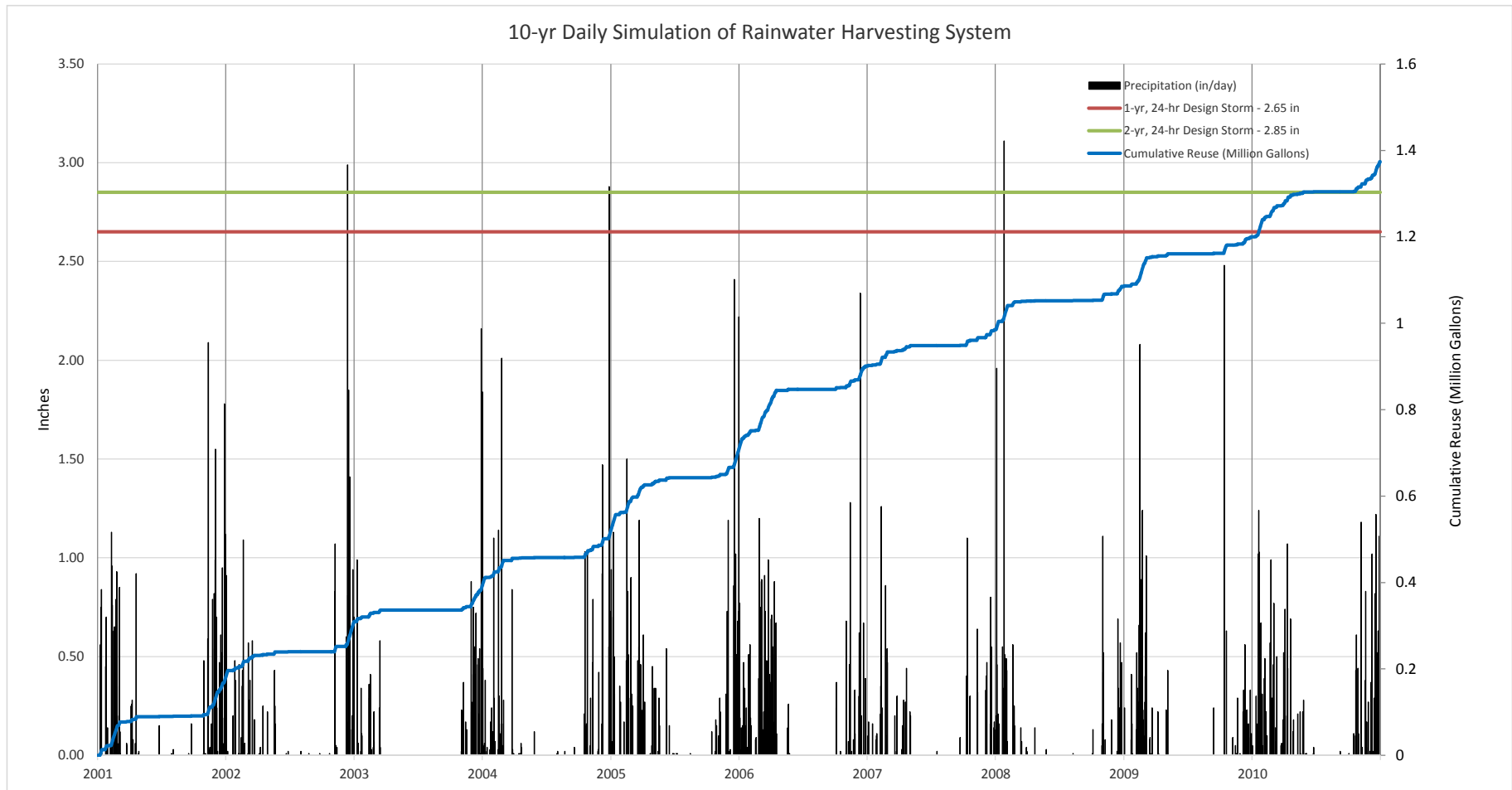
PART 3 Enter Cistern Design Information and the Conventional Areas that drain to the Cistern

20	Impervious Drainage Area	11,269	ft2 (Enter roof area, paved area, etc. that drain to cistern. Value will populate Step 3b of "CSS BMP Sizing Calculator".)
	Pervious Drainage Area		ft2 (Enter allowed pervious areas that drain to cistern. Value will populate Step 3b of "CSS BMP Sizing Calculator".)
21	Avg. Runoff Coefficient	0.85	Recommend 0.85 for roofs. Typical values are 0.85 to 0.95.
22	Shape of Cistern Footprint	Rectangular	Select Circular or Rectangular
	Cistern Length	18.00	ft
	Cistern Width	16.00	ft
	Cistern Depth	8.00	ft
22A	Depth of Additional Detention		ft (Enter the depth of any additional detention storage within the cistern footprint)
	Detention Orifice Diameter		in

