Report Template #3: Pond Report

Outline Plan # \_\_\_\_-\_\_\_\_ or DP # \_\_\_\_-\_\_\_\_

Prepared for: Name of Client (Developer/Landowner)

This template applies to both subdivision (public system) and private system submissions.   
Not all information and tables will be relevant for all submissions. The Consultant is responsible for ensuring that no relevant information is missing.

Please provide the report with reinforced, plasticized or plastic front and back covers.   
The binding shall be Cerlox; spiral bound reports or reports in binders will be returned.

This template is available on the [Development Approvals Submissions](http://www.calgary.ca/UEP/Water/Pages/Specifications/Submission-for-approval-/Development-Approvals-Submissions(v1).aspx) page of The City   
of Calgary’s website.

Consultant Name

Consultant E-mail

Consultant Address

Date

Consultant File Number

#### ADD PLASTIC SLEEVE HERE FOR FUTURE CORRESPONDANCE

#### ADD RELEVANT CHECKLISTS HERE

* Checklist #4: XP-SWMM Models (if required).
* Checklist #5: Water Quality BMPs - Oil/Grit Separators (if required).
* Checklist #6: Pond Report.
* ****Checklist #19: Stormwater Re-Use (if required).

If there is no preceding Staged Master Drainage Plan (SMDP), the Pond Report must address all items from Checklist #10: Staged Master Drainage Plan (SMDP) as well. Refer to Section 11.1.4 of The City of Calgary’s [*Stormwater Management & Design Manual*](http://www.calgary.ca/PDA/DBA/Pages/Urban-Development/Publications.aspx) for more information.

****  
Ensure that all checklist items marked in the shaded areas have been explained in the Comments section of the checklist or in additional attachments.

#### ADD COVER LETTER HERE

* Highlight all unresolved issues (with either Water Resources or Parks) or areas where guidelines cannot be met.
* Explicitly state that all details conform to the City of Calgary Standard Specifications and Stormwater Management Design Manual. If required, clearly explain all items that have to be addressed prior to report approval.
* Identify whether the pond is public or private.

All stormwater management should be located within the developer’s property limits. If the proposed pond is off-site, a ***Statement of Agreement*** with affected stakeholders should be enclosed. This statement **must** be co-signed by the affected stakeholders.

#### ADD SUPPORTING DOCUMENTATION HERE

* If the pond is a public pond, include a completed Alberta Environment [*Application Form and Guide for Registration to Construct and Operate a Municipal Storm Drainage System*](http://environment.alberta.ca/documents/Application-Form-and-Guide-for-Registration-to-Construct-and-Operate-a-Municipal-Storm-Drainage-System.pdf) (EPEA Application form).

Whereas The City of Calgary will coordinate the registration of public ponds under the EPEA with Alberta Environment, private ponds need to be registered by the proponent after the Pond Report and DSSP drawings have been approved by Water Resources. Refer to Section 11.1.6.1 of The City of Calgary’s [*Stormwater Management & Design Manual*](http://www.calgary.ca/PDA/DBA/Pages/Urban-Development/Publications.aspx) for more information.

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# EXECUTIVE SUMMARY

* Summarize report.
* Highlight all unresolved issues or areas where guidelines cannot be met.
* Explicitly state that all details conform to The City of Calgary’s *Standard Specifications* and *Stormwater Management and Design Manual*. If required, clearly explain all items that have to be addressed prior to report approval.
* Identify whether the pond is public or private.
* Identify guiding key targets (such as release rates, water quality, habitat protection, etc.).
* Identify key design characteristics (such as capacity, footprint, water reuse, etc.).

