DESIGN GUIDE NO. 1

DETENTION POND DESIGN UNDER THE 2009 DRAINAGE DESIGN & EROSION CONTROL MANAUL

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Purpose

The purpose of this design guide is to summarize in one location the requirements for designing detention ponds using the 2009 Drainage Design and Erosion Control Manual for Thurston County (DDECM). Detention pond design requirements are found in several locations within the DDECM including:

- Volume I, Section 2.4, *Minimum Requirements*
- Volume I, Section 3.8, *Drainage and Erosion Control Plan*
- Volume I, Chapter 4, Stormwater BMP Selection Process
- Volume III, Section 2.1, *Minimum Computational Standards*
- Volume V, Chapter 4, Section 4.1.1, D.01, *Detention Ponds.*
- Volume V, Appendix V-A, *Structures* -- Control structures
- Volume V, Appendix V-C, *Maintenance Guidelines*
- Volume V, Appendix V-D, *Access Roads and Ramps*
- Volume V, Appendix V-E, *Site Design Elements* – Requirements for fencing, signage, setbacks, easements & planting/landscaping.

Hydrologic Design Criteria

Minimum Requirement No. 7, *Flow Control,* requires projects to reduce the impacts of stormwater runoff from impervious surfaces and land cover conversions. This includes controlling the discharge from a project site such that the stormwater discharge from a threshold discharge area shall match developed discharge durations to pre-developed discharge durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. The purpose of the requirement is protect streams from stream bank erosion.

The pre-developed condition to be matched shall be a forested land cover, unless reasonable historic information is available that indicates the site was prairie prior to settlement.

A continuous simulation hydrologic model shall be used for designing detention ponds. Generally this is the Western Washington Hydrologic Model, Version 3 (WWHM3) as developed for the Department of Ecology by Clear Creek Solutions, Inc.. The WWHM3 has also been modified with Thurston County specific data and the modified version shall be used for design facilities in Thurston County.

A flow control facility (detention pond is one type of flow control facility) is required for projects that:

1. Create 10,000 square feet or more of effective impervious surfaces in a threshold discharge area.

2. Projects that convert ¾ of an acre of native vegetation to lawn or landscape or convert 2.5 acres or more of native vegetation to pasture in a threshold discharge area and from which there is a surface discharge in a conveyance system (natural or man-made) from the site.

3. Projects that through a combination of effective impervious surfaces and converted pervious surfaces, causes a 0.1 cubic feet per second increase in the 100-year recurrence interval flow frequency from a threshold discharge area.

A threshold discharge area is defined as an onsite area draining to a single natural discharge location or multiple discharge locations that combine within one-quarter mile downstream (as determined by the shortest flowpath).

Effective impervious surfaces are those impervious surfaces connected via sheet flow or discrete conveyance to a drainage system. If runoff from an impervious surface is infiltrated or dispersed into native vegetation or amended soils in accordance with Dispersion BMPs described in Volume V of the DDECM the surface is considered ineffective.

Pond Aesthetics

Detention ponds should be made an attractive feature of the urban environment. Aesthetic considerations should be incorporated into the design including:

- Curvilinear design (non rectangular)
- Landscape plantings above the water level of the pond.
- Design to allow public use for recreation during dry season. Play area, volleyball court, etc.
- Incorporate the detention pond into other on-site features such as walking trails, picnic area, etc.
- Consider combined detention and wetland/wetpond to provide permanent pool volume to enhance year-round aesthetics.

Special Requirements

If a detention pond is located within the Well Head Protection Area of a public water system with over 1,000 connections a minimum of 3-feet of separation to the seasonal high groundwater level is required or the pond shall be lined. Liners may not be used to locate the pond bottom below the seasonally high groundwater level.

If the detention pond includes a constructed berm above existing ground and the volume retained by the above grade portion of the berm exceeds 10 acre-feet then Dam Safety requirements of the Department of Ecology shall also be met.

Detention ponds shall be located within separate tracts (not easements) with a minimum of 5-ft separation between the tract lines and any improvements (including fill or cut slopes) associated with the detention pond.

Design Process

The following generalized design process is suggested for detention pond design:

1. Evaluate project site for suitability including area available, depth to bedrock, presence of wetlands depth to water table, etc. If a detention pond is deemed suitable to the site proceed with the design process.

