Appendix

I

Significant Site Design BMP (SSD-BMP) Sizing Methods and Calculations

This page was intentionally left blank.

Appendix I Significant Site Design BMP (SSD-BMP) Sizing Methods and Calculations

I.1 Significant Site Design BMPs (SSD-BMPs)

I.2 Step 1: Determine DCV

I.3 Step 2: Dispersion Areas

I.4 Step 3: Tree Wells

I.1 Significant Site Design BMPs (SSD-BMPs)

Significant site design BMPs (SSD-BMPs) are site design BMPs designed to fully retain the Design Capture Volume (DCV) for the Drainage Management Area (DMA) (Section 5.2.3). Tree Wells (Fact Sheet SD-A), Impervious Area Dispersion (Fact Sheet SD-B), Permeable Pavement (Fact Sheet SD-D), or any other SSD-BMP acceptable to the County may be used. This Appendix provides sizing methods for impervious area dispersion ("dispersion areas") and tree wells used as SSD-BMPs. An automated worksheet is available to prepare the calculations described in this Appendix. Dispersion areas and tree wells may be sized for pollutant control only or for pollutant control plus hydromodification control.

Permeable pavement may be used as an SSD-BMP for pollutant control only. Sizing methods for permeable pavement as an SSD-BMP for pollutant control only are provided in Section 5.2.3 and are not included in this Appendix or the automated worksheet. Hydromodification management performance standards can be satisfied using permeable pavement only if the permeable pavement is constructed to structural BMP specifications in accordance with the requirements of Appendix B and Fact Sheet INF-3.

I.2 Step 1: Determine DCV

The first step in performing design calculations for SSD-BMPs is to calculate the DCV. The DCV represents the volume of storm water runoff that must be retained and/or biofiltered in order to satisfy pollutant control requirements. This step is very similar to the first step in performing storm water pollutant control calculations described in Appendix B for the design of structural BMPs, except that the tree well volume reduction described in Appendix B Section B.1.4, when applicable, will be addressed in Step 3 of the SSD-BMP calculations instead of Step 1.

The DCVs for SSD-BMPs can be calculated through use of the SSD-BMP Automated Worksheet I-1: Step 1. Calculation of Design Capture Volume depicted on the following page or can be calculated manually by following procedures presented in Appendix B, Sections B.1.1 through B.1.3 as well as the rain barrel reduction procedure presented in Appendix B, Section B.1.4 when applicable.

$$DCV = \frac{D}{12}\ x\ A\ x\ C - R$$

Where:
DCV: Design Capture Volume (ft^3).
D: Rainfall Depth (inches), refer to Appendix B Section B.1.1.
A: Tributary Area (ft^2), refer to Appendix B Section B.1.2.
C: Runoff Factor (unitless), refer to Appendix B Section B.1.3.
R: Site Design Volume Reductions from Rain Barrels (ft^3). Refer to Appendix B Section B.1.4 regarding rain barrels (note that when tree wells are used as SSD-BMPs, the volume reduction from the use of tree wells will be addressed in Step 3).

If the project includes dispersion areas, proceed to Step 2: Dispersion Areas. If no dispersion areas are proposed, skip Step 2 and proceed to Step 3: Tree Wells.