# 

# INTRODUCTION

* 1. General
     + Brief introduction for the report in support of design drawings.
     + Outline Plan #\_\_\_\_-\_\_\_\_ or DP #\_\_\_\_-\_\_\_\_.
     + Name of the project and phase.
     + Client developer/landowner.
     + Overall site description, including:
       - Type of development (residential, industrial, commercial, etc.).
       - Land location (legal description).
       - Catchment area (in hectares).
       - Refer to Figure 1: Location Plan (see section for requirements).
     + Future external development areas included in the study area, if applicable.
     + Overall objectives.
  2. Study Area
     + Description of the study area.
     + Total site area, including interim undeveloped or future external development areas.
     + Identify overland drainage direction, downstream ponds, receiving water bodies, and outfalls.
     + Show maps of interface with adjacent past phases from previous reports in an Appendix.
     + Refer to **Figure 2: Study Area** (see section for requirements).
     + Refer to **Figure 3: Storm Area Design** (see section for requirements).
  3. Scope of Analysis
     + Analysis description, scope, assumptions, and limitations.
     + Specific work activities of the analysis.

Contact Water Resources prior to submission of the Pond Report if staged construction   
or temporary ponds are considered. Refer to Sections 6.1.11.1 and 6.1.12 of The City of Calgary’s [*Stormwater Management & Design Manual*](http://www.calgary.ca/PDA/DBA/Pages/Urban-Development/Publications.aspx) for more information.

# STORM DRAINAGE CONSIDERATIONS

* 1. Tributary Development Area
     + Storm catchment area definition, boundaries, and other general information.
  2. Stormwater Drainage Reports
     + List of reports that address the study area (to date), such as Watershed Report, Master Drainage Plan, Staged Master Drainage Plan, etc.

 If there is no preceding Staged Master Drainage Plan, the author of the Pond Report should ensure that all items from the Staged Master Drainage Plan Checklist are addressed in the Pond Report.

* 1. Upstream Catchment Areas
     + Information about storm discharge/runoff from upstream catchment areas (including temporary undeveloped catchments).
     + Ensure that catchment boundaries match those of existing reports, or supplemental information is included to rationalize any changes.
     + Show how overland drainage from upstream areas, if any, if routed into the pond. Identify what level of pre-treatment is provided.
  2. Allowable Release Rate/Runoff Volume Control Target
     + Design based on flow rate of AA L/s, corresponding to area of BB ha and unit area release rate of CC L/s/ha, to downstream infrastructure or outfall.
     + Identify Watershed and catchment runoff volume control targets.
  3. Development Unit Area Release Rate
     + Design based on flow rate of XX L/s, corresponding to area of YY ha and unit area release rate of ZZ L/s/ha, for each inlet into the pond (and including temporary undeveloped catchments).
     + Describe erosion protection design at inlets.
     + Describe skimming type manhole or equivalent, see Section 6.3.2.20 of The City of Calgary’s [*Stormwater Management & Design Manual*](http://www.calgary.ca/PDA/DBA/Pages/Urban-Development/Publications.aspx) for more information.
  4. Pond Capacity
     + Describe required storage capacity.

Typically, the storage capacity corresponds to a 1:100 year event. However, in the case of retrofit projects in existing communities, the service level may be reduced subject to approval by Water Resources.

* + - Tabulate the Stage-Storage-Discharge relationship for the forebays and the main cell(s) of the pond.

Table 1: Stage-Storage-Discharge Table for Main Cell of Pond

| Elevation | Depth Above NWL | Area | Total Storage Volume | Active Storage Volume | Discharge |  |
| --- | --- | --- | --- | --- | --- | --- |
| (m) | (m) | (m2) | (m3) | (m3) | (L/s) |  |
| 65.75 | N/A | 1,949.0 | 0.0 | 0.0 | 0.00 |  |
| 66.00 | N/A | 2,447.0 | 548.0 | 0.0 | 0.00 |  |
| 66.25 | N/A | 4,049.0 | 1,352.0 | 0.0 | 0.00 |  |
| 66.50 | 0.00 | 5,650.0 | 2,559.0 | 0.0 | 0.00 | NWL |
| 66.75 | 0.25 | 7,122.0 | 4,152.0 | 1,593.0 | 25.80 |  |
| 67.00 | 0.50 | 8,178.0 | 6,063.0 | 3,504.0 | 41.10 |  |
| 67.25 | 0.75 | 8,999.0 | 8,209.0 | 5,650.0 | 52.00 |  |
| 67.50 | 1.00 | 9,204.0 | 10,484.0 | 7,926.0 | 61.10 |  |
| 67.25 | 1.25 | 10,044.0 | 12,890.0 | 10,331.0 | 68.90 |  |
| 68.00 | 1.50 | 10,848.0 | 15,501.0 | 12,942.0 | 76.00 | HWL |
| 68.25 | 1.75 | 11,578.0 | 18,303.0 | 15,744.0 |  | Freeboard |

  
If the discharge is composed of multiple components (i.e. orifice and overflow weir or multiple outlets), the discharge relationship for the individual components shall be presented.  
  
