Appendix A New Development Design Forms

ATTENTION TO PERSONS USING THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT SUPPLIED DESIGN FORM WORKSHEETS

The Design Form Worksheets with the accompanying Visual Basic macros have been developed using a high standard of care, including professional review for identification of errors, bugs, and other problems related to the software. Minor modifications have been made by the City of Colorado Springs. However, as with any initial release of software driven products, it is likely that some nonconformities, defects, bugs, and errors with the software program will be discovered as they become more widely used. The developers of these products welcome user feedback in helping to identify these potential problems so that improvements can be made to future releases of the Design Form Worksheets.

The Design Form Worksheets are intended to streamline the preliminary design process. Preparation of final design plans, addressing details of structural adequacy, public safety, hydraulic functionality, maintainability, and aesthetics, remain the sole responsibility of the designer.

BY THE INSTALLATION AND USE OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT SUPPLIED DESIGN FORM WORKSHEETS, AS MODIFIED BY THE CITY OF COLORADO SPRINGS, THE USER AGREES TO THE FOLLOWING:

NO LIABILITY FOR CONSEQUENTIAL DAMAGES

To the maximum extent permitted by applicable law, in no event shall the Urban Drainage and Flood Control District or the City of Colorado Springs, their contractors, advisors, reviewers, or their member governmental agencies, be liable for any incidental, special, punitive, exemplary, or consequential damages whatsoever (including, without limitation, damages for loss of business profits, business interruption, loss of business information or other pecuniary loss) arising out of the use or inability to use these products, even if the Urban Drainage and Flood Control District or the City of Colorado Springs, their contractors, advisors, reviewers, or their member governmental agencies have been advised of the possibility of such damages. In any event, the total liability of the Urban Drainage and Flood Control District or the City of Colorado Springs, their contractors, advisors, reviewers, or their member governmental agencies, and your exclusive remedy, shall not exceed the amount of fees paid by you to the Urban Drainage and Flood Control District for the Product.

NO WARRANTY

The Urban Drainage and Flood Control District or the City of Colorado Springs, their contractors, advisors, reviewers, or their member governmental agencies do not warrant that the Design Form Worksheets will meet your requirements, or that the use of this product will be uninterrupted or error free.

THIS PRODUCT IS PROVIDED “AS IS” AND THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT OR THE CITY OF COLORADO SPRINGS, THEIR CONTRACTORS, ADVISORS, REVIEWERS, AND THEIR MEMBER GOVERNMENTAL AGENCIES DISCLAIM ALL WARRENTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY WARRENTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, PERFORMANCE LEVELS, COURSE OF DEALING OR USAGE IN TRADE.

Modifications made to UDFCD Design Form Worksheets by the City of Colorado Springs, CO:

Design Procedure Form: Grass Swale (GS) Sedimentation Facility

1. 2-Year design flow velocity changed from 1.5 fps to 2.0 fps Maximum
2. 2-year Design Flow Depth, D2 changed from 2 feet maximum to 3 feet Maximum

Design Procedure Form: Extended Detention Basin (EDB) – Sedimentation Facility

1. Basin Side Slopes (Z, horizontal distance per unit vertical), Z changed from 4 Minimum to 3 Minimum
2. Dam Embankment Side Slopes (Z, horizontal distance per unit vertical), Z changed from 4 Minimum to 3 Minimum

Design Procedure Form: Sand Filter Basin (SFB)

1. Average Side Slope of the Filter Basin changed from 4:1 or flatter to 3:1 or flatter.

Design Procedure Form: Constructed Wetland Basin (CWB) – Sedimentation Facility

1. Average Side Slope Above Water Surface changed from 4:1 or flatter to 3:1 or flatter.

Design Procedure Form: Grass Buffer (GB)