SSD-BMP Automated Worksheet I-1: Step 1. Calculation of Design Capture Volume

Category	#	Description	i	Units
Standard Drainage Basin Inputs	1	Drainage Basin ID or Name		unitless
	2	85th Percentile 24-hr Storm Depth		inches
	3	Is Hydromodification Control Applicable?		yes/no
	4	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)		sq-ft
	5	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)		sq-ft
	6	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)		sq-ft
	7	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)		sq-ft
	8	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)		sq-ft
	9	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)		sq-ft
	10	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)		sq-ft
SSD-BMPs Proposed	11	Does Tributary Incorporate Dispersion and/or Rain Barrels?		yes/no
	12	Does Tributary Incorporate Tree Wells?		yes/no
Dispersion Area & Rain Barrel Inputs (Optional)	13	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)		sq-ft
	14	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)		sq-ft
	15	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)		sq-ft
	16	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)		sq-ft
	17	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)		sq-ft
	18	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)		sq-ft
	19	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)		sq-ft
	20	Number of Rain Barrels Proposed per SD-E		#
	21	Average Rain Barrel Size		gal
Initial Runoff Factor Calculation	22	Total Tributary Area	0	sq-ft
	23	Initial Runoff Factor for Standard Drainage Areas	0.00	unitless
	24	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	unitless
	25	Initial Weighted Runoff Factor	0.00	unitless
	26	Initial Design Capture Volume	0	cubic-feet
Dispersion Area Adjustment & Rain Barrel Adjustment	27	Total Impervious Area Dispersed to Pervious Surface	0	sq-ft
	28	Total Pervious Dispersion Area	0	sq-ft
	29	Ratio of Dispersed Impervious Area to Pervious Dispersion Area for DCV Reduction	n/a	ratio
	30	Adjustment Factor for Dispersed & Dispersion Areas	1.00	ratio
	31	Runoff Factor After Dispersion Techniques	n/a	unitless
	32	Design Capture Volume After Dispersion Techniques	0	cubic-feet
	33	Total Rain Barrel Volume Reduction	0	cubic-feet
Results	34	Final Adjusted Runoff Factor	0.00	unitless
	35	Final Effective Tributary Area	0	sq-ft
	36	Initial Design Capture Volume Retained by Dispersion Area and Rain Barrel(s)	0	cubic-feet
	37	Remaining Design Capture Volume Tributary to Tree Well(s)	0	cubic-feet

SSD-BMP Worksheet I-1 Line Item Notes
1. User input from stormwater plans.
2. User input from BMPDM Figure B.1-1.
3. User input from stormwater plans.
4. User input from stormwater plans.
5. User input from stormwater plans.
6. User input from stormwater plans.
7. User input from stormwater plans.
8. User input from stormwater plans.
9. User input from stormwater plans.
10. User input from stormwater plans.
11. User input. Default is "No". Select Yes if any of the referenced elements are proposed.
12. User input. Default is "No". Select Yes if any of the referenced elements are proposed.
13. User input from stormwater plans. Must satisfy criteria from Fact Sheet SD-B.
14. User input from stormwater plans. Must satisfy criteria from Fact Sheet SD-B.
15. User input from stormwater plans. Must satisfy criteria from Fact Sheet SD-B.
16. User input from stormwater plans. Must satisfy criteria from Fact Sheet SD-B.
17. User input from stormwater plans. Must satisfy criteria from Fact Sheet SD-B.
18. User input from stormwater plans. Must satisfy criteria from Fact Sheet SD-B.
19. User input from stormwater plans. Must satisfy criteria from Fact Sheet SD-B.
20. User input. Must satisfy criteria from Fact Sheet SD-E. Cannot provide more than a 25% reduction to initial DCV.
21. User input. Must satisfy criteria from Fact Sheet SD-E. Acceptable range 0-100 gallons for generic volume reductions.
22. Sum of Lines 4 through 19.
23. [0.9(Line 4) + 0.3(Line 5 + Line 10) + 0.1(Line 6 + Line 7) + 0.14(Line 8) + 0.23(Line 9)] /(Sum of Lines 4 through Line 10).
24. [0.9(Line 13) + 0.3(Line 14 + Line 19) + 0.1(Line 15 + Line 16) + 0.14(Line 17) + 0.23(Line 18)] /(Sum of Lines 13 through Line 19).
25. [(Line 23 x (Sum of Lines 4 through 10) + Line 24 x (Sum of Lines 13 through 19)) / Line 22].
26. (Line 2/12) x Line 22 x Line 25.
27. Line 13.
28. Sum of Lines 14 through 19.
29. [Line 27 / Line 28]. If greater than 4.0 dispersion benefits are not quantified.
30. Lookup values from Table B.1-1 weighted with respect to distribution of dispersion areas specified in Lines 14-19.
31. [Line 23 x (Sum of Lines 4 through Line 10) + Line 24 x Line 30 x (Sum of Lines 13 through Line 19)] / Line 22.
32. (Line 2/12) x Line 22 x Line 31.
33. [Line 20 x Line 21/7.48]. Limited to 100 gallons per rain barrel and limited to maximum of 25% of Line 26.
34. Line 31 x [1 - (Line 33/Line 32)]. Value must be between zero and one.
35. Line 22 x Line 34.
36. [(Line 26 - Line 32) + Line 33].
37. [Line 26 - Line 36]. Minimum result of 0.