2. Using a hydrologic model (WWHM3) input all contributing basin information and setup model to route contributing basin to a detention pond. Be sure to include the estimated area of the detention pond as an impervious area.

3. Use “autopond” feature in WWHM3 to get preliminary pond dimensions--depth, volume, etc. and a preliminary control structure design.

4. Locate pond to approximate dimensions on the site plan accounting for access roads, tract line setbacks, point of discharge, etc.

5. If proposing a trapezoidal pond, refine the preliminary calculations to finalize the pond dimensions. Be sure to account for the volume of any access ramps required, revise the original estimate of pond area assumed as impervious, and adjust the design accordingly.

6. If proposing a curvilinear design, layout proposed curvilinear design with approximately the same volume and area as the trapezoidal pond designed above.

7. Create a stage/storage table or use “pond pad” features in WWHM3 to input pond to hydrologic model.

8. The “autopond” function in WWHM3 does not work for other than a trapezoidal pond. Run WWHM3 and make pond size and discharge structure modifications as necessary to meet discharge criteria. Adjust assumed impervious area of pond to match calculated area in finalizing design.

9. Confirm that overflow structures (riser pipe, birdcage or jailhouse window weir) are capable of passing the 100-year storm event.

10. Design emergency spillway and calculate maximum water surface elevation based on a plugged outlet structure. Add required freeboard to get top of berm elevations.

11. Layout pond design and grading on drainage plans and be sure to address all applicable design details such as access roads, ramps, berm construction, fencing, control structure, inlets and outlets per detention pond design requirements. Show design and maximum water surface elevations on plan drawing.

12. Show in drainage plans and construction drawings at least one pond cross-section through control structure. Indicate design and maximum water surface elevations.

13. Provide details and specifications for control structures, inlet and outlet piping, slope treatments, emergency spillways, seeding or Sodding, berms, etc.

14. Establish stormwater tract boundaries based on detention pond design. Boundary should be no closer than 5-feet to grading catch points or structures.

15. Prepare a landscaping plan showing plantings within the stormwater tract which contains the detention pond.

16. Include all design calculations, assumptions, modeling parameters, etc. in the Drainage Report for the project.

Pond Geometry & Structural Design

- Dissipate energy at inlet per outfall design criteria of Volume II, BMP C.209.
- Pond bottom shall be level with at least 0.5 feet of sediment storage.
- Interior side slopes shall not be steeper than 3H:1V unless a fence is provided.
- Retaining walls and rockeries are allowed if designed by a licensed professional and a fence is provided at the top of the wall.

- Ponds shall be designed as flow-through systems maximizing the flow path between inlet and outlet to promote sedimentation.

- Flows may not enter the pond from the control structure or outflow conveyance system.

- A debris barrier (trash rack) shall be installed on the pond outlet to the control structure. Debris barriers shall be installed on pond inlet pipes if the pipe diameter is 18-inches or greater.

- Pond Berm Embankments:
    - Exterior and interior side slopes steeper than 2H:1V shall be designed by geotechnical engineer.

    - Excavate “key” equal to 50% of the berm embankment cross-sectional height and width, except on till soils “key” can be reduced to 1-foot of excavation into the till.

    - Construct on suitable base soils either consolidated native soil or adequately compacted and stable fill soils as determined by a geotechnical engineer.

    - Place in 6-inch lifts and compact to 95% of maximum dry density. Soils as recommended by geotechnical engineer or alternatively: 30% clay minimum, 60% sand maximum, and 60% silt maximum.

    - Provide anti-seepage collars on pipes through embankments ponding greater than 8-feet of water.

    - Exposed earth on embankment shall be sodded or seeded. No trees or shrubs shall be planted on berms taller than 4 feet. Trees or shrubs planted on berms 4 feet or smaller shall not exceed 20 feet mature height and have a fibrous root system.

    - Minimum berm width is 15-feet where maintenance access is provided, otherwise minimum top width is 6-feet or as recommended by professional engineer.

    - Pond berm embankments greater than 6-ft in height require design by a geotechnical engineer.

Setbacks

Setbacks from the maximum water surface (pond elevation when emergency spillway is passing the 100-year event):

- 1-foot vertical clearance to structures within 25 feet.