Designer: _____

Company: _____

Date: _____

Project: _____

Location: _____

1. 2-Year Design Discharge (Total)	Q_2 = _____ cfs
2. Tributary Catchment Flow A) Design Length (Normal to runoff flow path): $L_G = Q_2 / 0.05$ B) Tributary Area in Square Feet (A_t)	 L_G = _____ feet A_t= _____ square feet
3. Design Width Along Direction of Flow (Use A **or** B) A) Sheet Flow Control Upstream i) Length of Flow Path Over Upstream Impervious Surface ii) Design Width of Buffer: $W_G = 0.2 * L_I$ (8' minimum) B) Concentrated (Non-Sheet) Flow Control Upstream (requires a level spreader in step 5 below) i) Length of Upstream Flow Level Spreader ii) Design Width of Buffer: $W_G = 0.15 * A_t / L_t$ (8' minimum)	 L_I = _____ feet W_G = _____ feet L_t = _____ feet W_G = _____ feet
4. Design Slope (not to exceed 4%)	S = _____ %
5. Flow Distribution (Check the type used or describe "Other") Note: If Method B was Used In Step 3, Level Spreader Must Be Checked Here	_____ Slotted Curbing _____ Modular Block Porous Pavement _____ Level Spreader _____ Other: _____
6. Vegetation (Check the type used or describe "Other") Note: Irrigated Turf Grass Is Required in Semi-Arid Climates	_____ Irrigated Turf Grass _____ Non-Irrigated Turf Grass _____ Other: _____
7. Outflow Collection (Check the type used or describe "Other")	_____ Grass Lined Swale _____ Street Gutter _____ Storm Sewer Inlet _____ Underdrain Used _____ Other: _____

Notes: _____

Design Procedure Form: Grass Swale (GS) Sedimentation Facility

Designer: _____
Company: _____
Date: _____
Project: _____
Location: _____

1. 2-Year Design Discharge (Total)	Q_2 = _____ cfs
2-Year Design Flow Velocity (V_2, 2.0 fps Maximum)	V_2 = _____ fps
2. Swale Geometry	
A) Channel Side Slopes (Z, horizontal distance per unit vertical)	Z = _____ (horizontal/vertical)
B) 2-Year Design Flow Depth (D_2, 3 feet Maximum)	D_2 = _____ feet
C) Bottom Width of Channel (B)	B = _____ feet
3. Longitudinal Slope	
A) Froude Number (F, 0.50 maximum, reduce V_2 until F $\leq$ 0.50)	F = _____
A) Design Slope (S, Based on Manning's n = 0.05, 0.01 Maximum)	S = _____ feet/feet
B) Number of grade control structures required	_____ (number)
4. Vegetation (Check the type used or describe "Other") (Must use irrigated turf grass if S >0.005 in semi-arid areas of Colorado)	_____ Dryland Grass _____ Irrigated Turf Grass _____ Other: _____
5. Outlet (Check the type used or describe "Other")	_____ Infiltration Trench w/ Underdrain _____ Grated Inlet _____ Other: _____

Notes: _____

Design Procedure Form: Modular Block Porous Pavement (MBP)

Designer: _____
Company: _____
Date: _____
Project: _____
Location: _____

1. Modular Block Properties May substitute MBP with reinforced turf pavement such as provided by Invisible Structures (or equal). Note: Blocks shall have no less than 40% open area and shall be no less than 4" thick	Block Name: _____ Manufacturer: _____ Open Surface Area = _____ % Thickness = _____ inches
2. Porous Pavement Infill (Check the type or describe "Other")	_____ ASTM C-33 Sand _____ Sandy Loam Sod _____ Other: _____
3. Base Course A) Sand (ASTM C-33) B) Gravel (AASHTO #8 Coarse Aggregate-CDOT Section 703)	 _____ 1" Layer ASTM C-33 Sand _____ Other: _____ _____ 9" Layer AASHTO #8 Course Agg. _____ Other: _____
4. Design Impervious Area to Porous Pavement Area Ratio (Not to Exceed 2.0)	Ratio = _____ (A_{IMP} / A_{POROUS})
5. Perimeter Wall (6" deeper than base coarse)	_____ Concrete _____ inches thick _____ Other _____
6. Contained Cells A) Type B) Slope of the base course C) Minimum distance between cutoffs (normal to flow, L_{MAX}) $L_{MAX} = 0.8 / S_O$	 _____ 15 mil (min) P.E. Liner _____ Concrete Wall S_O = _____ ft/ft L_{MAX} = _____ feet
7. Draining of modular block pavement (Check a, **or** b, **or** c, **answer** d) Based on answers to 7a through 7d, check the appropriate method a) Check box if subgrade is heavy or expansive clay ☐ b) Check box if subgrade is silty or clayey sands ☐ c) Check box if subgrade is well-draining soils ☐ d) Does tributary catchment contain land uses that may have petroleum products, greases, or other chemicals present, such as gas station, hardware store, restaurant, etc.? yes ☐ no ☐	_____ Infiltration to Subgrade with Permeable Membrane: 7(c) checked **and** 7(d) = no _____ Underdrain with Impermeable Membrane: 7(a) checked **or** 7(d) = yes _____ Underdrain with Permeable Membrane: 7(b) checked **and** 7(d) = no _____ Other: _____

