Supplemental Documentation Sheet

Plans

Storm drain easement pipe chart:

PIPE SIZE (FT)	MAXIMUM PIPE INVERT DEPTH (FT) MINIMUM EASEMENT WIDTH (FT)												
NA	4	5	6	7	8	9	10	11	12	13	14	15	16
1.25	20	20	20	20	20	25	25	30	30	30	35	35	40
1.5	20	20	20	20	20	25	25	30	30	30	35	35	40
2.0	20	20	20	20	20	25	25	30	30	30	35	35	40
2.5	20	20	20	20	25	25	25	30	30	35	35	35	40
3.0	20	20	20	20	25	25	25	30	30	35	35	35	40
3.5	NA	20	20	20	25	25	30	30	30	35	35	40	40
4.0	NA	20	20	20	25	25	30	30	30	35	35	40	40
4.5	NA	NA	20	25	25	25	30	30	35	35	35	40	40
5.0	NA	NA	20	25	25	25	30	30	35	35	35	40	40
5.5	NA	NA	NA	25	25	30	30	30	35	35	40	40	40
6.0	NA	NA	NA	25	25	30	30	30	35	35	40	40	40

Contour scale:

Map Scale	*Ground slope*	*Contour interval (ft)*
1"=100', or larger	Flat: 0-2%	0.5 or 1
	Rolling: 2-8%	1 or 2
	Steep: 8%+	2, 5, or 10

Riprap Apron Summary:

Headwall ID	Pipe diameter (Do)	Riprap size (d_{50})	Apron Length (La)	Width of Apron (W=Do+La)
A				

Riprap Basin Details:

Headwall ID	Pool Length, ft (> of 10 h_s or 3W_o)	Basin Length, ft (> of 15h_s or 4W_o)	Approach Thickness, ft, 3D_{50}	Basin Thickness, ft, 2D_{50}
A				

Baffled Outlet Details/Dimensions:

Head wall ID	Fr	W	L	f	e	H	a	b	c
A									

Hydro

Flow Summary

Basin	Return Frequency	Pre-developed flow @ property line	Routed flow	By-pass flow	Post – developed flow (routed + bypass) @ property line	Ponding elevation	10% point pre-developed flow	10% point post-developed flow
	1							
A	2							
	5							
	10							
	25							
	50							
	100							

Energy Dissipation Summary:

Pipe outlet headwall / Detention pond outlet	25 year post developed flow velocity at outlet headwall	Non-erosive velocity from Storm Water Design Manual	Froude Number	Type of Energy Dissipation Measures proposed
A				
B				
C				

Downstream receiving conveyance velocity summary:

Study point/ hydraulic structure/ Basin	25 year pre-developed flow velocity	25 year post-developed flow velocity	Non-erosive velocity from Storm Water Design Manual	Current condition of the channel (appear stable or is it eroding)	Adverse impact expected from proposed project	Detention necessary?
A						
B						
C						

Times of Concentration Summary:

Sub-area	Pre/Post Overland flow, minutes	Pre/Post Shallow Concentrated flow, minutes	Pre/Post Open channel flow, minutes	Pre-developed Tc, minutes	Post-developed Tc, minutes
A-1	25/15	35/20	10/10	70	45
A-2					

Curve Number Summary:

Sub-area	Pre-developed Curve Number	Post-developed Curve Number
A-1		
A-2		

Gutter Spread Calculations Summary: (for roadways, max to be 8')

CB	Max spread, ft
1	
2	

Maximum flow into street

STREET CLASSIFICATION	ALLOWABLE PEAK FLOW RATE FOR A 2-YEAR STORM
Local	2.0 cfs
Minor Collector	1.0 cfs
Other	0.5 cfs

Energy Dissipater

Energy dissipater	*Froude Number range*
Riprap apron	Less than or equal to 2.5
Riprap outlet basins	Less than or equal to 2.5
Baffled outlets	1 to 9

Equation to size the orifice:

$A = (V/t)/(0.6*(64.4*H/2)^{0.5})$ where t = 86,400 sec.