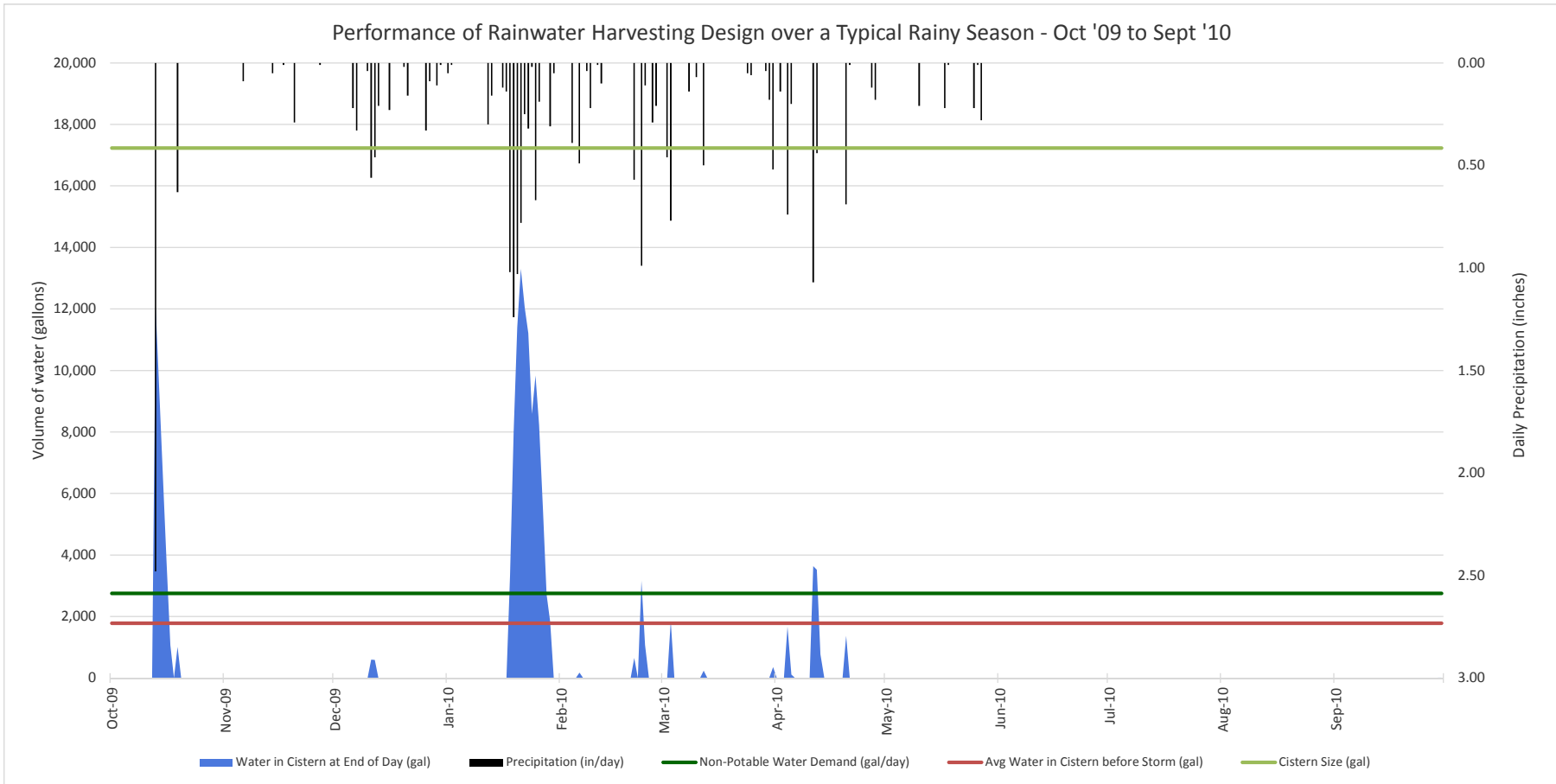
PART 4 - Calculate Cistern Performance in 10-year Simulation Based on Inputs

23	Cistern Surface Area	288	square ft	<i>Adjust the cistern size until the desired performance is achieved (e.g., CSS performance measures met or 100% of runoff captured). Annual cistern performance is summarized in PART 4 while the 10-year daily precipitation data and the daily cistern performance over an average wet season are shown in the graphs below. The "Available Cistern Volume prior to Design Storm Event" is used as the starting volume for the calculations to evaluate performance during the 1- and 2-yr 24 hr design storms in the "CSS BMP Sizing Calculator". Check results in Steps 5 and 6 of the "CSS BMP Sizing Calculator".</i>
	Cistern Volume	17,234	gallons	
	Detention Volume	0	gallons	
	Average Volume in Cistern prior to each Rainy-Season Storm Event	1783	gallons	
	Available Cistern Volume prior to Design Storm Event	15,451	gallons	
24	Percent of 2yr Design Storm Volume Captured	99%	Percent of runoff to the cistern from the 2yr, 24hr design storm that is captured (i.e., is reused or is still in Cistern storage at the end of the simulation). Steps 1-3 of "CSS BMP Sizing Calculator" tab must be complete for results to populate correctly. See that tab for full site results.	
	Ave. Annual Non-Potable Demand Met by RW Harvesting	14%	Average annual percentage of non-potable water demand supplied by water captured in the cistern for reuse	

10-year Daily Precipitation Data used to evaluate RWH performance



RWH Performance Metrics



Rainwater Harvesting Performance from Part 4	(gallons)	(%)
Total Cistern Volume	17,234	
Volume Available in Cistern prior to Storm Event	15,451	90%
2-yr, 24 hr Runoff Volume (from contributing area)	18,415	
2-yr, 24 hr Runoff Captured (Reused or Detained)	18,211	99%
Ave. Annual Runoff Volume (from contributing area)	138,956	
Ave. Annual Runoff Captured & Reused	137,374	99%
Annual Non-Potable Demand Volume	1,003,786	
Annual Non-Potable Demand Met by RWH	137,374	14%

Example 2: Modified SMR Compliance

- Calculation Summary Table summarizing the cumulative stormwater management performance of two sub-watersheds
- Completed Modified Compliance application
- SMP 1 (Plan View) & SMP 2 (Details) - Two CSS connection points, thus two Sub-Watersheds
- Completed 'CSS BMP Sizing Calculator' for Sub-Watersheds 1 & 2

Calculation Summary Table:

Sub-Watershed	Total Area (sf)	Flow Rate (cfs)			Volume (cf)		
		Existing	Proposed	% Reduction	Existing	Proposed	% Reduction
1	31,932	1.355	0.638	53%	6,972	6,546	6%
2	10,444	0.443	0.332	25%	2,281	1,780	22%
TOTAL	56,050	1.798	0.970	46%	9,253	8,317	10%
REQUIRED % REDUCTION		-	-	40%	-	-	10%

Note: This project complies with modified compliance as the sum of reductions is greater than or equal to 50% and the volume reduction is greater than or equal to 10%.