- 10-feet horizontal to:
    - Property lines and onsite structures
    - Building sewer lines
    - Tract property boundary line

- 30-feet horizontal to:
    - Septic tank or distribution box
    - Septic drainfield and drainfield reserve areas for single family septic systems.

- 50-feet horizontal to slopes steeper than 15% and greater than 10 feet high.

- 100-feet horizontal to:
    - Septic drainfields and reserve areas for community septic systems.
    - From a drinking water well.

Access Roads & Ramps

Requirements for access roads and ramps for detention ponds are found in Volume V, Appendix V-D of the DDECM. These requirements include:

- A 15-foot wide access easement shall be provided from a public street or right-of-way to the detention pond. Access shall be surfaced with a 12-foot width of crushed rock or lattice block pavement or other acceptable surface. The easement shall include easement markers at each corner of easement, at angle points and at least every 100-ft along the easement length.

- An access road shall be provided to the control structure and other drainage structures associated with the pond (e.g, inlet or bypass structures).

- If pond maintenance will be provided from the access road, the access road shall extend around the pond perimeter for access to each pond cell.

- Access road design criteria include:
    - 15% maximum grade. (12% maximum grade to control structure)
    - Outside turning radius of 40-feet minimum.
    - 15-feet width minimum.
    - Provide paved apron where access road connects to paved public roadway.
    - Provide asphalt, gravel, or modular grid pavement surface.
    - When length of road exceeds 75-feet a vehicle turnaround must be provided for a design vehicle with a 31 foot length and inside wheel path radius of 40-ft.
    - Vehicle access shall be limited by a locking gate or bollards. Gates are required if pond is fenced and shall meet WSDOT standard plans and be located only on a straight section of road.

- Access ramps provide access to the bottom of a pond for maintenance, repair and sediment removal. They are required unless the pond is small enough that a trackhoe with a maximum reach of 20-ft can reach all areas of the pond from a perimeter access road.

- Access ramp design criteria include:
    - 15-feet width minimum.
    - 15% maximum grade if surfaced to access road standard.
    - 12% maximum grade for alternative ramp surface using geotextile over native soils, 6-inches of quarry spalls (2”-4”), and 2 inches of crushed rock surface.
    - Extend ramp to bottom of pond if pond bottom is greater than 1,500 square feet, otherwise ramp may end 4 feet above the pond bottom.

Control Structure

The control structure for a detention pond is typically a Type 2 Catch Basin structure (54-inch minimum diameter) with an inverted tee riser pipe restrictor device for the outlet. When designed using the Western Washington Hydrologic Model the control structure restrictor device typically consist of one orifice and a rectangular notched weir with an overflow riser at the maximum design water level. Alternative weir types and multiple orifices may be included in the design, but are not typical.

For a flow restrictor TEE, (typical control restrictor type) the tee shall be secured to the control structure using pipe supports vertically spaced at not greater than 3-ft spacing. A minimum clear space of 6-inches shall be provided from the top of the riser pipe to the bottom of the structure lid. A shear gate shall be provided with a control rod for operation. The TEE shall be located to be visible from the structure lid when open. For additional details of the configuration of the control structure see Figure A-6 of Appendix V-A of the DDECM.

A nomograph included in Appendix V-A of the DDECM can be used to determine the head above the overflow riser required to pass the 100-year peak flow. This is required to establish correct emergency overflow structure elevations.

Most control structures include at least one restrictor orifice. Orifices shall meet the following requirements:

- Minimum orifice diameter is 0.5 inches. This may be too large to meet minimum target release rates. In this case, live storage depth shall not be reduced less than 3 feet in an attempt to meet the performance standard. A plug resistant flow throttling device may be required.

- Orifices may be constructed on a tee section or on a baffle.

- If using multiple orifices, the top orifice may be located too high to be physically constructed, in which case a notch weir could be used to meet performance requirements.

- Consider backwater affects of water surface elevations downstream of the conveyance system. High tailwater elevations may affect the restrictor system.

- At least two feet of separation between the bottom orifice and the bottom of the structure shall be provided.

- At least two feet of separation between the invert elevation of the outlet pipe and the elevation of the lower orifice shall be provided (i.e. 4-ft minimum separation from structure bottom to invert elevation of outlet pipe).