I.3 Step 2: Dispersion Areas

Dispersion areas are dedicated pervious areas, typically vegetated, with in-situ soil infiltration capacity for partial or full infiltration (Figure I.3-1). Impervious area dispersion refers to the practice of effectively disconnecting impervious areas from directly draining to the storm drain system by routing runoff from the impervious area onto an adjacent pervious dispersion area. The pervious dispersion area surface may consist of natural in-situ soils, amended soils, or permeable pavement. This appendix discusses natural in-situ soils and amended soils. For permeable pavement dispersion areas, refer to Section 5.2.3.

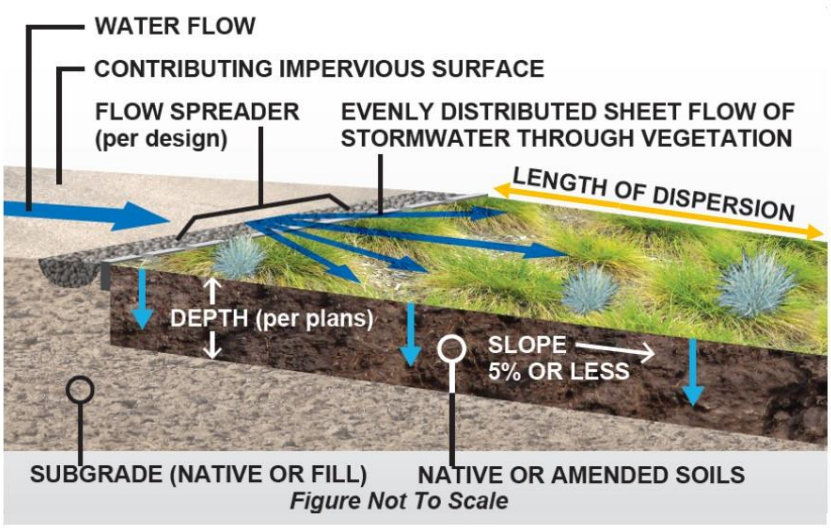

Figure I.3-1 Dispersion Area Schematic

When a dispersion area is proposed to be used as an SSD-BMP, the calculated DCV (Line 37 of the SSD-BMP Automated Worksheet I-1 depicted on the previous pages, "Remaining Design Capture Volume Tributary to Tree Well(s)") must be zero. This is achieved when the ratio of dispersed impervious surface area to total engineered pervious surface and/or natural hydrologic soil group A or B soil dispersion area meets the requirements outlined in Fact Sheet SD-B (2:1 or 1:1 depending on the dispersion area surface and whether hydromodification control applies) and there are no other surfaces within the DMA that contribute to the project DCV, such as surfaces not directed to the dispersion area, semi-pervious surface used as dispersion area, or natural (non-amended) hydrologic soil group C or D soils used as dispersion area.