APPLICATION

STEP 1 - Project Summary Information

Project Name:	Example 2	Applicant's Name:	
Project Address:	MOD SMR COMP	Company:	
In the Combined Sewer System Area?	Yes	Date:	
Total Project Site Area (ft ²):	42,363	% Impervious	
Project EXISTING Impervious Area (ft ²):	42,363	100%	

Result: PROCEED TO STEP 2

STEP 2 - Infiltration Restrictions

Step 2a - Select Response Based on Majority Site Conditions			Required Supporting Materials
Soil Type:	Type D	----->	Geotechnical Report, Boring Log and Map
Depth to Bedrock < 4ft:	No	----->	Geotechnical Report, Boring Log and Map
Depth to Groundwater < 4ft:	No	----->	Geotechnical Report, Boring Log and Map
Contaminated Soil:	No	----->	Documentation of Contamination

Step 2b - Enter Area of Site Impacted by the Following Restrictions			Required Supporting Materials
Building/Foundation Footprint (ft ²):	40,959	----->	Site Plan - Conceptual w/ Property Line
Site Area with Other Limitations (ft ²):		----->	List SFPUC Approved Other Limitation Type(s)
		----->	List Backup Type for Other Limitation(s)

Est. Area Available for Infiltration (ft²): 1,404

Result: PROCEED TO STEP 3

STEP 3 - Rainwater Harvesting (RWH) Feasibility

STEP 3 - Rainwater Harvesting (RWH) Feasibility			Required Supporting Materials
Subject to the Recycled Water Ord.?	No	----->	Project Location (Link to Map)
Project Type:	Select	----->	If Other, List Type
# of Residential Units:		----->	Project Narrative
Office/Retail Gross Square Footage (ft ²):		----->	Project Narrative
Est. Non-Potable Demand (gpd):	--	----->	N/A
User Entered Non-Potable Demand (gpd):		----->	SFPUC Non-Potable Calculator (Link)
		----->	If Different Documentation Provided, List

NP Demand/DMA (gpd/acre):

Result: SKIP TO STEP 4

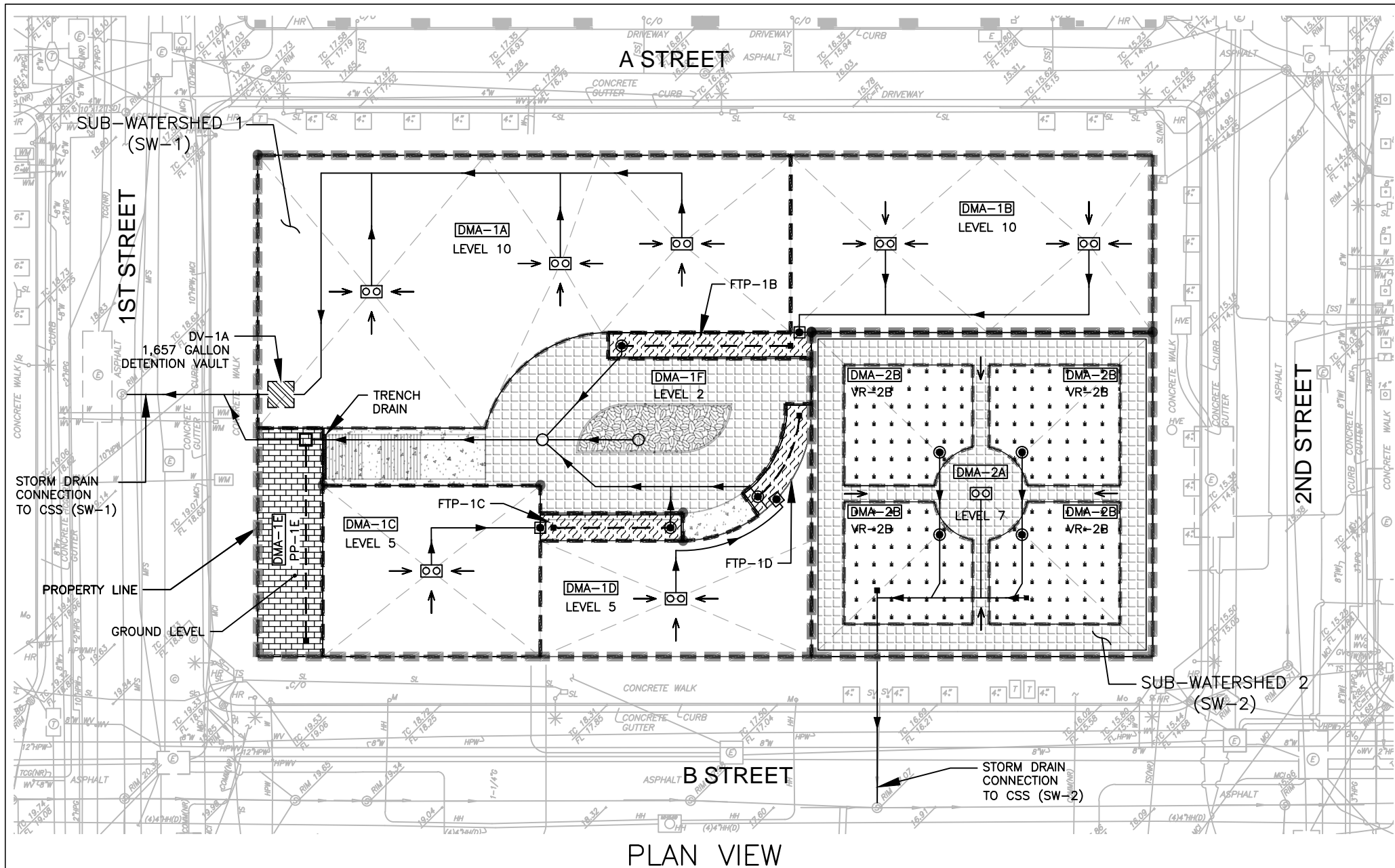
STEP 4 - Modified Requirements

Area Available for Infiltration (ft ²):	1,404		
% of Site Available for Infiltration:	3.3%		
Soil Type:	Type D		

Performance Requirement Parameter	Target % Reduction
2-yr, 24 hr Peak Flow	40
2-yr, 24 hr Runoff Volume	10