Notes: _____

Design Procedure Form: Porous Pavement Detention (PPD)

Designer: _____
Company: _____
Date: _____
Project: _____
Location: _____

1. Basin Storage Volume A) Tributary Area's Imperviousness Ratio (i = I_a / 100) (I_a = 100% if all paved and roofed areas) B) Contributing Watershed Area, Including PPD Area C) Water Quality Capture Volume (WQCV) (WQCV = 0.8 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I)) D) Design Volume: Vol = (WQCV / 12) * Area E) Porous Pavement Suface Elevation	I_a = _____ % i = _____ Area = _____ square feet WQCV = _____ watershed inches Vol = _____ cubic feet Elev. = _____ feet
2. Required Minimum MBP Surface Area: A = Vol / 0.17 Overflow Inlet Elevation: Porous Pavement Elev. + 0.17 feet	A = _____ square feet Elev. = _____ feet
3. Modular Block Properties Note: Blocks shall have no less than 40% open area and shall be no less than 4" thick	Block Name: _____ Manufacturer: _____ Open Surface Area = _____ % Thickness (4" min.) _____ inches
4. Porous Pavement Infill (Check the type used or describe "Other")	_____ ASTM C-33 Sand _____ Other: _____
5. Base Course A) Sand B) Gravel	_____ 1" Layer ASTM C-33 Sand _____ Other: _____ _____ 9" Layer AASHTO #8 Course Agg. _____ Other: _____
6. Perimeter Wall (required)	_____ Concrete _____ inches thick _____ Other: _____
7. Draining of porous pavement (Check a, **or** b, **or** c, **answer** d) Based on answers to 7a through 7d, check the appropriate method a) Check box if subgrade is heavy or expansive clay ☐ b) Check box if subgrade is silty or clayey sands ☐ c) Check box if subgrade is well-draining soils ☐ d) Does tributary catchment contain land uses that may have petroleum products, greases, or other chemicals present, such as gas station, hardware store, restaurant, etc.? yes ☐ no ☐	_____ Infiltration to Subgrade with Permeable Membrane: 7(c) checked **and** 7(d) = no _____ Underdrain with Impermeable Membrane: 7(a) checked **or** 7(d) = yes _____ Underdrain with Permeable Membrane: 7(b) checked **and** 7(d) = no _____ Other: _____
8. Overflow For Larger Storms	_____ Yes / No

Notes: _____

Design Procedure Form: Porous Landscape Detention (PLD)

Designer: _____
Company: _____
Date: _____
Project: _____
Location: _____

1. Basin Storage Volume (I_a = 100% if all paved and roofed areas u/s of PLD) A) Tributary Area's Imperviousness Ratio (i = I_a / 100)	I_a = _____ % i = _____
B) Contributing Watershed Area Including the PLD (Area)	Area = _____ square feet
C) Water Quality Capture Volume (WQCV) (WQCV = 0.8 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I)) D) Design Volume: Vol_{PLD} = (WQCV / 12) * Area	WQCV = _____ watershed inches Vol = _____ cubic feet
2. PLD Surface Area (A_{PLD}) and Average Depth (d_{av}) (d_{av}: = (Vol / A_{PLD}), Min=0.5', Max=1.0')	A_{PLD} = _____ square feet d_{av} = _____ feet
3. Base Course (See Figure PLD-1)	_____ 6" (Min.) Sandy Loam Turf Layer, Plus 18" (Min.) Layer of 25% Peat and 75% Sand Mix, Plus 9" (Min.) Layer of ASSHTO #8 Coarse Aggregate (CDOT Section 703 Specification). _____ Other: _____
5. Draining of porous pavement (Check a, **or** b, **or** c, **answer** d) Based on answers to 5a through 5d, check the appropriate method a) Check box if subgrade is heavy or expansive clay ☐ b) Check box if subgrade is silty or clayey sands ☐ c) Check box if subgrade is well-draining soils ☐ d) Does tributary catchment contain land uses that may have petroleum products, greases, or other chemicals present, such as gas station, hardware store, restaurant, etc.? yes ☐ no ☐	_____ Infiltration to Subgrade with Permeable Membrane: 5(c) checked **and** 5(d) = no _____ Underdrain with Impermeable Membrane: 5(a) checked **or** 5(d) = yes _____ Underdrain with Permeable Membrane: 5(b) checked **and** 5(d) = no _____ Other: _____