Semi-pervious surfaces and/or natural (non-amended) hydrologic soil group C or D soils that receive runoff from impervious surfaces may be used as a regular site design BMP to reduce DCV but may not be used as an SSD-BMP because they do not reduce DCV to zero. When soils are amended in accordance with Fact Sheet SD-F, this is considered "engineered pervious surface" regardless of the subgrade. Any natural hydrologic soil group or fill soil may be amended in accordance with Fact Sheet SD-F and then be considered engineered pervious surface.

If the dispersion area is used for pollutant control plus hydromodification control, the dispersion area must include amended soil. As a minimum, the top 11 inches of the pervious area must use amended soils in accordance with Fact Sheet SD-F.

Table I.3-1 summarizes certain design criteria for the use of dispersion areas as SSD-BMPs and illustrates the difference between the criteria for pollutant control only and for pollutant control plus hydromodification control. Refer to Fact Sheet SD-B for additional requirements applicable to all types of dispersion areas.

Table I.3-1 Criteria for use of Dispersion Areas as SSD-BMPs for Pollutant Control Only vs. Pollutant Control Plus Hydromodification Control

SSD-BMP	Criteria for Pollutant Control Only	Criteria for Pollutant Control Plus Hydromodification Control
Dispersion Area (SD-B)	• Ratio of impervious area to engineered pervious surface and/or natural hydrologic soil group A soil area is 2:1 or less; OR ratio of impervious area to natural hydrologic soil group B soil area is 1:1 or less • Sheet flow travel length across dispersion area is 10 feet or more* • Slope is less than 5%	• Ratio of impervious area to engineered pervious surface area is 1:1 or less • Sheet flow travel length across dispersion area is 10 feet or more* • Slope is less than 5% • The top 11 inches of soil is amended in accordance with Fact Sheet SD-F
*Exemption to this minimum travel length criterion may be allowed when the contributing flow path length of the impervious area /pervious area travel length ≤ 2		

The dispersion area sheet flow travel length, slope, and amended soil when applicable must be shown on the project plans. When the SSD-BMP Automated Worksheet is used, these characteristics may be documented in SSD-BMP Automated Worksheet I-2: Step 2. Dispersion Area Validation depicted on the following page in addition to the plans.

Dispersion areas meeting the SSD-BMP criteria do not need an additional downstream BMP. Dispersion areas not meeting the SSD-BMP criteria can be used as regular site design BMPs to reduce the DCV draining to a tree well just as they can be used to reduce the DCV draining to a structural BMP pursuant to Appendix B. If the project includes tree wells, proceed to Step 3: Tree Wells.

SSD-BMP Automated Worksheet I-2: Step 2. Dispersion Area Validation

Category	#	Description	i	Units
Standard Dispersion Area Inputs	1	Drainage Basin ID or Name	-	unitless
	2	Final Design Capture Volume (DCV)	-	cubic-feet
	3	Is Hydromodification Control Applicable?	-	yes/no
	4	Total Impervious Area Dispersed to Pervious Surface	-	sq-ft
	5	Total Engineered Pervious Surface and/or Natural Soil Dispersion Area (Does Not Include Semi-Pervious Surfaces Serving as Dispersion Area)	-	sq-ft
	6	Ratio of Dispersed Impervious Area to Total Engineered Pervious Surface and/or Natural Soil Dispersion Area	-	unitless
	7	Dispersion Area Length (Length of Sheet Flow Across Dispersion Area)		feet
	8	Dispersion Area Slope		%
	9	Thickness of Amended Soil		inches
	10	How is Flow Dispersed Across Width of Dispersion Area (definitions below*)?		unitless
Results	11	Is DCV Requirement Fully Satisfied by Dispersion Area?	-	yes/no
	12	Is Hydromodification Control Requirement Satisfied by Dispersion Area?	-	yes/no
	13	Are Dispersion Area Length, Slope, and Thickness of Amended Soil (when applicable) Adequate?	-	yes/no

Notes:

***How is Flow Dispersed Across Width of Pervious Dispersion Area?**

Sheet Flow:	Flow arrives as sheet flow across the width of the adjacent impervious area
Spreader(s):	Flow is discharged from flow spreader(s) across the width of the pervious area
Roof Drains:	Discharge from roof drains distributed across the width of the pervious area
Curb Cuts:	Discharge from curb cuts distributed across the width of the pervious area
Other:	Other (Describe in PDP SWQMP)

SSD-BMP Worksheet I-2 Line Item Notes
1. Populated per result of Worksheet I-1 (Step 1. DCV) Line 1.
2. Populated per result of Worksheet I-1 (Step 1. DCV) Line 37.
3. Populated per result of Worksheet I-1 (Step 1. DCV) Line 3.
4. Populated per result of Worksheet I-1 (Step 1. DCV) Line 13.
5. Populated per result of Worksheet I-1 (Step 1. DCV) Sum of Lines 15 through 19.
6. Line 4 / Line 5.
7. User input from stormwater plans.
8. User input from stormwater plans.
9. User input from stormwater plans.
10. User input from stormwater plans.
11. "Yes" when DCV = 0.
12. When hydromodification control is applicable, "Yes" when remaining DCV=0, ratio<=1, and thickness >=11.0 inches.
13. "Yes" when length, slope, and thickness (for hydromodification control) meet requirements of SD-B.

I.4 Step 3: Tree Wells

A tree well as a storm water management feature consists of a tree with a minimum amount of soil media to allow for storage, infiltration, and evapotranspiration of runoff (Figure I.4-1).

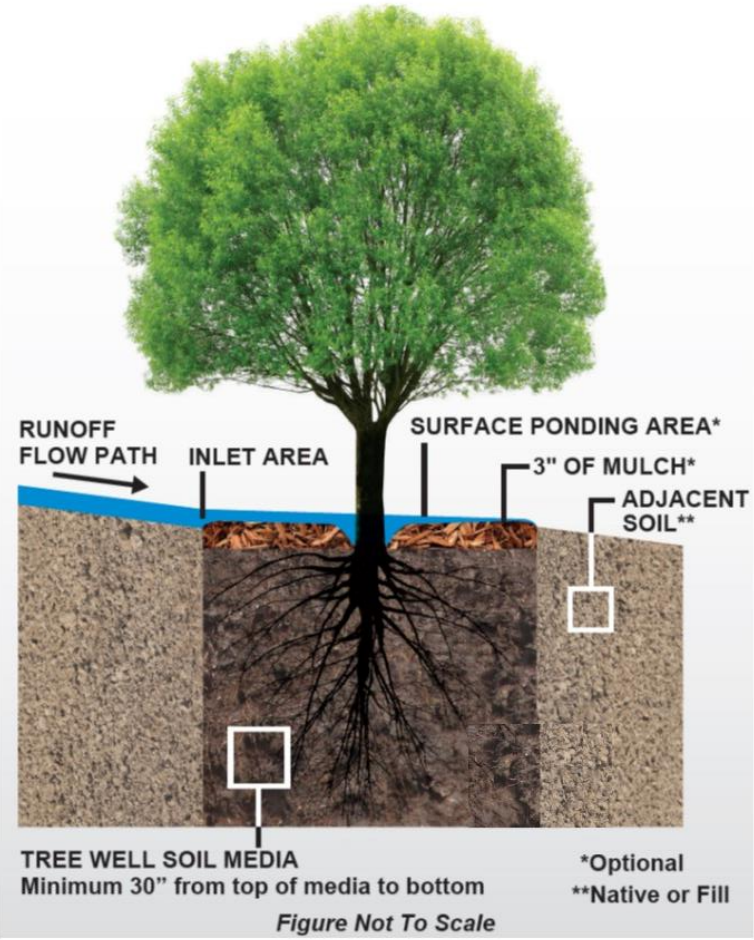

Figure I.4-1 Tree Well Schematic

Tree wells as SSD-BMPs must provide tree credit volume equal to or greater than the DCV for pollutant control only; or for pollutant control plus hydromodification control provide tree credit volume equal to or greater than the required retention volume (RRV), where RRV accounts for a multiplier applied to the DCV value. Tree credit volume for a single tree is based on the mature canopy diameter of the tree. More than one tree may be used in a single DMA in order to provide the total required volume. The tree well must also include tree well soil based on the mature tree canopy diameter in accordance with Fact Sheet SD-A.