  
Ensure that Table 1 reflects the presence of maintenance access roads to the forebay and/or main cells as well as pathways.

* 1. Stormwater Quality Enhancement
     + Summarize water quality performance targets for the forebay (or equivalent) and pond.
     + Summarize length to width ratios of the forebay and the main cell(s) of the pond. Describe how short-circuiting is avoided.
     + Express wet pool storage volume of wet pond on a unit area basis. See Section 6.1.2 (iv) of The City of Calgary’s [*Stormwater Management & Design Manual*](http://www.calgary.ca/PDA/DBA/Pages/Urban-Development/Publications.aspx) for more information.
     + Describe sediment forebays and tabulate key forebay characteristics.

Table 2: Common Characteristics for Forebay

| Parameter | Unit | Value |
| --- | --- | --- |
| Bottom Elevation | m |  |
| Normal Water Level (NWL) | m |  |
| High Water Level (HWL) | m |  |
| Invert Elevation of Incoming Pipe | m |  |
| Pond Depth below NWL | m |  |
| Forebay Length | m |  |
| Forebay Width | m |  |
| 25-Year Sediment Storage Capacity | m3 |  |

* + - Tabulate the Stage-Storage-Discharge relationship for the forebay.

Table 3: Stage-Storage-Discharge Table for Forebay

| Elevation | Depth Above NWL | Area | Total Storage Volume | Active Storage Volume | Discharge |  |
| --- | --- | --- | --- | --- | --- | --- |
| (m) | (m) | (m2) | (m3) | (m3) | (L/s) |  |
| 65.156 | N/A | 13.0 | 0.0 | 0.0 | 0.0 |  |
| 65.500 | N/A | 67.0 | 13.0 | 0.0 | 0.0 |  |
| 66.000 | N/A | 217.0 | 80.0 | 0.0 | 0.0 |  |
| 66.500 | N/A | 460.0 | 245.0 | 0.0 | 0.0 |  |
| 67.000 | N/A | 626.0 | 516.0 | 0.0 | 0.0 |  |
| 67.156 | 0.000 | 714.0 | 620.0 | 0.0 | 0.0 | NWL |
| 67.500 | 0.344 | 908.0 | 898.0 | 278.0 | 761.0 |  |
| 68.000 | 0.844 | 1,272.0 | 1,441.0 | 820.0 | 2,926.0 | HWL |
| 68.500 | 1.344 | 1,677.0 | 2,176.0 | 1,556.0 | 5,407.0 | Freeboard |

  
Table information shall match the data presented in the preceding Staged Master Drainage Plan report or Pond Report.

* 1. Best Management Practices
     + Identify and quantify all stormwater quality treatment facilities or Source Control Practices upstream of the pond.
     + Identify and quantify water re-use strategies including seasonal usage patterns (if applicable).

Information about stormwater quality treatment facilities, Source Control Practices **existing or envisioned** in the catchment upstream of the pond, or water re-use   
 strategies is of particular importance where the design of the pond is directly affected.

 In case of water re-use strategies for zero-discharge facilities, the report shall also address a fall-back scenario in which the re-use strategies are not operational. The grading of the site shall be such that the runoff, including for the fall-back   
 scenario, is fully contained up to the 1:100 year event without spillover.



In case of water re-use strategies for ponds with a discharge, the report shall also address the consequences of the re-use strategy not being operational. That is, the   
 increased average annual runoff volume, increased design flow for the emergency   
 escape route (if any), and decreased service level of the pond (if any) should be   
 quantified. In addition, the additional (theoretical) storage requirements to ensure that   
 the pond has adequate capacity to store the runoff from a 1:100 year event shall be   
 quantified (with the premise that runoff volume targets will not be met).