A brass or stainless steel information plate should be provided and permanently attached inside each control structure. Information required is provided in Appendix V-A of the DDECM.

Overflow Protection

- A primary overflow must be provided to pass the 100-year developed peak flow over or around the restrictor system. (typically a riser pipe within the control structure).

- A secondary inlet to the control structure must be provided. This may be a grated opening to the control structure or a “birdcage” overflow structure. A grated opening shall be designed to pass the 100-year developed peak flow. Vertical bars spaced 4-inches on center shall be provided within the window opening.

- Where an emergency overflow would discharge toward a steep slope, consider providing both an emergency overflow structure in addition to the spillway.

- Provide an emergency spillway sized to pass the 100-year developed peak flow. As an alternative to an emergency overflow spillway for constructed berms over 2-feet in height, or ponds located on grades in excess of 5%, emergency overflow may be

provided by an emergency overflow structure such as a Type II manhole fitted with a birdcage. The emergency spillway shall meet the following design criteria:

- A minimum of 6 inches of freeboard shall be provided above the maximum water surface elevation.
- Comply with details of Figure 4.2 of Volume V for emergency spillway.
- Discharge directly to the downstream conveyance system or another acceptable discharge point.
- Armored per Outlet Protection BMPs to full width, beginning at a point midway across the berm embankment and extending downstream to where the emergency overflow reenters the conveyance system.
- Alternative armoring may of 2" asphalt concrete pavement may be provided for spillways on access roads.
- Design the spillway as a broad-crested weir. A broad-crested weir equation is provided in Appendix V-A of the DDECM.

Signage & Fencing

- Fence required where slopes greater than 3H:1V above the emergency overflow water surface elevation or higher or where there is a wall greater than 30-inches in height.
- Public stormwater pond tracts shall be fenced. Place fence 1-foot inside the tract boundary or a minimum of 5 feet from the top slope catch point.
- Public drainage ponds fence shall be 6-ft WSDOT Type 1 chain link.
- Wood fence allowed in subdivisions. Use pressure treated posts and cedar, pressure treated fir, or hemlock rails and fence boards.
- Pond shall have an information sign. Applicant shall submit sign design and proposed location for County acceptance. Sample sign specifications are included in Appendix V-E.

Plantings & Landscaping

- As required by Minimum Requirement No. 5, *Onsite Stormwater Management,* all disturbed area of the project to be landscaped shall implement BMP LID.02 to restore soil quality and depth.
- All disturbed or exposed soils shall be planted and/or landscaped. Table E-2 of Volume V, Appendix V-E gives an appropriate seed mix. Seed should be applied at 2.5 to 3 pounds per 1,000 square feet.
- Pond interior side slopes and bottom shall be sodded or seeded with an appropriate seed mixture.
- All remaining areas of the tract should be planted with grass or landscaped and mulched with 4-inch cover of hog fuel or shredded wood mulch.

- Other than the above requirements, a specific landscape plan for ponds is not specified. However, if landscaping is provided, the following general criteria should be considered:

    - Plant no trees or shrubs within 25-feet of inlet or outlet pipes or drainage structures. Species with roots that seek water such as willow or poplar shall be avoided within 50-ft of structures.

    - Trees and shrubs should be planted in clumps to form "*landscape islands."* Landscape islands should be a minimum of 6 feet apart and 6 feet from any fences or other barriers. The 6-feet allows a mower to pass between the landscape islands.

    - Plant evergreen trees or trees with relatively little leaf fall in areas draining to the pond.

    - Deciduous trees shall be set back from the pond so that branches do not extend over the pond.

    - Two naturalistic planting schemes are suggested: "Open Woodland" or "Northwest Savannah or Meadow." See Volume V, Appendix V-E for details on these two planting schemes. The "Open Woodland" design recommends a minimum of 30% (excluding the pond area) of the tract be in landscape islands (when mature). The "Northwest Savannah or Meadow" design recommends that a minimum of 10% of the tract (excluding the pond area) be in landscape islands (when mature), the remainder of the area being seeded or sodded. Creation of emergent vegetation in shallow areas of the pond is recommended. Use native wetland plants.

Submittal Information

Include the following in any submittal documentation for the project:

- Show on the work map included in the Drainage Report the following:

    - Limits of contributing drainage basins per threshold discharge area for pre-development and developed conditions

    - Summary of areas by type (impervious, native, landscape).