Table I.4-1 summarizes certain design criteria for the use of tree wells as SSD-BMPs and illustrates the difference between the criteria for pollutant control only and for pollutant control plus hydromodification control. Refer to Fact Sheet SD-A for additional requirements applicable to all types of tree wells.

Table I.4-1 Criteria for use of Tree Wells as SSD-BMPs for Pollutant Control Only vs. Pollutant Control Plus Hydromodification Control

SSD-BMP	Criteria for Pollutant Control Only	Criteria for Pollutant Control Plus Hydromodification Control
Tree Well (SD-A)	• The total tree credit volume is greater than DCV • Provide tree well soil based on the mature tree canopy diameter in accordance with Fact Sheet SD-A	• The total tree credit volume is greater than RRV, where RRV accounts for a multiplier applied to the DCV value • Provide tree well soil based on the mature tree canopy diameter in accordance with Fact Sheet SD-A

Tree well design can be prepared through the use of SSD-BMP Automated Worksheet I-3: Step 3. Tree Well Sizing depicted on the following page or can be calculated manually by following procedures below in Sections I.4.1 through I.4.4.

SSD-BMP Automated Worksheet I-3: Step 3. Tree Well Sizing

Category	#	Description	i	Units
Standard Tree Well Inputs	1	Drainage Basin ID or Name	-	unitless
	2	Design Capture Volume Tributary to BMP	-	cubic-feet
	3	Is Hydromodification Control Applicable?	-	yes/no
	4	Predominant NRCS Soil Type Within Tree Well(s) Location		unitless
	5	Select a Tree Species for the Tree Well(s) Consistent with SD-A Tree Palette Table Note: Numbers shown in list are Tree Species Mature Canopy Diameters		unitless
	6	Tree Well(s) Soil Depth (Installation Depth) Must be 30, 36, 42, or 48 Inches; Select from Standard Depths**		inches
	7	Number of Identical* Tree Wells Proposed for this DMA		trees
	8	Proposed Width of Tree Well(s) Soil Installation for One (1) Tree		feet
	9	Proposed Length of Tree Well(s) Soil Installation for One (1) Tree		feet
Tree Data	10	Botanical Name of Tree Species	-	unitless
	11	Tree Species Mature Height per SD-A	-	feet
	12	Tree Species Mature Canopy Diameter per SD-A	-	feet
	13	Minimum Soil Volume Required In Tree Well (2 Cubic Feet Per Square Foot of Mature Tree Canopy Projection Area)	-	cubic-feet
	14	Credit Volume Per Tree	-	cubic-feet
Tree Well Sizing Calculations	15	DCV Multiplier To Meet Flow Control Requirements	-	unitless
	16	Required Retention Volume (RRV) To Meet Flow Control Requirements	-	cubic-feet
	17	Number of Trees Required	-	trees
	18	Total Area of Tree Well Soil Required for Each Tree	-	sq-ft
	19	Approximate Required Width of Tree Well Soil Area for Each Tree	-	feet
	20	Approximate Required Length of Tree Well Soil Area for Each Tree	-	feet
	21	Number of Trees Proposed for this DMA	-	trees
	22	Total Area of Tree Well Soil Proposed for Each Tree	-	sq-ft
	23	Minimum Spacing Between Multiple Trees To Meet Soil Area Requirements (when applicable)***	-	feet
Results	24	Are Tree Well Soil Installation Requirements Met?	-	yes/no
	25	Is Remaining DCV Requirement Fully Satisfied by Tree Well(s)?	-	yes/no
	26	Is Hydromodification Control Requirement Satisfied by Tree Well(s)?	-	yes/no

Notes:

*If using more than one mature canopy diameter within the same DMA, only the smallest mature canopy diameter should be entered. Alternatively, if more than one mature canopy diameter is proposed and/or the dimensions of multiple tree well installations will vary, separate DMAs may be delineated.