Table 1 - Modified % Volume Reduction Based on Site Constraints

Infiltration Category	Percent of Site Available For Infiltration								
	≤ 1	> 1 to 2	> 2 to 3	> 3 to 4	> 4 to 5	> 5 to 6	> 6 to 8	> 8 to 10	>10
Type A Soils	10	15	20	25	25	25	25	25	25
Type B Soils	10	10	15	20	25	25	25	25	25
Type C Soils	10	10	10	15	15	20	20	25	25
Type D Soils	10	10	10	10	10	10	15	15	20



LEGEND

- LINED FLOW-THROUGH PLANTER (FTP)
- PERMEABLE PAVERS ON GRADE (PP)
- DETENTION VAULT (DV)
- VEGETATED/GREEN ROOF (VR)
- ROOF
- PEDESTAL PAVERS ON PODIUM (PAVEMENT)
- CONCRETE (PAVEMENT)
- TRADITIONAL PLANTER
- SUB WATERSHED BOUNDARY
- DMA BOUNDARY
- ROOF SLOPE BREAK LINE
- SCHEMATIC PIPE WITH FLOW DIRECTION
- SLOTTED UNDERDRAIN
- SURFACE FLOW
- ROOF DRAIN
- UNDERDRAIN OUTLET STRUCTURE
- OVER-FLOW DRAIN
- AREA DRAIN
- DOWNSPOUT
- CLEAN-OUT

SMP DETAIL

- A SMP-2
- B SMP-2
- C SMP-2
- D SMP-2

AREA SUMMARY TABLE:

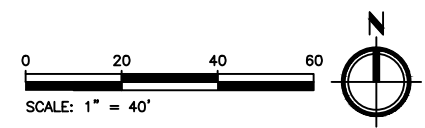
BOUNDRY	BMP-ID	CONVENTIONAL SURFACES (SF)			LID/BMPs (SF)			TOTAL (SF)
		ROOF	PAVEMENT	TRAD. PLANTER	FTP	PP	VR	
SUB-WATERSHED 1 (SW-1)								
DMA-1A	DV-1A *	11,270						11,270
DMA-1B	FTP-1B	6,057	35		465			6,557
DMA-1C	FTP-1C	3,515	24		346			3,885
DMA-1D	FTP-1D	3,311	26		274			3,611
DMA-1E	PP-1E					1,404		1,404
DMA-1F	UNCAPTURED		4,633	559				5,192
SUB TOTAL		24,153	4,718	559	1,085	1,404		31,919
SUB-WATERSHED 2 (SW-2)								
DMA-2A (UNCAPTURED)	UNCAPTURED	901	4,075					4,976
DMA-2B	VR-2B						5,468	5,468
SUB TOTAL		901	4,075				5,468	10,444
OVERALL TOTAL (SF)		25,054	8,793	559	1,085	1,404	5,468	42,363

* DETENTION VAULT LOCATED LEVEL B1 - ACTIVE CAPACITY 1,657 GALLON

CALCULATION SUMMARY TABLE:

BOUNDRY	EXISTING	PROPOSED	%REDUCTION ACHIEVED*	%REDUCTION REQUIRED	
					2-YR, 24HR STORM
PEAK FLOW (CFS)	SW-1	1.355	0.638	53%	-
	SW-2	0.443	0.332	25%	-
	TOTALS	1.798	0.991	46%	40%
VOLUME (FTP)	SW-1	6,972	6,546	6%	-
	SW-2	2,281	1,780	22%	-
	TOTALS	9,253	8,317	10%	10%

* THIS PROJECT COMPLIES WITH MODIFIED COMPLIANCE:
 1. THE SUM OF REDUCTIONS IS GREATER THAN OR EQUAL TO 50% AND
 2. THE VOLUME REDUCTION IS GREATER THAN OR EQUAL TO 10%.



SMP NOTE:

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THIS EXAMPLE SMP IS FOR REFERENCE ONLY