* 1. Storm Sewers (On-Site/Off-Site)
     + Identify trunk sizes, alignment, elevations, and hydraulic grade line(s) at the pond interface.\*
     + Identify any flow offsite.\*

\* If this information is not available in previous reports, such as the Staged Master Drainage Plan, it must be detailed in this submission. In this case, the hydraulic grade line(s) must be estimated, tabulated, and graphically displayed to the extreme extent of the storm sewer system.

* 1. Overland Drainage Routes into Pond
     + Describe how overland drainage route from upstream areas, if any, is routed into the pond and what level of pre-treatment is provided.
     + Geotechnical Information
     + Identify Geotechnical Report (date/title/Consultant). See Section 6.1.7 of The City of Calgary’s [*Stormwater Management & Design Manual*](http://www.calgary.ca/PDA/DBA/Pages/Urban-Development/Publications.aspx) for more information.

 The core of the forebay berm shall be impermeable and the berm itself shall be geotechnically stable under submerged conditions.

* + - Identify whether any infiltration or percolation into the subsoils is proposed to meet runoff volume targets.
    - Identify whether any embankments could be classified as a dam under the *Water Act*.

 A “dam” is a barrier constructed for the purpose of storing water, that (a) provides for a storage capacity of 30,000 cubic metres or more, and (b) is 2.5 metres or more in height when measured vertically to the top of the barrier.

Mitigation strategies for potential impacts from failure of a pond, which has an embankment that is not classified as a dam under the *Water Act* but has a total   
  
(i.e., dead + live) 1:100 year storage volume of more than 10,000 m3 and an   
 embankment of more than 1.0 m above original ground, will be assessed on a case-  
 by-case basis. See Section 6.1.7 of The City of Calgary’s [*Stormwater Management &   
 Design Manual*](http://www.calgary.ca/PDA/DBA/Pages/Urban-Development/Publications.aspx) for more information.

* + - Identify any constrictions to pond design as per Geotechnical Report.

Where infiltration/percolation into the subsoils is proposed to meet runoff volume targets, the proponent shall:

* + - * Assess the impact on the groundwater table;
      * Demonstrate that the assumed percolation rates are sustainable in the long run on a local and a regional level;
      * Demonstrate that the percolating runoff will have no detrimental impact on adjacent roadways or any downstream structures; and
      * Demonstrate that the percolating runoff will not contribute to an increase in inflow and infiltration into the sanitary system.
      * Infiltration and / or percolation into the subsoils are not permitted if the runoff is contaminated with highly mobile constituents as assessed by an environmental specialist with Environmental Safety Management (The City of Calgary).
  1. Emergency Escape Route
     + Describe emergency escape route.

The configuration and capacity of the emergency escape route shall be adequate to convey the design capacity without creating unsafe conditions or negatively impacting downstream property. Assessment of the overland emergency escape route shall   
 extend to the location where the spilling flow will enter a downstream pond or drainage   
 course that has a capacity exceeding that of the overland emergency escape route.

* 1. Biophysical Impact Assessment and Inventory
     + Identify Biophysical Impact Assessment and Biophysical Inventory reports for the development area.
     + Identify habitat targets, especially in the case of engineered natural stormwater wetlands and constructed wetlands that provide compensatory value.
     + Summarize conclusions and demonstrate how recommendations have been incorporated into the pond design.
     + For ponds in the vicinity of the Calgary International Airport, describe the wildlife mitigation measures that are being implemented.
  2. Construction Tolerances
     + Identify construction tolerances for engineered natural stormwater wetlands.

# ANALYSIS METHODOLOGY

* 1. Conceptual Approach
     + Describe the conceptual approach to the simulation of runoff in the study area (i.e., single event and/or continuous simulations).
  2. Computer Model
     + Describe the computer model used (for example: SWMHYMO, XPSWMM, QHM, water balance spreadsheet, etc.).
     + Describe design storm used and/or climate database employed

 The precipitation database shall include both rainfall and snowfall and cover the entire period of record (i.e., 1960 through 2008 or later). Representative databases will be posted on the City of Calgary website in the near future.