**If the actual proposed installation depth is not available in the table of standard depths, select the next lower depth.

***Tree Canopy or Agency Requirements May Also Influence the Minimum Spacing of Trees.

SSD-BMP Worksheet I-3 Line Item Notes
1. Populated per result of Worksheet I-1 (Step 1. DCV) Line 1.
2. Populated per result of Worksheet I-1 (Step 1. DCV) Line 37.
3. Populated per result of Worksheet I-1 (Step 1. DCV) Line 3.
4. User input from stormwater plans. Only required when hydromodification control is applicable.
5. User input from stormwater plans. Select from Tree Palette Table in SD-A Tree Wells Fact Sheet. Tree species other than those listed are allowable, but must be approved by the County. Provide documentation in PDP SWQMP for alternative species.
6. User input from stormwater plans. In accordance with SD-A Tree Wells Fact Sheet, depth must be 30 inches or greater. Select from standard depths typical of tree box sizes. If the actual proposed installation depth is not available in the table of standard depths, select the next lower depth.
7. User input from stormwater plans.
8. User input from stormwater plans.
9. User input from stormwater plans.
10. Populated based on selected tree species from Tree Palette Table in SD-A Tree Wells Fact Sheet. Provide documentation in PDP SWQMP for alternative species.
11. Populated from Tree Palette Table in SD-A Tree Wells Fact Sheet. Provide documentation in PDP SWQMP for alternative species.
12. Populated from Tree Palette Table in SD-A Tree Wells Fact Sheet. Provide documentation in PDP SWQMP for alternative species.
13. 2 cubic feet per square foot of mature tree canopy projection area: 2 x Pi x ((Line 12)/2)^2.
14. Populated from Tree Palette Table in SD-A Tree Wells Fact Sheet based on Mature Canopy Diameter.
15. When hydromodification control is applicable, populated from DCV Multiplier Table in SD-A Tree Wells Fact Sheet based on hydrologic soil type and tree well soil installation depth.
16. When hydromodification control is applicable, DCV Multiplier x DCV: Line 15 x Line 2.
17. When hydromodification control is applicable, Line 16 / Line 14 (RRV / Credit Volume per Tree); otherwise Line 2 / Line 14 (DCV / Credit Volume per Tree).
18. Minimum required volume (2 cubic feet per square foot of mature tree canopy projection area) / proposed installation depth: Line 13 / ((Line 6)/12).
19. The square root of the required area (assumes a square installation): (Line 13 / ((Line 6)/12))^0.5. This is a guideline for the user to estimate the installation size; however, the actual length, width and configuration may vary. Lines 7 and 8 control the final result.
20. The square root of the required area (assumes a square installation): (Line 13 / ((Line 6)/12))^0.5. This is a guideline for the user to estimate the installation size; however, the actual length, width and configuration may vary. Lines 7 and 8 control the final result.
21. Reflects user input from Line 7.
22. Line 8 x Line 9.
23. When number of trees proposed > 1, Maximum of Mature Canopy Diameter or Proposed Dimension of Soil Installation (Line 12 or Lines 8 and 9).
24. "Yes" when Lines 3 through 9 are completed and soil installation requirements are satisfied.
25. "Yes" when Lines 3 through 9 are completed and credit volume requirement is satisfied.
26. When hydromodification control is applicable, "Yes" when Lines 3 through 9 are completed and required retention volume is satisfied.