    - Location of clear path of overflow to downstream collection point.

    - Natural drainage channels.

- Include in the construction plans and specifications:

    - Catch points for cuts and fills.

    - Tract boundaries and easements and location of easement markers.

    - Details, construction notes and specifications for all structures and materials.

    - Planting plan showing plant species, quantity, location and any special planting requirements.

    - Channel protection from path of overflow to downstream collection point.

- Pond cross-section through control structure.
- Cross-sections – access roads, ramps, and spillway.
- Design and maximum water surface shown in plan view & pond cross-section.
- Proposed design & location for the stormwater facility information sign.

- Include in the Drainage Report for the project:
  - Design calculations for overflow structures and emergency spillway.
  - Document facility meets any setback requirements.
  - If pond is to provide infiltration and detention document soils testing requirements as for an infiltration facility.
  - If the pond is located within 300 feet of the top of a slope designated a landslide hazard area or within the minimum setback distance of 50-feet to a slope of greater than 15% and 10-ft height a geotechnical analysis and report shall be submitted.
  - Hydrologic modeling results including a schematic of the model setup referencing model basin identifiers to basins and sub-basins shown in the work map.

REVIEW CHECKLIST
DETENTION PONDS

Applicant Use	REVIEW CHECKLIST	Staff Use Only
	HYDROLOGIC DESIGN	
	Verify input to WWHM3 for pre-development and developed land use, soil type and areas are consistent with site plan and other documentation.	
	Continuous simulation model used to size detention pond. If WWHM3, verify Thurston County customized version used in design.	
	If separate threshold discharge areas exist, verify that they meet criteria for designation as a separate TDA.	
	If impervious areas are not included in model because they are considered ineffective, verify that dispersion criteria are met per appropriate BMP to designated impervious area as ineffective.	
	Verify that WWHM3 model report is submitted and verify that detention facility meets discharge criteria.	
	Verify that WWHM3 model computer file is submitted with project, consider running model to verify report conclusions.	
	Check that layout of detention pond and control structure design shown on site plans/drainage plans is consistent with results of WWHM3 model.	
	A schematic of the hydrologic modeling parameters (network diagram of model, or equivalent) should be provided with basin designations matching basin designations on drainage work map required to be included in the Drainage Report.	
	SPECIAL REQUIREMENTS	
	Is project located within the Well Head Protection Area of a public water system with over 1,000 connections. If so is proposed pond bottom at least 3-feet above seasonal high groundwater level or is the pond lined with an impermeable liner per Volume V, Appendix V-B	
	Is an above grade berm proposed that impounds more than 10 acre-feet of water at the maximum water surface? If so, verify that Dam Safety requirements of WAC 173-175 are complied with and applicant has applied to Ecology for Dam Safety review.	
	Is a separate tract established that encompasses the detention pond, access roads, and associated appurtenances and structures and is there is at least a 5-ft separation between any facility, the catch point of fill or cut slopes, or access road to the tract line.	
	POND GEOMETRY & STRUCTURAL DESIGN	
	Pond bottom level with at least 0.5 feet of sediment storage provided below pond outlet.	
	Interior side slopes steeper than 3H:1V are provided with protective fencing.	
	If interior or exterior side slopes steeper than 2H:1V are proposed, is the design addressed in the geotechnical report by a licensed professional engineer with geotechnical expertise.	
	If retaining walls or rockeries are proposed have they been designed by a licensed professional engineer.	
	Is the flow path from pond inlet to outlet maximized to the extent feasible to promote sedimentation. Verify that the inlet to the pond is not via the control structure or outflow conveyance system.	
	Is a debris barrier (trash rack) provided for the pond outlet and for any pond inlet pipes that are 18-inches in diameter or greater.	
	If a berm embankment is proposed (i.e. berm construction above existing grade) to impound water a geotechnical engineer is required to design the embankment for embankments with slopes steeper than 2H:1V or 6-ft in height.	
	Is a pond berm embankment "key" equal to 50% of the berm embankment cross-sectional height and width included in the design? If in till soils, Pond berm embankment "key" can be reduced to 1-foot of excavation into till soils.	
	Is the pond berm embankment constructed on fill soils? If so, a geotechnical engineer shall provide design and design should be included in geotechnical report.	
	Are anti-seepage collars provided on pipes through embankments ponding greater than 8-ft of water.	
	Is any pond berm embankment soils and compaction specified? Either as recommended by a geotechnical engineer, or alternatively, if geotechnical engineer design is not required the following specification is allowed: Soil placed in 6-inch lifts and compacted to 95% of maximum dry density and embankment soils are 30% clay minimum, 60% sand maximum and 60% silt maximum, per USDA soil triangle.	