PROJECT NAME

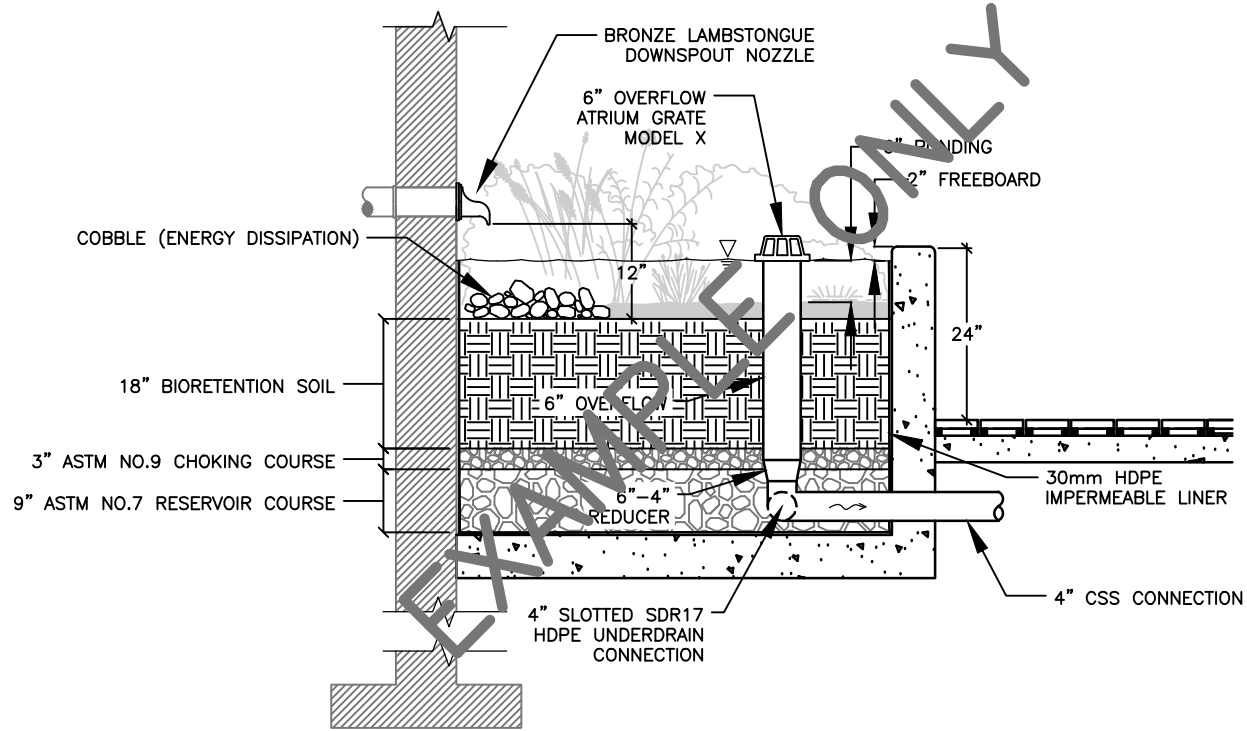
PROJECT ADDRESS
 SAN FRANCISCO, CALIFORNIA

SCALE: 1" = 40'
 DATE: JUNE ,2017

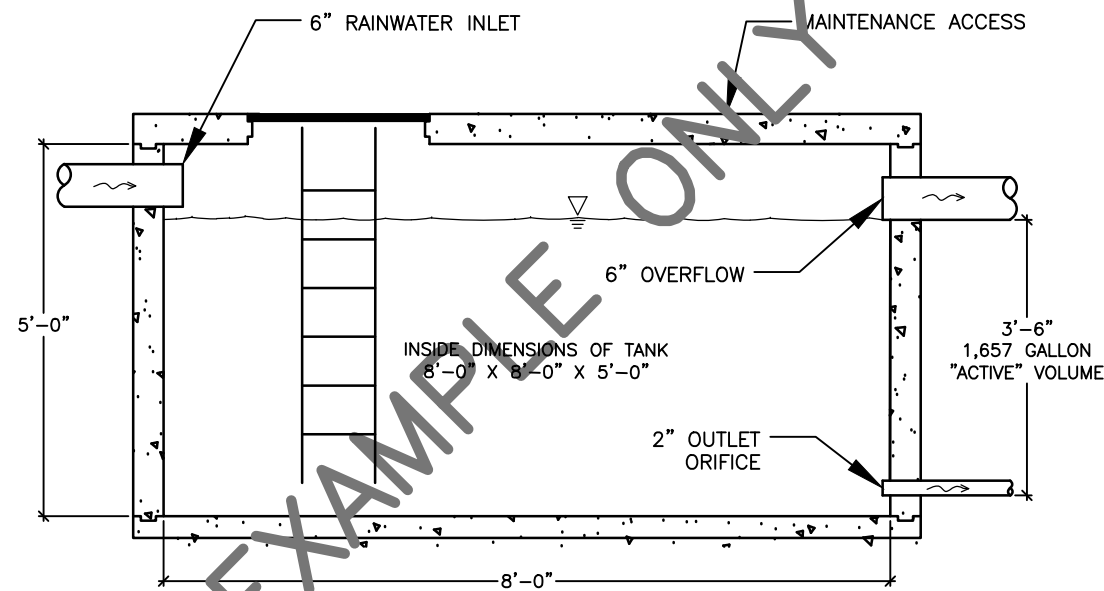
EXAMPLE 2
STORMWATER
MANAGEMENT PLAN
 (W/ MODIFIED SMR COMPLIANCE)

DRAWING NUMBER:

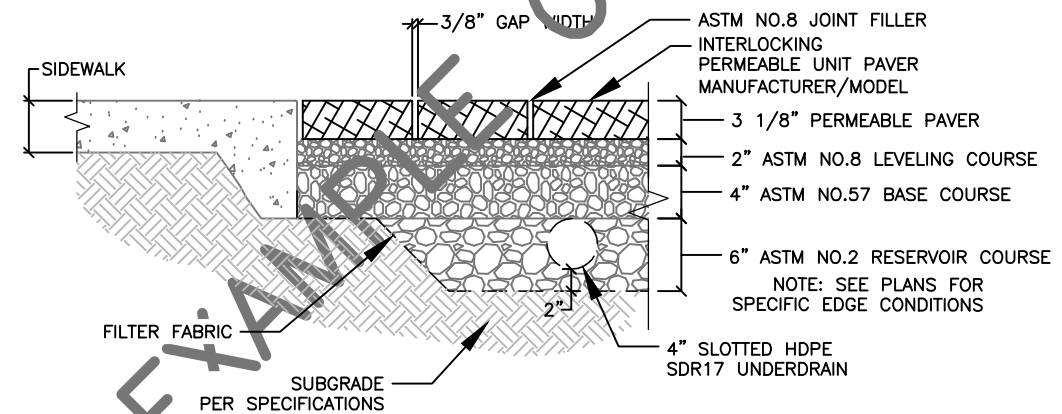
SMP-1



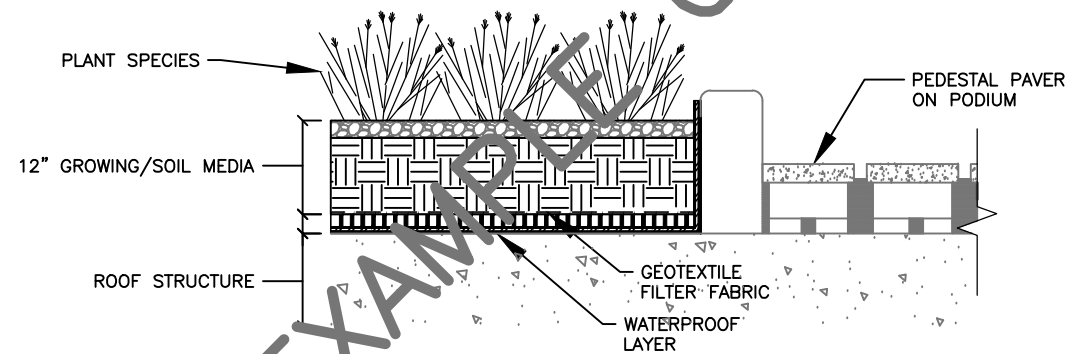
A LINED FLOW-THROUGH PLANTER (FTP)
 (CD DETAILS X/C-XX) SCALE: NTS



C DETENTION VAULT
 (CD DETAILS X/C-XX) SCALE: NTS



B PERMEABLE PAVERS ON GRADE (PP)
 (CD DETAIL X/L-XX) SCALE: NTS



D VEGETATED/GREEN ROOF (VR)
 (CD DETAIL X/L-XX) SCALE: NTS

THIS EXAMPLE SMP IS FOR REFERENCE ONLY

PROJECT NAME
 PROJECT ADDRESS
 SAN FRANCISCO, CALIFORNIA

DATE: JUNE ,2017
 SCALE: 1"=40'