Notes: _____

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer: _____

Company: _____

Date: _____

Project: _____

Location: _____

1. Basin Storage Volume	
A) Tributary Area's Imperviousness Ratio (i = I_a / 100)	I_a = _____ % i = _____
B) Contributing Watershed Area (Area)	Area = _____ acres
C) Water Quality Capture Volume (WQCV) (WQCV =1.0 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I))	WQCV = _____ watershed inches
D) Design Volume: Vol = (WQCV / 12) * Area * 1.2	Vol = _____ acre-feet
2. Outlet Works	
A) Outlet Type (Check One)	_____ Orifice Plate _____ Perforated Riser Pipe _____ Other: _____
B) Depth at Outlet Above Lowest Perforation (H)	H = _____ feet
C) Required Maximum Outlet Area per Row, (A_o)	A_o = _____ square inches
D) Perforation Dimensions **(enter one only)**: i) Circular Perforation Diameter **OR** ii) 2" Height Rectangular Perforation Width	 D = _____ inches, **OR** W = _____ inches
E) Number of Columns (nc, See Table 6a-1 For Maximum)	nc = _____ number
F) Actual Design Outlet Area per Row (A_o)	A_o = _____ square inches
G) Number of Rows (nr)	nr = _____ number
H) Total Outlet Area (A_{ot})	A_{ot} = _____ square inches
3. Trash Rack	
A) Needed Open Area: A_t = 0.5 * (Figure 7 Value) * A_{ot}	A_t = _____ square inches
B) Type of Outlet Opening (Check One)	_____ ≤ 2" Diameter **Round** _____ 2" High **Rectangular** _____ Other: _____
C) For 2", or Smaller, **Round Opening** (Ref.: Figure 6a):	
i) Width of Trash Rack and Concrete Opening (W_{conc}) from Table 6a-1	W_{conc} = _____ inches
ii) Height of Trash Rack Screen (H_{TR})	H_{TR} = _____ inches

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer: _____
Company: _____
Date: _____
Project: _____
Location: _____

iii) Type of Screen (Based on Depth H), Describe if "Other"	_____ S.S. #93 VEE Wire (US Filter) _____ Other: _____
iv) Screen Opening Slot Dimension, Describe if "Other"	_____ 0.139" (US Filter) _____ Other: _____
v) Spacing of Support Rod (O.C.) Type and Size of Support Rod (Ref.: Table 6a-2)	_____ inches
vi) Type and Size of Holding Frame (Ref.: Table 6a-2)	
D) For 2" High **Rectangular Opening** (Refer to Figure 6b):	
I) Width of Rectangular Opening (W)	W = _____ inches
ii) Width of Perforated Plate Opening (W_{conc} = W + 12")	W_{conc} = _____ inches
iii) Width of Trashrack Opening ($W_{opening}$) from Table 6b-1	$W_{opening}$ = _____ inches
iv) Height of Trash Rack Screen (H_{TR})	H_{TR} = _____ inches
v) Type of Screen (based on depth H) (Describe if "Other")	_____ Klemp™ KPP Series Aluminum _____ Other: _____
vi) Cross-bar Spacing (Based on Table 6b-1, Klemp™ KPP Grating). Describe if "Other"	_____ inches _____ Other: _____
vii) Minimum Bearing Bar Size (Klemp™ Series, Table 6b-2) (Based on depth of WQCV surcharge)	
4. Detention Basin length to width ratio	_____ (L/W)
5 Pre-sedimentation Forebay Basin - Enter design values	
A) Volume (5 to 10% of the Design Volume in 1D)	_____ acre-feet
B) Surface Area	_____ acres
C) Connector Pipe Diameter (Size to drain this volume in 5-minutes under inlet control)	_____ inches
D) Paved/Hard Bottom and Sides	_____ yes/no