	Is all exposed earth on embankment either sodded or seeded? No trees or shrubs are allowed to be planted on berms taller than 4 feet. Trees or shrubs planted on berms 4 feet or smaller shall not exceed 20 feet mature height and have a fibrous root system.	
	Is the top of berm width at least 6-feet, or as recommended by a geotechnical engineer? If the top of berm is to be used for maintenance access, minimum width is 15-feet.	
	SETBACKS	
	Is the maximum water surface elevation shown on the drainage plan and also shown in the pond cross-section?	
	Is there at least a 1-foot vertical clearance from the maximum water surface to any structures (buildings) within 25-feet?	
	Is there at least a 10-foot horizontal separation from the maximum water surface to property lines, structures, sewer lines and the tract property boundary line?	
	Is there at least a 30-foot horizontal separation from the maximum water surface to any septic tank or distribution box or any septic drainfield or reserve area for single family septic systems? The location of nearby septic systems (on-site and off-site) and drainfields should be shown on the site plan if they are in proximity to the detention pond.	
	Is there at least a 50-foot horizontal separation from the maximum water surface to slopes steeper than 15% and greater than 10 feet high? If not, a geotechnical engineer shall evaluate for stability and include recommendations in the geotechnical report. In no case shall setback be less than the height of the slope greater than 15%.	
	Is there at least a 100-foot horizontal separation from the maximum water surface to any septic drainfields or reserve areas for a community septic system or drinking water well?	
	ACCESS ROADS	
	Is access to the detention pond provided from a public street or right-of-way?	
	For access to the detention pond outside of the public right-of-way is a minimum 15-foot easement provided? Is the easement provided with a minimum 12-foot width all weather surface such as crushed rock or lattice block pavement?	
	Is an access road provided to the control structure and other drainage structures associated with the detention pond? If pond maintenance is to be performed from the access road (i.e. no ramp to pond bottom) the access road should extend around the pond perimeter.	
	Is the pond access road grade less than 15% and less than 12% to the control structure?	
	Minimum horizontal curve radius 40-feet.	
	If access road length exceeds 75-ft a turnaround must be provided for a 31-ft length design vehicle with an inside wheel path radius of 40-ft.	
	Is paved apron provided where access road connects to paved public roadway?	
	Is a gate or are bollards provided for the access road? If the pond is fenced, a double posted fence gate meeting WSDOT standards is required. Gate should be located on a straight section of access road. If bollards are proposed, fixed bollards shall be set at the road edges and two removable bollards equally spaced between the fixed.	
	ACCESS RAMPS	
	Access ramp required unless applicant demonstrated that a 20-ft reach trackhoe can access all areas of the pond from the perimeter access road? Perimeter access road shall be extended around entire perimeter of pond (see above).	
	Access ramp grade less than 15%.	
	Access ramp width at least 15-feet.	
	Access ramp section of suitable design to provide year round access? Standard section of geotextile over native soils with 6-inches of quarry spalls and 2 inches of crushed rock allowed, but slope limited to 12% maximum for this design.	
	Ramp extended to bottom of pond for bottom area greater than 1,500 square feet? Otherwise ramp may end 4 feet (measured horizontally) from pond bottom.	
	CONTROL STRUCTURE	
	Control structure diameter suitable to pipe sizes (54" minimum).	
	Orifice(s) and weirs sizes and elevations match hydrologic model output.	
	Control structure detail provided in plans – consistent with Drainage Manual control structure detail (Figure A-6 of Volume V, Appendix V-A)	
	Flow restrictor TEE secured to structure wall at 3-ft or less spacing.	
	Minimum clear space of 6-inches provided from top of riser to bottom of structure lid.	
	Locking lid provided.	
	Shear gate provided with control rod for operation (not chain).	
	Minimum orifice diameter > 0.5"	
	Backwater affects possible for outlet pipe? If so, have they been analyzed for.	