EXAMPLE 2
STORMWATER
MANAGEMENT PLAN
 (W/MODIFIED COMPLIANCE)

DRAWING NUMBER:

SMP-2

SMP NOTE:



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SAN FRANCISCO PUBLIC UTILITIES COMMISSION - URBAN WATERSHED MANAGEMENT PROGRAM

COMBINED SEWER SYSTEM BMP SIZING CALCULATOR

for QUANTITY CONTROL

525 Golden Gate, 11th Floor
San Francisco, CA 94102

CSS BMP SIZING CALCULATOR - Only use for subwatersheds less than 2 acres, and sites less than 5 acres.

Project Address: Example 2
 Project Name (Alias): Modified SMR Compliance
 Total Project Site Area (ft²): 42,363
 Subwatershed Name (if applicable): SW-1 (of 2)

Applicant Name: _____
 Company: _____
 Date: _____

Modified Compliance Application

Modified Compliance approved? Yes
 2-yr, 24-hr: Peak Flow % Reduction 40%
 2-yr, 24-hr: Runoff Volume % Reduction 10%

Project Requirement: Modified Compliance Percent Reductions Entered Above

LEGEND:

User Input
Default Value
Locked
Comment

STEP 1 - Enter the site's infiltration characteristics

HSG Soil Type: D
 Is Infiltration Feasible or Proposed? Yes
 Measured Infiltration Rate (in/hr): 0.02
 Infiltration Testing Method: Double-Ring Infiltrometer
 Infiltration Rate Correction Factor: 0.33
 Design Infiltration Rate (in/hr): 0.01

STEP 2 - Enter the site's EXISTING runoff pathway information to estimate the Time of Concentration (Tc)

Existing Means of Conveying Runoff Offsite? Pipe
 Avg. Site Slope in Direction of Flow (%): 2.0%
 Maximum Flow Length (ft): 200

STEP 3a - Enter the sites EXISTING and PROPOSED areas of impervious, pervious, and BMP surfaces.

	Surface Type	Existing (ft ²)		Proposed (ft ²)		Curve Number
		Existing	Proposed	Existing	Proposed	
Conventional Surfaces	Impervious	Pavement (Conventional)	2,500	4,718		98
		Roof (Conventional)	29,419	24,153		98
		Gravel on Soils				91
		Other:				
		<i>Impervious Areas Subtotal</i>	<i>31,919</i>	<i>28,871</i>		
	Pervious	Grass/Lawn				80
		Landscaping at Grade (Low Density)				77
		Landscaping at Grade (High Density)				73
		Tree Well (ROW Only)				35
		Traditional Planter on Podium		559		74
Other:						
<i>Pervious Areas Subtotal</i>	<i>0</i>	<i>559</i>				
Stormwater BMPs	Retention	Bioretention (No Underdrain, No Liner)	--			--
		Cistern	--	0		--
		Infiltration Trench	--			--
		Dry Well/Infiltration Gallery	--	0		--
		Permeable Pavement (No Underdrain)	--		0	--
	Detention	Bioretention/FTP (Underdrain, No Liner)	--			--
		Bioretention/FTP (Underdrain, Liner)	--	1,085		--
		Vegetated Roof	--			--
		Permeable Pavement (Underdrain)	--	1,404		--
		Detention Vault or Tank	--	0		--
<i>BMP Areas Subtotals</i>	<i>--</i>	<i>2,489</i>				
Total Project Site Areas		31,919	31,919			

BMPs in Series	
Are BMPs in Series Proposed?	No
First BMP in Series	
Receiving BMP in Series	

STEP 3b - Enter stormwater BMP design information AND the conventional areas from Step 3a that drain to each BMP measure.

Drainage Areas	BMP Depths and Volumes					Outlet Design			
	Impervious Area Draining to BMP (ft ²)	Pervious Area Draining to BMP (ft ²)	BMP Ponding Depth (ft)	BMP Media Depth (ft)	Gravel Storage Depth (ft)	Height of Underdrain Above Base (ft)	Storage Volume (gallons)	Outlet or Orifice Diameter (in)	Approx. Drawdown Time (hrs)
			0.5	1.5		--	0	--	0
	0		0.0	--	0.00	--	0	0.0	0 days
			--	--	3.00	--	0	--	0
			0.0	--	4.00	--		--	0
	0		--	--	1.00	--	0	--	0
			0.5	1.5		0.17	0	4.0	0
	12,986		0.5	1.5	1.00	--	10,956	4.0	2
			--	1.00	--	--	0	4.0	0
		0	--	--	1.00	0.17	4,201	4.0	1
	11,270		3.0	--	--	--	1,657	2	0
<i>BMP Areas Subtotals</i>	<i>--</i>	<i>0</i>							
Total Project Site Areas	24,256	0					16,814		



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COMBINED SEWER SYSTEM BMP SIZING CALCULATOR

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San Francisco, CA 94102

CSS BMP SIZING CALCULATOR - Only use for subwatersheds less than 2 acres, and sites less than 5 acres.

Project Address:	Example 2	Applicant Name:	
Project Name (Alias):	Modified SMR Compliance	Company:	
Total Project Site Area (ft ²):	42,363	Date:	
Subwatershed Name (if applicable):	SW-1 (of 2)		

Modified Compliance Application

Modified Compliance approved?	Yes
2-yr, 24-hr: Peak Flow % Reduction	40%
2-yr, 24-hr: Runoff Volume % Reduction	10%

Project Requirement: Modified Compliance Percent Reductions Entered Above

LEGEND:

User Input
Default Value
Locked
Comment

STEP 4 - Check that site and drainage management areas are entered correctly. (Note: CSS = Combined Sewer System.)