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer: _____

Company: _____

Date: _____

Project: _____

Location: _____

6. Two-Stage Design	
A) Top Stage (D_{WQ} = 2' Minimum)	D_{WQ} = _____ feet Storage= _____ acre-feet
B) Bottom Stage (D_{BS} = D_{WQ} + 1.5' Minimum, D_{WQ} + 3.0' Maximum, Storage = 5% to 15% of Total WQCV)	D_{BS} = _____ feet Storage= _____ acre-feet Surf. Area= _____ acres
C) Micro Pool (Minimum Depth = the Larger of 0.5 * Top Stage Depth or 2.5 Feet)	Depth= _____ feet Storage= _____ acre-feet Surf. Area= _____ acres
D) Total Volume: Vol_{tot} = Storage from 5A + 6A + 6B Must be ≥ Design Volume in 1D	Vol_{tot} = _____ acre-feet
7. Basin Side Slopes (Z, horizontal distance per unit vertical) Minimum Z = 3, Flatter Preferred	Z = _____ (horizontal/vertical)
8. Dam Embankment Side Slopes (Z, horizontal distance) per unit vertical) Minimum Z = 3, Flatter Preferred	Z = _____ (horizontal/vertical)
9. Vegetation (Check the method or describe "Other")	_____ Native Grass _____ Irrigated Turf Grass _____ Other: _____

Notes: _____

Design Procedure Form: Sand Filter Basin (SFB)

Designer: _____
Company: _____
Date: _____
Project: _____
Location: _____

1. Basin Storage Volume	
A) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	I_a = _____ % i = _____
B) Contributing Watershed Area (Area)	Area = _____ acres
C) Water Quality Capture Volume (WQCV) ($WQCV = 1.0 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I)$)	WQCV = _____ watershed inches
D) Design Volume: Vol = (WQCV / 12) * Area	Vol = _____ acre-feet
2. Minimum Filter Surface Area: A_s = (Vol / 3) * 43,560	A_s = _____ square feet
Filter Surface Elevation	_____ feet
Average Side Slope of the Filter Basin (3:1 or flatter)	Z = _____
3. Estimate of Basin Depth (D), based on filter area A_s	D = _____ feet
4. Outlet Works	
A) Sand (ASTM C-33) Layer Thickness (18" min.)	_____ inches
Gravel (AASHTO No. 8; CDOT Section 703) Layer Thickness (9" min.)	_____ inches
B) Overflow Elevation At Top of Design Volume (Filter Surface Elev. + Estimate of Basin Depth (D))	_____ feet
5. Draining of porous pavement (Check a, **or** b, **or** c, **answer** d) Based on answers to 5a through 5d, check the appropriate method	_____ Infiltration to Subgrade with Permeable Membrane: 5(c) checked **and** 5(d) = no
a) Check box if subgrade is heavy or expansive clay	_____ Underdrain with Impermeable Membrane: 5(a) checked **or** 5(d) = yes
b) Check box if subgrade is silty or clayey sands	
c) Check box if subgrade is well-draining soils	_____ Underdrain with Permeable Membrane: 5(b) checked **and** 5(d) = no
d) Does tributary catchment contain land uses that may have petroleum products, greases, or other chemicals present, such as gas station, hardware store, restaurant, etc.? yes ☐ no ☐	_____ Other: _____
6 Describe Provisions for Maintenance	_____