* + - Describe modeling of Pre-Development Upstream Discharge (if applicable, and if this information is not available in previous submissions). Include computer simulation input data files and output files and modeling schematic in Appendix B (see section for requirements).
    - Tabulate relevant catchment information.

Table 4: Catchment Parameters, Imperviousness Ratios and Design Discharge Rates

| Catchment ID | Area | Total  Imperviousness Ratio | Directly Connected Imperviousness Ratio | Curve Number | Unit Area Release Rate | Discharge Rate |
| --- | --- | --- | --- | --- | --- | --- |
| (-) | (ha) | (%) | (%) | (-) | (L/s/ha) | (L/s) |
|  |  |  |  |  |  |  |
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If other infiltration methods are used, provide relevant information, such as Horton’s or Green-Ampt parameters. If source control practices are used in the upstream catchment, provide all relevant information.

* + - Identify boundary conditions and starting water levels (if applicable).

 For evaporation and other facilities that do not empty from year to year, the starting water level or pond volume for the simulation shall be established iteratively, and correspond to the average water level or pond volumes over the period of record.

* 1. Stormwater Quality Enhancement
     + Describe runoff and pollutant simulation.
     + Describe sedimentation process.
     + Describe pond flow path.
     + Summarize input parameters used.
  2. Technical Analyses
     + List tables, figures, and appendices presented in the analysis.

 In case CFD analysis techniques are used as part of the analysis, the proponent shall meet with Water Services to discuss submission requirements prior to submitting the report.



The hydraulic losses associated with the incorporation of a skimming manhole must be   
 included in the modelling of the storm sewer system upstream of the pond.

# ANALYSIS AND RESULTS

* 1. General
     + Describe location and area of service as shown in **Figure 2: Study Area** (see section for requirements).
     + Explicitly state that all details conform to The City of Calgary’s *Standard Specifications* and *Stormwater Management and Design Manual*.
     + Refer to **Figure 4: Pond Drawing(s)** (see section for requirements).
  2. Hydrologic/Hydraulic Analysis
     + Summarize model input and output data.
     + Provide hardcopy of computer simulation input/output data files and modeling schematic in Appendix A (see section for requirements).
     + Summarize annual runoff volume discharged (in mm) from the pond or wetland, if applicable.
     + For wetlands, provide elevation exceedance curves and compare with pre-development conditions, if applicable.
     + For wet ponds subject to water re-use, provide elevation exceedance curves and quantify volumes of water available for re-use.
     + For Source Control Practices in the upstream catchment that affect the sizing of the storm pond, provide all relevant output data.
     + Provide results of statistical analysis of annual maxima for each frequency distribution analyzed.

 The numbering system shall be logical. Preferably, catchment, street segment, and storm sewer identification numbers shall relate to the phase and manhole number. For example, manhole 5-8D, located in Phase 5, receives runoff from catchments 5-8A   
 through 5-8E, street segments 5-8-1 and 5-8-2, and trap low 5-8.

* 1. Downstream Allowable Discharge Rate
     + Summarize allowable discharge rate as per the Staged Master Drainage Plan.
  2. Pre-Development Upstream Discharge
     + Summarize results of upstream discharge analysis (if applicable).
  3. Emergency Escape Route
     + Provide derivation of the emergency escape design flow rate and demonstrate that the configuration and capacity of the emergency escape route is adequate to convey the design capacity without creating unsafe conditions or negatively impacting downstream property. See Section 6.1.3 of The City of Calgary’s [*Stormwater Management & Design Manual*](http://www.calgary.ca/PDA/DBA/Pages/Urban-Development/Publications.aspx) for more information.
  4. Stormwater Storage Requirements
     + Summarize storage requirements based on single-event and/or continuous simulation. Provide results of statistical analysis of annual maxima for each frequency distribution analyzed.
     + For zero-discharge facilities:
       - Describe area subject to inundation for 1:100 year event.
       - Demonstrate balance between runoff and evaporation losses and/or water re-use for average annual year
       - Identify area subject to inundation and water level for 1:100 year event in case water re-use system is not operational (if applicable).
     + Tabulate key pond characteristics.