I.4.1 Step 3.1: Determine DCV or RRV as applicable

To design a tree well as an SSD-BMP, first determine whether the tree well is to be sized for pollutant control only or pollutant control plus hydromodification control. Tree wells sized for pollutant control only must provide tree credit volume for the total DCV from the DMA (previously determined in Step 1) tributary to the tree well. Tree wells sized for pollutant control plus hydromodification control must be provide tree credit volume for the RRV tributary to the tree well, where RRV is the total DCV from the DMA increased by a DCV multiplier provided in Fact Sheet SD-A. Table I.4-1 presents the DCV multipliers from Fact Sheet SD-A.

Table I.4-1 DCV Multiplier Table from Fact Sheet SD-A

Minimum Tree Well Soil Depth (inches)	Hydrologic Soil Group				
	A	B	C	D (Default)	
30"	1.60	2.20	2.50	2.90	DCV Multiplier
36"	1.80	2.47	2.83	3.17	
42"	2.00	2.73	3.17	3.43	
48"	2.20	3.00	3.50	3.70	

The DCV multiplier to determine RRV is based on the underlying hydrologic soil group at the location of the tree well and the minimum tree well soil depth. Determining the tree well soil depth requires coordination with the selection of the tree species (Step 3.2). Therefore, determination of the DCV multiplier and RRV may be an iterative process with Step 3.2, selection of tree species and tree well soil depth. The minimum tree well soil depth is 30 inches. If the actual proposed tree well soil depth is not shown in the table of DCV multipliers, select the next lower depth from the table for the purpose of determining the DCV multiplier. For example, if the proposed tree well soil depth is 60 inches, select 48 inches from the table for the purpose of determining the DCV multiplier.

Multiply the DCV by the DCV multiplier to obtain the RRV.

$$RRV\ (ft^3) = DCV\ (ft^3)\ x\ DCV\ Multiplier$$

I.4.2 Step 3.2: Select a tree species and tree well soil depth

Select a tree species that will provide sufficient tree credit volume to meet the DCV or RRV as applicable. Fact Sheet SD-A provides a tree palette table and the tree credit volume per tree, which is based on the mature canopy diameter of the tree. Selection of the tree species should be coordinated with the project landscape architect. Multiple trees may be used in a single DMA to collectively provide sufficient tree credit volume, provided that drainage from the DMA is distributed equally to the trees. If the DMA drainage is not distributed equally to the proposed trees, split the DMA into smaller DMAs and size the proposed tree wells individually based on the DCV or RRV tributary to each tree.

Coordinate with the project landscape architect to determine the tree well soil depth. Ensure that the proposed tree well soil depth is appropriate to the size and type of tree(s) proposed.

I.4.3 Step 3.3: Determine the minimum soil volume required in the tree well

The minimum soil volume required in the tree well is based on the mature canopy diameter of the proposed tree. A tree well for storm water control requires a minimum of 2 cubic feet of soil per square foot of mature tree canopy projection area in accordance with the SD-A Tree Wells Fact Sheet. The minimum tree well soil volume can be calculated by the following equation:

$$Minimum\ Tree\ Well\ Soil\ Volume\ (ft^3) = 2\ x\ \pi\ x\ \left(\frac{D}{2}\right)^2$$

Where D = mature canopy diameter (feet)

I.4.4 Step 3.4: Determine tree well soil installation area and show on plans

Based on the required tree well soil volume and proposed tree well soil depth, the minimum area required for the tree well soil can be determined.

$$Minimum\ Tree\ Well\ Soil\ Area\ (ft^2) = \frac{Minimum\ Tree\ Well\ Soil\ Volume\ (ft^3)}{Tree\ Well\ Soil\ Depth\ (ft)}$$

Show the proposed tree well soil area on the project plans. Ensure that the area reserved for tree well soil meets the following requirements:

- The tree well soil must be placed within 1.5 times the mature tree canopy radius.

When multiple trees are used, the trees must be spaced so that the minimum tree well soil volume for each tree does not overlap.

This page was intentionally left blank.