Notes: _____

Design Procedure Form: Constructed Wetland Basin (CWB) - Sedimentation Facility

Designer: _____

Company: _____

Date: _____

Project: _____

Location: _____

1. Basin Storage Volume	
A) Tributary Area's Imperviousness Ratio (i = I_a / 100)	I_a = _____ % i = _____
B) Contributing Watershed Area (Area)	Area = _____ acres
C) Water Quality Capture Volume (WQCV) (WQCV =0.9 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I))	WQCV = _____ watershed inches
D) Design Volume: Vol = (WQCV / 12) * Area	Vol = _____ acre-feet
2. Wetland Pond Volume, Depth, and Water Surface Area	
A) Minimum Permanent Pool: $Vol_{Pool} \geq 0.75 * Vol$	Calculated Required Minimums: $Vol_{Pool} \geq$ _____ acre-feet WS Area = _____ acres, estimated Enter the Actual Design Values: $Vol_{Pool} \geq$ _____ acre-feet, final design WS Area = _____ acres, final design
B) Forebay (Volume $\geq$ 0.05 * Vol in 1D) Depth minimum = 2.5', maximum = 4.0'	Volume= _____ acre-feet Depth= _____ feet Area= _____ acres, % = _____ %
C) Outlet Pool (Area > 0.06 * Design WS Area) Depth minimum = 2.5', maximum = 4.0'	Depth= _____ feet Area= _____ acres, % = _____ %
D) Wetland Zones with Emergent Vegetation (6" to 12" deep) (Area = 50% to 70% of Design WS Area)	Depth= _____ feet Area= _____ acres, % = _____ %
E) Free Water Surface Areas (2' to 4' deep) (Area = 30% to 50% of Design WS Area)	Depth= _____ feet Area= _____ acres, % = _____ % _____ %
3 Average Side Slope Above Water Surface (3:1 or flatter)	Z = _____
A) Depth of WQCV Surcharge (above permanent pool, 2' max.)	_____ feet
4. Outlet Works	
A) Outlet Type (Check One)	_____ Orifice Plate _____ Perforated Riser Pipe _____ Other: _____
B) Depth at Outlet Above Lowest Perforation (H, 2' max.)	H = _____ feet
C) Required Maximum Outlet Area per Row, (A_o)	A_o = _____ square inches
D) Perforation Dimensions (Refer to Figure 5 in W.Q. Str. Det.): **(Enter one only)**: i) Circular Perforation Diameter **OR** ii) 2" Height Rectangular Perforation Width	 D = _____ inches, **OR** W = _____ inches

Design Procedure Form: Constructed Wetland Basin (CWB) - Sedimentation Facility

Designer: _____

Company: _____

Date: _____

Project: _____

Location: _____

E) Number of Columns (nc)	nc = _____ Number
F) Actual Design Outlet Area per Row (A_o)	A_o = _____ square inches
G) Number of Rows (nr)	nr = _____ Number
H) Total Outlet Area (A_{ot})	A_{ot} = _____ square inches

5. Trash Rack

A) Needed Open Area: A_t = 0.5 * (UDFCD Vol. 3 Figure 7 Value) * A_{ot} — A_t = _____ square inches

B) Type of Outlet Opening (Check One)

_____ ≤ 2" Diameter **Round**
_____ 2" High **Rectangular**
_____ Other: _____

C) For 2", or Smaller, **Round Opening** (Ref.: Figure 6a):

i) Width of Trash Rack and Concrete Opening (W_{conc}) from UDFCD Vol. 3, Table 6a-1 — W_{conc} = _____ inches

ii) Height of Trash Rack Screen (H_{TR}) — H_{TR} = _____ inches

iii) Type of Screen (Based on Depth H), Describe if "Other"

_____ S.S. #93 VEE Wire (US Filter)
_____ Other: _____

iv) Screen Opening Slot Dimension, Describe if "Other"

_____ 0.139" (US Filter)
_____ Other: _____

v) Spacing of Support Rod (O.C.) _____ inches
Type and Size of Support Rod (Ref.: UDFCD Vol. 3 Table 6a-2) _____

vi) Type and Size of Holding Frame (Ref.: UDFCD Vol. 3 Table 6a-2) _____

D) For 2" High **Rectangular Opening** (Refer to UDFCD Vol. 3 Figure 6b):

I) Width of Rectangular Opening (W) — W = _____ inches

ii) Width of Perforated Plate Opening (W_{conc} = W + 12") — W_{conc} = _____ inches

iii) Width of Trashrack Opening ($W_{opening}$) from Table 6b-1 — $W_{opening}$ = _____ inches

iv) Height of Trash Rack Screen (H_{TR}) — H_{TR} = _____ inches

v) Type of Screen (based on depth H) (Describe if "Other")

_____ Klemp™ KPP Series Aluminum
_____ Other: _____

vi) Cross-bar Spacing (Based on Table 6b-1, Klemp™ KPP Grating). Describe if "Other"