	2-ft separation from bottom of structure to lowest orifice?	
	2-ft minimum separation from lowest orifice to outlet pipe invert?	
	Brass or stainless steel information plate with information specified in Appendix V-A?	
	Structure lid set flush to final grade and centered over control structure?	
	Capacity of overflow riser adequate to pass 100-year storm?	
	Grated bar inlet structure provided and designed to pass 100-year storm? Bar spacing 4".	
	EMERGENCY SPILLWAY	
	Emergency spillway provided and designed to pass 100-year developed peak flow? Or alternative emergency overflow structure (separate from control structure) provided. Design calculations included in Drainage Report.	
	Minimum freeboard above maximum water surface elevation of 6-inches.	
	Discharge from spillway or overflow directly to downstream conveyance system or other acceptable discharge point.	
	Spillway armored to full width beginning at least midway across the berm embankment and extending downstream to where overflow reenters conveyance system. Armoring design per outlet protection of Volume II BMP C.209 or channel protection requirements of Table 3.8 of Volume III.	
	SIGNAGE AND FENCING	
	Fencing provided where pond slope greater than 3H:1V above emergency overflow water surface, or where there are walls greater than 30-inches in height.	
	If a public facility – pond tract fenced with 6-ft WDOT Type 1 chain link.	
	Wood fence or other alternative fencing/shrubbery screening allowed for private facilities.	
	Information sign provided. Comply generally with sign specifications of Appendix V-E.	
	PLANTINGS & LANDSCAPING	
	Disturbed soil quality and depth restored per BMP LID.02.	
	Pond interior side slopes and bottom sodded or seeded with appropriate seed mixture (Table E-2 of Volume V, Appendix V-E give appropriate seed mix).	
	All remaining areas of storm pond tract seeded, sodded or landscaped with 4-inches mulch in landscape areas.	
	Landscape plan includes pond tract. Note: Landscaping (beyond soil restoration & seeding/Sodding) of detention pond area is recommended but not required. If landscaping is proposed, apply the following criteria to review:	
	No trees or shrubs within 25-feet of inlet or outlet pipes or drainage structures.	
	No water seeking plants such as willow or poplar within 50-ft of structures.	
	Trees and shrubs planted in clumps to form landscape island a minium of 6-feet apart and 6-feet to fences and other barriers.	
	Evergreen trees or trees with little leaf fall in areas draining to pond.	
	Deciduous tree set back from pond so branches do not extend over pond.	
	Emergent (wetland) type vegetation planted in shallow areas of pond.	
	SUBMITTAL INFORMATION	
	DRAINAGE REPORT	
	Hydrologic modeling results including schematic of model setup referencing model basin identifies to basins and sub-basins shown in the work map and hydrologic model.	
	Work map showing subbasins and basins contributing to the detention pond with basin identifies corresponding to the nomenclature used in the hydrologic model.	
	Summary table of contributing sub basins identifying soil type and areas of impervious, landscape, forest, etc. corresponding to hydrologic model inputs.	
	Document how all required facility setbacks are met.	
	Geotechnical report including analysis of embankment berms, slope stability for steep slopes located within setback distances or within 300-ft of the top of a slope designated a landslide hazard area, retaining wall design, and any other analysis required by geotechnical engineer.	
	If pond is to provide for infiltration and detention, document soils testing requirements per infiltration facility standards.	
	Design calculations for overflow structures, emergency spillway, and outfall protection.	
	Show on work map the location of natural drainage channels and show a clear path of overflow to downstream collection point from emergency spillways.	

	CONSTRUCTION DRAWINGS	
	Show existing topography based on field verified survey.	
	Show proposed topography and extend proposed topography to catch points.	
	Show tract boundaries and easements with widths and location of easement markers.	
	Planting plan showing plant species, quantity, location and any special planting requirements.	
	Design and maximum water surface shown in plan view.	
	Design and maximum water surface shown in pond cross-section	
	Provide at least one pond cross-section through the control structure.	
	Details of emergency spillway provided.	
	Details of control structure shown – include control structure detail showing elevations of orifices, riser overflow, top of structure, etc.	
	Proposed design and location of information sign including sign specifications.	