Table 5: Common Characteristics for Main Cell of Pond (Conventional)

| Parameter | Value |
| --- | --- |
| Upstream Catchment Controlled by Upstream Ponds | ha |
| Upstream Catchment Release Rate | L/s and L/s/ha |
| Direct Catchment Area | ha |
| Total Catchment Area | ha |
| Bottom Elevation | m |
| Normal Water Level (NWL) | m |
| High Water Level (HWL) | m |
| Invert Elevation of Control Structure | m |
| Pond Depth below NWL | m |
| Active Pond Depth (NWL to HWL) | m |
| Area at NWL | ha |
| Area at HWL | ha |
| Release Rate at HWL | m3/s and L/s/ha |
| Emergency Overflow Design Rate | m3/s |
| Emergency Overflow Design Rate Elevation | m |
| Freeboard Elevation | m |
| Storage Volume at NWL | m3 |
| Storage Volume at HWL | m3 |
| Live Storage Volume at HWL | m3 |
| 1:100 Year Live Storage Volume | m3 |
| 1:100 Year Water Level | m |
| 1:100 Year Discharge | m3/s |

Table 6: Common Characteristics for Main Cell of Pond (Subject to Stormwater Reuse)

| Parameter | Value |
| --- | --- |
| Upstream Catchment Controlled by Upstream Ponds | ha |
| Upstream Catchment Release Rate | L/s and L/s/ha |
| Direct Catchment Area | ha |
| Total Catchment Area | ha |
| Bottom Elevation | m |
| Lower Normal Water Level (LNWL) | m |
| Upper Normal Water Level (UNWL) | m |
| High Water Level (HWL) | m |
| Invert Elevation of Control Structure | m |
| Pond Depth below NWL | m |
| Active Pond Depth (NWL to HWL) | m |
| Area at PWL | ha |
| Area at HWL | ha |
| Release Rate at HWL | m3/s and L/s/ha |
| Emergency Overflow Design Rate | m3/s |
| Emergency Overflow Design Rate Elevation | m |
| Freeboard Elevation | m |
| Discharge at HWL | m3/s and L/s/ha |
| Storage Volume at PWL | m3 |
| Storage Volume at HWL | m3 |
| Live Storage Volume at HWL | m3 |
| 1:100 Year Live Storage Volume | m3 |
| 1:100 Year Water Level | m |
| 1:100 Year Discharge | m3/s |

Table information shall match the data presented in the preceding Staged Master Drainage Plan Report (if applicable).

* 1. Water Quality Performance
     + Summarize forebay settling length and dispersion length as well as minimum forebay bottom width.
     + Summarize 25-year sediment accumulation in forebay.
     + Summarize Total Suspended Solids (TSS) removal in pond in tabular format for the particle size distribution used in the model.
     + Summarize detention time and provide the computation in Appendix A (see section for requirements). See Section 6.1.2 (v) of The City of Calgary’s [*Stormwater Management & Design Manual*](http://www.calgary.ca/PDA/DBA/Pages/Urban-Development/Publications.aspx)for more information.
  2. Habitat
     + In case of engineered natural stormwater wetlands and constructed stormwater wetlands that provide compensatory value, demonstrate how the design objectives for the operation of the “habitat” components of the wetlands, as agreed with Water Resources and Parks during the establishment of the SMDP, have been met.

# OPERATION AND MAINTENANCE CONSIDERATIONS

* + - Describe sediment removal.
    - Describe weed and vegetation removal.
    - Describe algae treatment.
    - Describe mosquito control.
    - Describe outlet control structure(s).
    - Describe monitoring system.
    - Describe maintenance access.