A = area of the orifice, ft^2

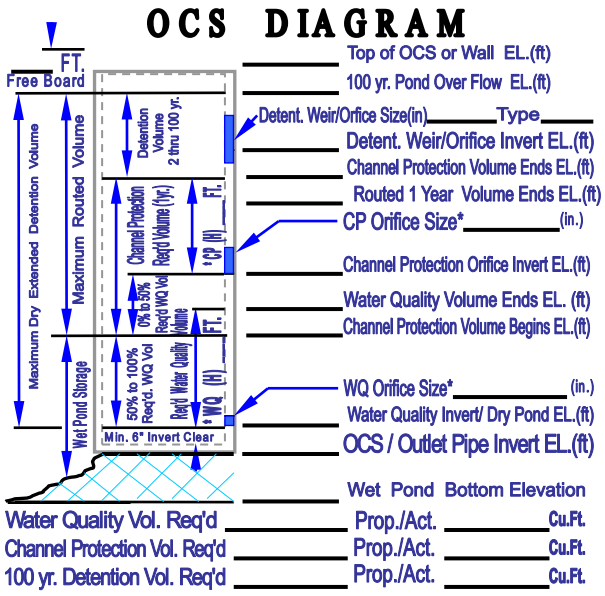
H= height above the centroid of the orifice

V = 1-yr channel protection volume, ft^3

Outlet control structure pipe sizes are required based on outlet orifice diameters .

Orifice Diameter	Minimum Pipe Diameter
< 3"	6"
3" to < 5"	8"
5" to 11"	12"

Pond OCS Diagram



	1	2	3	4	5	6	7	8
Pond ID	WQV required/ provided (c.f.)	50% WQV ponding elev. (2nd line in above fig.)	Water Quality volume ponding elev. (3rd line in above fig.)	1 year storm orifice invert elev. (3rd line in above fig.)	Channel protection volume elev. (Use Direct runoff volume from 1-yr storm.)	H Height of CPV above the centroid of the orifice (ft.) to use equation in comment 27 below.	Routed Channel protection elevation (4th line in above fig.)	2 thru 25-yr-detention orifice invert elev. (4th line in above fig.)
Example	*2500/2840*	*945.23*	*947.50*	*947.50*	*956.00*	*8.5*	*955.5*	*956.00*
A								
B								

Water Quality Volume Calculation:

$$WQ_R = 1.2" * (R_v)$$

$$R_v = 0.05 + (I) * .009$$

$$WQ_V = \frac{WQ_R}{12} * A$$

Calculation to size the outlet orifice for a 24-hour drawdown time:

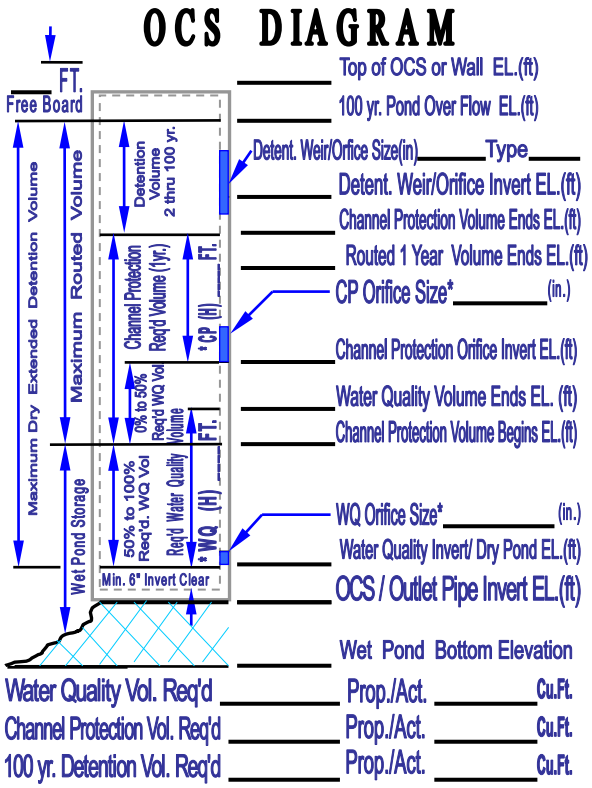
$A = (WQV/t)/(0.6*(64.4*H/2)\ 0.5)$ where t = 86,400 sec.