_____ inches
_____ Other: _____

Design Procedure Form: Constructed Wetland Basin (CWB) - Sedimentation Facility

Designer: _____
Company: _____
Date: _____
Project: _____
Location: _____

vii) Minimum Bearing Bar Size (Klemp™ Series, Table 6a-2) (Based on depth of WQCV surcharge)	_____
6. Basin Use for Quantity Controls (Check one or describe if "Other")	_____ Detention within the facility _____ Detention upstream of the facility _____ Other: _____
7. Basin length to width ratio	_____ (L/W)
8. Basin Side Slopes (Z, horizontal distance per unit vertical)	_____ (horizontal/vertical)
9 Annual/Seasonal Water Balance (Q_{net} has to be positive)	Q_{inflow} _____ acre-feet/year Q_{evap} _____ acre-feet/year $Q_{seepage}$ _____ acre-feet/year $Q_{E.T.}$ _____ acre-feet/year Q_{net} _____ acre-feet/year
10 Vegetation (Check the method being applied or describe)	_____ Native Grass _____ Irrigated Turf Grass Side Slopes _____ Wetland Species in Pool* _____ Other: _____ *Describe Species Density and Mixl.

Notes: _____

Design Procedure Form: Retention Pond (RP) - Sedimentation Facility (Sheet 1 of 3)

Designer: _____
Company: _____
Date: _____
Project: _____
Location: _____

1. Basin Storage Volume	
A) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	I_a = _____ % i =
B) Contributing Watershed Area (Area)	Area = _____ acres
C) Water Quality Capture Volume (WQCV) ($WQCV = 0.8 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I)$)	WQCV = _____ watershed inches
D) Design Volume: Vol = (WQCV / 12) * Area	Vol = _____ acre-feet
2. Permanent Pool	
A) Volume: Vol_{Pool} = (1.0 to 1.5) * Vol	_____ acre-feet
B) Average Depth Zone 1 = Littoral Zone - 6 to 12 inches deep	_____ feet
Zone 2 = Deeper Zone - 4 feet to 8 feet deep	Zone 2 _____ feet
C) Maximum Zone 2 Pool Depth (not to exceed 12 feet)	Depth = _____ feet
D) Permanent Pool Water Surface Area (Estimated Minimum)	
(Zone 1 - Littoral Zone = 25% to 40% of the total surface area)	% = _____ acres =
(Zone 2 - Deeper Zone = 60% to 75% of the total surface area)	% = _____ acres =
Total Estimated Minimum Surface Area (A_{Total})	% = _____ acres =
3. Annual/Seasonal Water Balance (Q_{net} has to be positive)	Q_{inflow} _____ acre-feet/year Q_{evap} _____ acre-feet/year $Q_{seepage}$ _____ acre-feet/year $Q_{E.T.}$ _____ acre-feet/year Q_{net} _____ acre-feet/year
4. Outlet Works	
A) Outlet Type (Check One)	_____ Orifice Plate _____ Perforated Riser Pipe _____ Other: _____
B) Depth at Outlet Above Lowest Perforation (H)	H = _____ feet
C) Required Maximum Outlet Area per Row, (A_o)	A_o = _____ square inches
D) Perforation Dimensions **(enter one only)**:	
i) Circular Perforation Diameter **OR**	D = _____ inches, **OR**
ii) 2" Height Rectangular Perforation Width	W = _____ inches
E) Number of Columns (nc)	nc = _____ Number

Design Procedure Form: Retention Pond (RP) - Sedimentation Facility (Sheet 2 of 3)