Typical Operation and Maintenance considerations for storm ponds are outlined in Section 10.2.2 of The City of Calgary’s [*Stormwater Management & Design Manual*](http://www.calgary.ca/PDA/DBA/Pages/Urban-Development/Publications.aspx). Only unique considerations not covered by Section 10.2.2 need to be described in this section.

# SUMMARY

* + - Conclusions and recommendations.
    - Explicitly state that the design meets stormwater quantity and quality enhancement guidelines.

# REFERENCES

Give a list of references in support of this report, including (but not limited to):

* Computer Model User’s Manual.
* The City of Calgary’s [*Stormwater Management & Design Manual*](http://www.calgary.ca/PDA/DBA/Pages/Urban-Development/Publications.aspx).
* MDP report or SWM reports which provide the basis for the design objectives.

# CORPORATE AUTHORIZATION

Include appropriate wording for the consultant’s authorization.

Show stamp of Professional Engineer.

**RESPONSIBLE ENGINEER**

Show Permit to Practice stamp or number.

**PERMIT TO PRACTICE**

# FIGURES

Figure 1: Location Area

* 8½ x 11
* Legal land location.
* Site location within City of Calgary.
* Section numbers.
* Major roadways.

Figure 2: Study Area

* 8½ x 11 or 11 x 17, as appropriate.
* Legal land location.
* Section numbers.
* Development area.
* Overall storm catchment area boundary.
* Catchment area (in hectares).
* Contours of lands adjacent to pond.
* Adjacent LOC numbers.

Figure 3: Storm Area Design

* 11 x 17 minimum
* Pre-development boundaries (i.e. for existing wetlands).
* Proposed catchment area boundaries.
* Existing drainage features that are retained as part of the drainage concept such as wetlands, perennial or intermittent streams including ravines and man-made drainage infrastructure (i.e., impoundments, ponds and culverts).
* Unit-area discharge.
* Legal boundaries (as appropriate).
* Overland drainage routes entering the pond.
* All overland emergency escape routes
* Contours of adjacent properties.
* Receiving water bodies and outfalls.
* Trunk alignment.

Figure 4: Pond Drawing(s)

* 11 x 17 minimum
* Maintenance vehicle access.
* Pathways.
* Monitoring equipment (location and type).
* Pond volume.
* Pond contours and grading showing bottom, NWL, (or (L)NWL and (U)NWL), HWL, and FB elevations where applicable.
* Pond depth.
* Side slopes
* Sediment forebay (or equivalent).
* Storm sewer inlet and overland flow inlet details.
* Rim, gratings, orifice, trash rack, and gate valve.
* Outlet control structure details.
* Piping information (inverts, size, type, length, and slope) and block profiles where applicable.
* Pond discharge rates (provide as-built Stage-Storage-Discharge Table).
* Overland Escape Route (location and spill elevation).

# APPENDICES

Appendix A: Computer Model Data Files

* Input and Output Files
* For zero-discharge facilities, provide annual minimum and maximum storage volumes, and maximum surface areas inundated. Also, identify starting water level and/or storage volume.
* For statistical analysis, provide results from all frequency distributions examined including confidence band.
* The following considerations apply to all data files:
  + - * Use header with the following info: project name, page x of y.
      * Use footer with following info: filename / date-time.
      * Use a coloured sheet to separate data files.
      * Text in data files should not wrap at end of line – consider using “Courier New” font in WORD.
* Show schematic with size commensurate with the number of model segments
* Model routing order for of subcatchments, minor segments, major segments and major-minor storage, if applicable.

Ensure that the model identification numbering system matches the Overland Drainage and Storm Drainage drawings to the greatest extent possible. For example, manhole numbers should include phase number and subcatchment identification should relate to manhole number.

Appendix B: Design Storm and/or Climate Data

* For single-event analysis, include:
  + - * Design storm parameters.
      * Duration.
      * Time increments.
* For continuous simulation analysis, include:
  + - * Precipitation database.

The precipitation database shall include **both** rainfall and snowfall, and should cover at least the period of 1960 through 2008 (or later).

* + - * Evaporation and evapotranspiration database.
      * Water re-use database.
      * Start and finish dates of simulation.
      * Time increments.