Project Site Surfaces	Existing Area (ft ²)	Proposed Area (ft ²)	CHECK OF AREAS
Impervious Area Draining to BMP	0	24,256	OK
Impervious Area Draining Directly to CSS	31,919	4,615	
Pervious Area Draining to BMP	0	0	OK
Pervious Area Draining Directly to CSS	0	559	
Stormwater BMP Area	0	2,489	
Total Area	31,919	31,919	OK

STEP 5 - Compare if the SMR runoff reductions to quantity control requirements are met. If not, review BMP performance output in Step 6, then return to Step 3 to adjust stormwater strategies.

Quantity Control Parameter	Existing Conditions	Proposed Conditions	% Reduction From Existing Conditions	Target % Reduction	Requirement Met?
1-yr, 24 hr: Peak Flow (cfs)	1.124	0.476	58%	N/A	N/A
1-yr, 24 hr: Runoff Volume (ft ³)	6,435	6,014	7%	N/A	N/A
2-yr, 24 hr: Peak Flow (cfs)	1.355	0.638	53%	40%	YES
2-yr, 24 hr: Runoff Volume (ft ³)	6,972	6,546	6%	10%	NO

Use retention or evapotranspiration BMP measures to reduce runoff volume

STEP 6 - Review the summary table below to see how each BMP performs during the 2-yr 24 hr storm. The site's hydrographs are shown in the "Rainfall and Hydrographs" tab.

Stormwater BMP Measures	Inflows	Outflows		Volume In	Volume Retained		Volume Out to CSS		
	Peak Flow to BMP (cfs)	Peak Rate of Discharged Flow (cfs)	Peak Rate of Overflow (cfs)	Runoff to BMP (ft ³)	Infiltration + E/T (ft ³)	Volume Reuse (ft ³)	Volume Remaining in Storage (ft ³)	Detained Discharge Volume (ft ³)	Overflow Volume (ft ³)
Retention	Bioretention (No Underdrain, No Liner)	0.000	0.000	0.000	0	0	0	0	0
	Cistern	0.000	0.000	0.000	0	0	0	0	0
	Infiltration Trench	0.000	0.000	0.000	0	0	0	0	0
	Dry Well/Infiltration Gallery	0.000	0.000	0.000	0	0	0	0	0
	Permeable Pavement (No Underdrain)	0.000	0.000	0.000	0	0	0	0	0
Detention	Bioretention/FTP (Underdrain, No Liner)	0.000	0.000	0.000	0	0	0	0	0
	Bioretention/FTP (Underdrain, Liner)	0.596	0.098	0.000	3074	231	0	2843	0
	Vegetated Roof	0.000	0.000	0.000	0	0	0	0	0
	Permeable Pavement (Underdrain)	0.059	0.053	0.000	307	55	0	195	0
	Detention Vault	0.477	0.200	0.112	2462	0	0	2428	34
Totals				5,843	286	0	56	5,467	34

For BMPs in Series Only

Volume to Receiving BMP	
Detained Discharge Volume (ft ³)	Overflow Volume (ft ³)
--	--
0	0
--	--
--	--
--	--
0	0
0	0
0	0
--	--
0	0
0	0

NOTE: With the exception of Cisterns, BMP measures should not have any "Volume Remaining in Storage". If volume is remaining in any BMP measures other than a Cistern, check and revise STEP 3b for the "Outlet Design" (outlet/orifice diameter) or underdrain such that the "Approx. Drawdown Time" is less than 48 hours, therefore empty for the next storm event.



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San Francisco, CA 94102

CSS BMP SIZING CALCULATOR - Only use for subwatersheds less than 2 acres, and sites less than 5 acres.

Project Address: Example 2
 Project Name (Alias): Modified SMR Compliance
 Total Project Site Area (ft²): 42,363
 Subwatershed Name (if applicable): SW-2 (of 2)

Applicant Name: _____
 Company: _____
 Date: _____

Modified Compliance Application

Modified Compliance approved? Yes
 2-yr, 24-hr: Peak Flow % Reduction 40%
 2-yr, 24-hr: Runoff Volume % Reduction 10%

Project Requirement: *Modified Compliance Percent Reductions Entered Above*

LEGEND:

User Input
Default Value
Locked
Comment

STEP 1 - Enter the site's infiltration characteristics

HSG Soil Type: D
 Is Infiltration Feasible or Proposed? Yes
 Measured Infiltration Rate (in/hr): 0.02
 Infiltration Testing Method: Double-Ring Infiltrometer
 Infiltration Rate Correction Factor: 0.33
 Design Infiltration Rate (in/hr): 0.01

STEP 2 - Enter the site's EXISTING runoff pathway information to estimate the Time of Concentration (Tc)

Existing Means of Conveying Runoff Offsite? Pipe
 Avg. Site Slope in Direction of Flow (%): 2.0%
 Maximum Flow Length (ft): 200

STEP 3a - Enter the sites EXISTING and PROPOSED areas of impervious, pervious, and BMP surfaces.

	Surface Type	Existing (ft ²)		Proposed (ft ²)		Curve Number
		Existing	Proposed	Existing	Proposed	
Conventional Surfaces	Impervious	Pavement (Conventional)	10,444	4,075	98	
		Roof (Conventional)		901	98	
		Gravel on Soils			91	
		Other:				
		<i>Impervious Areas Subtotal</i>	<i>10,444</i>	<i>4,976</i>		
	Pervious	Grass/Lawn			80	
		Landscaping at Grade (Low Density)			77	
		Landscaping at Grade (High Density)			73	
		Tree Well (ROW Only)			35	
		Traditional Planter on Podium			74	
Other:						
<i>Pervious Areas Subtotal</i>	<i>0</i>	<i>0</i>	<i>--</i>	<i>--</i>		
Stormwater BMPs	Retention	Bioretention (No Underdrain, No Liner)	--	--	--	
		Cistern	--	0	--	
		Infiltration Trench	--	--	--	
		Dry Well/Infiltration Gallery	--	0	--	
		Permeable Pavement (No Underdrain)	--	--	0	
	Detention	Bioretention/FTP (Underdrain, No Liner)	--	--	--	
		Bioretention/FTP (Underdrain, Liner)	--	--	--	
		Vegetated Roof	--	5,468	--	
		Permeable Pavement (Underdrain)	--	--	0	
		Detention Vault or Tank	--	0	--	
<i>BMP Areas Subtotals</i>	<i>--</i>	<i>5,468</i>	<i>--</i>	<i>--</i>		
Total Project Site Areas	10,444	10,444	--	0	0	

BMPs in Series	
Are BMPs in Series Proposed?	No
First BMP in Series	
Receiving BMP in Series	

STEP 3b - Enter stormwater BMP design information AND the conventional areas from Step 3a that drain to each BMP measure.