Designer: _____
Company: _____
Date: _____
Project: _____
Location: _____

F) Actual Design Outlet Area per Row (A_o)	A_o = _____ square inches
G) Number of Rows (nr)	nr = _____ Number
H) Total Outlet Area (A_{ot})	A_{ot} = _____ square inches
5. Trash Rack	
A) Needed Open Area: A_t = 0.5 * (Figure 7 Value) * A_{ot}	A_t = _____ square inches
B) Type of Outlet Opening (Check One)	_____ ≤ 2" Diameter **Round** _____ 2" High **Rectangular** _____ Other: _____
C) For 2", or Smaller, **Round Opening** (Ref.: Figure 6a):	
I) Width of Trash Rack and Concrete Opening (W_{conc}) from Table 6a-1	W_{conc} = _____ inches
ii) Height of Trash Rack Screen (H_{TR})	H_{TR} = _____ inches
iii) Type of Screen (Based on Depth H), Describe if "Other"	_____ S.S. #93 VEE Wire (US Filter) _____ Other: _____
iv) Screen Opening Slot Dimension, Describe if "Other"	_____ 0.139" (US Filter) _____ Other: _____
v) Spacing of Support Rod (O.C.) Type and Size of Support Rod (Ref.: Table 6a-2)	_____ inches
vi) Type and Size of Holding Frame (Ref.: Table 6a-2)	
D) For 2" High **Rectangular Opening** (Refer to Figure 6b):	
I) Width of Rectangular Opening form 4.D.ii. (W)	W = _____ inches
ii) Width of Perforated Plate Opening (W_{conc} = W + 12")	W_{conc} = _____ inches
iii) Width of Trash Rack Opening ($W_{opening}$) from Table 6b-1	$W_{opening}$ = _____ inches
iv) Height of Trash Rack Screen (H_{TR})	H_{TR} = _____ inches
v) Type of Screen (based on depth H) (Describe if "Other")	_____ Klemp™ KPP Series Aluminum _____ Other: _____
vi) Cross-bar Spacing (Based on Table 6b-1, Klemp™ KPP Grating). Describe if "Other"	_____ inches _____ Other: _____

Design Procedure Form: Retention Pond (RP) - Sedimentation Facility (Sheet 3 of 3)

Designer: _____
Company: _____
Date: _____
Project: _____
Location: _____

vii) Minimum Bearing Bar Size (Klemp™ Series, Table 6a-2) (Base on depth of WQCV surcharge)	_____
6. Basin length to width ratio	_____ (L/W)
7. Basin Side Slopes (Z:1)	
A) Above the Permanent Pool: Z=	_____ (horizontal/vertical)
B) Below the Permanent Pool Z=	Zone 1= _____ (horizontal/vertical)
Z=	Zone 2= _____ (horizontal/vertical)
8. Dam Embankment Side Slopes Z=	_____ (horizontal/vertical)
9. Vegetation (Check the type used or describe if "Other")	_____ Native Grass _____ Irrigated Turf Grass _____ Emergent Aquatic Species* _____ Other: _____ *Specify types and densities:
10. Forebay Storage (5% to 10% of Design Volume in 1D)	Storage= _____ acre-feet
11. Underdrains	_____ yes/no

Notes: _____

Design Procedure Form: Constructed Wetlands Channel (CWC) - Sedimentation Facility

Designer: _____
Company: _____
Date: _____
Project: _____
Location: _____

1. Design Discharge (total)	Q_2 = _____ cfs Q_{100} = _____ cfs
2. Channel Geometry (New Channel - No Wetland Veg. in Bottom)	
A) Channel Side Slopes (Z:1, i.e., H/V) (Z ≥ 2.5)	Z = _____ (horizontal/vertical)
B) 2-Year Design Flow Depth (D_2) Maximum D_2 = 4', Minimum D_2 = 2'	D_2 = _____ feet
C) Bottom width of the channel (B_2) - 8-foot minimum	B_2 = _____ feet
D) Top width of the 2-Year Design Water Surface (W_2)	W_2 = _____ feet
3. Longitudinal Slope (Based on a Manning's n = 0.03 for the 2-year Channel, velocity set to 2 fps)	S = _____ feet/feet
4. Final Channel Goemetry - Wetland Vegetation in Bottom) (Based on a Manning's n = 0.08)	
A) Calculated channel geometry required to maintain design discharge during a 2-year event with mature vegetation	Z = _____ feet D_2 = _____ feet B_2 = _____ feet W_2 = _____ feet
B) Calculated discharge and velocity during a 2-year event with mature vegetation	Q_2 = _____ cfs V_2 = _____ fps
C) Geometry and velocity to use for the 100-year discharge if composite channel section is used.	D_{100} = _____ feet B_{100} = _____ feet W_{100} = _____ feet V_{100} = _____ fps
5. Number of grade control structures required	_____ number
6. Vegetation (Check the type or describe "Other")	_____ Native Grass _____ Irrigated Turf Grass _____ Wetland Species _____ Other: _____

Notes: _____