A = area of the orifice, ft2

H= height above the centroid of the orifice (ft.)

WQV = water quality volume, ft3

Wet Pond OCS Diagram



1	2	3	4	5	6	7	8	9
Pond ID	Total Drainage area to facility (ft^2)	% imperviou s	WQ_V required (c.f.)	Permanent Pool volume (c.f.) (must be > or = 50% WQ_V)	Permanen t pool elev. / water quality orifice size (2^{nd} line in above fig.)	Water Quality volume ponding elev. (3^{rd} line in above fig.)	1-year storm orifice invert elev./orifi ce size (3^{rd} line in above fig.)	Direct runoff from 1-year storm (in.; from fig. 2-4 SWDM)
Example	*3,789,720*	*75*	*274,754*	*261,000*	*945.23 / 5”*	*945.39*	*945.39 / 12”*	*2.4*
A								
B								

10	11	12	13	14	15	16	17	18	19
Channel protection volume elev. (Use volume reported in column 9.)	H Height of CPV above the centroid of the orifice (ft.) to use equation in comment 27 below	Routed Channel protection elevation (4th line in above fig.)	2 thru 25-yr. detention orifice invert elev. (4th line in above fig.)	Permanent pool surface area (ft^2)	Mean depth (ft) (col. 5/col. 12) (must be between 3 & 7 ft)	Maximum depth (ft; must be < or = 12)	Perm pool surface area/drainage area ratio (must be >0.01)	Length/width ratio of permanent pool (must be > or = 2)	Forebay volume required / provided (ft^3)
954.01	*8.62*	*953.80*	*954.01*	*87,120*	*3*	*5*	*0.023*	*3*	*26,100 / 28,426*

Calculations for Water Quality Volume:

$$WQ_R = 1.2" * (R_v)$$
$$R_v = 0.05 + (I) * .009$$

$$WQ_V = \frac{WQ_R}{12} * A$$

Where: WQ_R = water quality runoff (watershed inches)
R_v = the weighted volumetric runoff coefficient
I = Percent Impervious as a whole number
A = on-site area (ft^2)

Forebay calculation volume, however, the volume need not exceed 10% of the permanent pool volume.

$FBV = (0.1)\ 1.2(Rv)A_T/12$ Where $Rv = 0.05 + I(0.009)$

I = Percent Impervious as a whole number

A_T =Total area draining to facility (ft^2)

Calculation to size the channel protection outlet orifice for a 24-hour drawdown time.

$A = (V/t)/(0.6*(64.4*H/2)^{0.5})$ where t = 86,400 sec.

A = area of the orifice, ft^2

H= height above the centroid of the orifice (ft.)

V = channel protection volume, ft^3

Flood

When floodplain encountered is not FEMA related (i.e. is not shown as floodplain on the FIRM maps but is a drainage area greater than 100 acres), and NO encroachment in the floodplain is proposed, flood study shall contain the following:

Cross Section station	Water surface elevation based on existing hydrology	Water surface Elevation based on future hydrology
1+00		
2+00		
3+00		

When Floodplain encountered is not FEMA related (i.e. is not shown as floodplain on the FIRM maps but is a drainage area greater than 100 acres), but encroachment IS proposed, Flood Study shall contain the following:

Cross Section station	Manning's 'n' channel	Pre developed Water surface elevation based on existing hydrology	Post-developed Water surface Elevation based on existing hydrology*	Pre-developed Water surface elevation based on future hydrology*	Post developed Water surface elevation based on future hydrology*
1+00					
2+00					

Proposed floodplain storage (end area) calculations based on maximum 100' cross section spacing (or other approved methods) (include cross sections in report) showing that flood storage capacity will not be reduced by the proposed grading. Following is an example:

Cross Section station	Pre-encroachment wetted	Average area, S.F.	Channel length, ft	Pre-encroachment Volume,	Post-encroachment wetted	Average area, S.F.	Channel length, ft	Post encroachment Volume,

	area, S.F.			c.f.	area, S.F.			c.f.
1+00	5000				4200			
		6271	100	627,100		6350	100	635,000
2+00	7542				8500			

When floodplain encountered is FEMA related (i.e. is shown as floodplain on the FIRM maps), and NO encroachment in the floodplain is proposed, flood study shall contain the following:

Cross Section station	Q_{100} Using existing hydrology*	Q_{100} Using future hydrology (2020 Land Use) *	Manning's 'n' Channel*	Water surface elevation based on existing hydrology*	Water surface Elevation based on future hydrology
1+00					
2+00					
3+00					

**This information from FIS, Flood Insurance Study*

When Floodplain encountered is FEMA related (i.e. is shown as floodplain on the FIRM maps), and encroachment in the floodplain IS proposed, Flood Study shall contain the following:

Cross Section station	Q_{100} Using existing hydrology*	Q_{100} Using future hydrology (2020 Land Use) *	Manning's 'n' channel *	Pre developed Water surface elevation based on existing hydrology*	Post-developed Water surface Elevation based on existing hydrology	Pre-developed Water surface elevation based on future hydrology*	Post developed Water surface elevation based on future hydrology
1+00							
2+00							

**This information from FIS, Flood Insurance Study*

Proposed floodplain storage (end area) calculations based on maximum 100' cross section spacings (or other approved methods) (include cross sections in report) showing that flood storage capacity will not be reduced by the proposed grading. Following is an example:

Cross Section station	Pre-encroachment wetted area, S.F.	Average area, S.F.	Channel length, ft	Pre-encroachment Volume, c.f.	Post-encroachment wetted area, S.F.	Average area, S.F.	Channel length, ft	Post encroachment Volume, c.f.
1+00	5000				4200			
		6271	100	627,100		6350	100	635,000
2+00	7542				8500			

DOT

Flow Summary

Basin (as shown on drainage area maps)	Return Frequency	Drainage area to receiving structure (ac)	Receiving structure type	Pre-developed flow (cfs)	Post-developed flow (cfs)	Calculated percent increase (%)
A	2					
	5					
	10					
	25					
	50					
	100					

Energy Dissipation Summary:

Pipe outlet headwall / Detention pond outlet	25 year post-developed flow velocity at outlet headwall	Non-erosive velocity from Storm Water Design Manual	Froude Number	Type of Energy Dissipation Measures proposed
A				
B				

Downstream receiving conveyance velocity summary:

Study point/ hydraulic structure / Basin	25 year pre-developed flow velocity	25 year post-developed flow velocity	Non-erosive velocity from Storm Water Design Manual	Current condition of the channel (appear stable or is it eroding)	Adverse impact expected from proposed project	Detention necessary?
A						
B						

Times of Concentration Summary:

Sub-area	Pre/Post Overland flow, minutes	Pre/Post Shallow Concentrated flow, minutes	Pre/Post Open channel flow, minutes	Pre-developed Tc, minutes	Post-developed Tc, minutes
A-1	25/15	35/20	10/10	70	45
A-2					

Curve Number Summary:

Sub-area	Existing Curve Number	Post-developed Curve Number
A-1		
A-2		

Gutter Spread Calculations Summary:

CB	Max spread, ft
1	
2	