Impervious Area Draining to BMP (ft ²)	Pervious Area Draining to BMP (ft ²)	BMP Depths and Volumes					Outlet Design	
		BMP Ponding Depth (ft)	BMP Media Depth (ft)	Gravel Storage Depth (ft)	Height of Underdrain Above Base (ft)	Storage Volume (gallons)	Outlet or Orifice Diameter (in)	Approx. Drawdown Time (hrs)
		0.5	1.5			0	--	0
	0	0.0	--	0.00	--	0	0.0	0 days
		--	--	3.00	--	0	--	0
	0	0.0	--	4.00	--		--	0
	0	--	--	1.00	--	0	--	0
		0.5	1.5		0.17	0	4.0	0
		0.5	1.5		--	0	4.0	0
		--	1.00	--	--	13,974	4.0	4
	0	--	--	1.00	0.17	0	4.0	0
		3.0	--	--	--		1.5	0
<i>BMP Areas Subtotals</i>	<i>--</i>	<i>3.0</i>	<i>--</i>	<i>--</i>	<i>--</i>	<i>13,974</i>	<i>--</i>	<i>0</i>
Total Project Site Areas	10,444	10,444	--	0	0	13,974	--	0



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San Francisco, CA 94102

CSS BMP SIZING CALCULATOR - Only use for subwatersheds less than 2 acres, and sites less than 5 acres.

Project Address:	Example 2	Applicant Name:	
Project Name (Alias):	Modified SMR Compliance	Company:	
Total Project Site Area (ft ²):	42,363	Date:	
Subwatershed Name (if applicable):	SW-2 (of 2)		

Modified Compliance Application

Modified Compliance approved?	Yes
2-yr, 24-hr: Peak Flow % Reduction	40%
2-yr, 24-hr: Runoff Volume % Reduction	10%

Project Requirement: Modified Compliance Percent Reductions Entered Above

LEGEND:

User Input
Default Value
Locked
Comment

STEP 4 - Check that site and drainage management areas are entered correctly. (Note: CSS = Combined Sewer System.)

Project Site Surfaces	Existing Area (ft ²)	Proposed Area (ft ²)	CHECK OF AREAS
Impervious Area Draining to BMP	0	0	OK
Impervious Area Draining Directly to CSS	10,444	4,976	
Pervious Area Draining to BMP	0	0	OK
Pervious Area Draining Directly to CSS	0	0	
Stormwater BMP Area	0	5,468	
Total Area	10,444	10,444	OK

STEP 5 - Compare if the SMR runoff reductions to quantity control requirements are met. If not, review BMP performance output in Step 6, then return to Step 3 to adjust stormwater strategies.

Quantity Control Parameter	Existing Conditions	Proposed Conditions	% Reduction From Existing Conditions	Target % Reduction	Requirement Met?
1-yr, 24 hr: Peak Flow (cfs)	0.368	0.295	20%	N/A	N/A
1-yr, 24 hr: Runoff Volume (ft ³)	2,106	1,606	24%	N/A	N/A
2-yr, 24 hr: Peak Flow (cfs)	0.443	0.332	25%	40%	NO
2-yr, 24 hr: Runoff Volume (ft ³)	2,281	1,780	22%	10%	YES

Use detention or retention BMP measures to reduce peak flow

STEP 6 - Review the summary table below to see how each BMP performs during the 2-yr 24 hr storm. The site's hydrographs are shown in the "Rainfall and Hydrographs" tab.

Stormwater BMP Measures	Inflows	Outflows		Volume In	Volume Retained		Volume Out to CSS		
	Peak Flow to BMP (cfs)	Peak Rate of Discharged Flow (cfs)	Peak Rate of Overflow (cfs)	Runoff to BMP (ft ³)	Infiltration + E/T (ft ³)	Volume Reuse (ft ³)	Volume Remaining in Storage (ft ³)	Detained Discharge Volume (ft ³)	Overflow Volume (ft ³)
Retention	Bioretention (No Underdrain, No Liner)	0.000	0.000	0.000	0	0	0	0	0
	Cistern	0.000	0.000	0.000	0	0	0	0	0
	Infiltration Trench	0.000	0.000	0.000	0	0	0	0	0
	Dry Well/Infiltration Gallery	0.000	0.000	0.000	0	0	0	0	0
	Permeable Pavement (No Underdrain)	0.000	0.000	0.000	0	0	0	0	0
Detention	Bioretention/FTP (Underdrain, No Liner)	0.000	0.000	0.000	0	0	0	0	0
	Bioretention/FTP (Underdrain, Liner)	0.000	0.000	0.000	0	0	0	0	0
	Vegetated Roof	0.232	0.120	0.000	1195	501	0	693	0
	Permeable Pavement (Underdrain)	0.000	0.000	0.000	0	0	0	0	0
	Detention Vault	0.000	0.000	0.000	0	0	0	0	0
Totals				1,195	501	0	0	693	0

For BMPs in Series Only

Volume to Receiving BMP	
Detained Discharge Volume (ft ³)	Overflow Volume (ft ³)
--	--
0	0
--	--
--	--
--	--
0	0
0	0
0	0
--	--
0	0
0	0

NOTE: With the exception of Cisterns, BMP measures should not have any "Volume Remaining in Storage". If volume is remaining in any BMP measures other than a Cistern, check and revise STEP 3b for the "Outlet Design" (outlet/orifice diameter) or underdrain such that the "Approx. Drawdown Time" is less than 48 hours, therefore empty for the next storm event.