

# Drainage Report Formatting

(For Single Lot Commercial Development)

*Note to Designer:*

- a. Please tab each section of the report.*
- b. Please submit a digital copy in either Word or PDF along with the hard copy.*
- c. The report should include any future phases of the project as well as the current proposed project.*
- d. Please use a scale of 1":100' or larger and a minimum font size of 8 points on all maps and figures used in the report.*
- e. All notes in italics are explanatory and should not be included in the final report.*
- f. Items listed with letters and bullets are provided to inform which items/data should be included in the appropriate sections. Additional explanations, tables or graphs may be required to properly address a particular issue. The letter/bullet formatting of this drainage report template does not imply that submitted drainage reports must follow similar formatting.*
- g. All sections need to be addressed or acknowledged, N.A. or does not apply is an acceptable response.*

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional under the laws of the State of Minnesota.

Print Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_ License #: \_\_\_\_\_

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## **SECTION 1.0 - Report Summary and Site Background**

- 1.1 Background Summary - Provide a Brief Overview of Existing Site Conditions and Proposed Improvements including the following information:
  - a. Location (Sec-Twp-Rng)
  - b. Description of the number of acres being developed and their current use(s).
  - c. Description of adjoining properties including current use(s) and zoning.
  - d. Description of the improvements proposed with this project and any planned future phases.
  
- 1.2 Report summary of Existing and Proposed Hydrology (Next Page, *See Table 1.2.A-C – Hydrologic Summary Tables*). Please ensure that the design information (areas, structure's i.d., pipe data, points) matches what is shown in the table.



**City of Rochester**  
**Single Lot Commercial Development**  
**Storm Sewer Analysis Summary Table**

***Table 1.2.C - Pipe Capacity, Inlet and Spread Analysis***

<i>Structure I.D.</i>	<i>Routing</i>		<i>10-Year Storm</i>		<i>Pipe Capacity</i>				<i>Drive Lane Requirements</i>				<i>Grate Capacity</i>					
	From	To	Drainage Area (ac)	Total Flow (cfs)	Flow in Pipe (cfs)	Pipe Slope (%)	Pipe Diameter (inches)	Pipe Capacity (cfs)	Street Width (Face-to-Face)	Street Grade (% Longitudinal)	Allowable Spread Width (ft)	Max Depth (ft)	Inlet Type*	Flow to Inlet (cfs)	Grate Capacity (cfs)	Flow Depth (ft)	By-Pass Flow (cfs)	By-Pass to Structure I.D.

NOTE: \* In Line (IL) or Low Point (LP)

## **SECTION 2.0 - Existing Conditions**

### 2.1 Existing Site Conditions

(Refer to Appendix A for the Existing Conditions and Drainage Map)

- a. Describe the Current Land Use and Site Area
- b. Current Site Cover Break Down
  - Type of cover/vegetation
  - Percent impervious
  - CN or C values and how they were determined
- c. Hydrologic Analysis
  - Detailed summary of variables and coefficients used
  - Analysis nodal i.d.'s match what is shown on the drainage map.
  - Account for off site water entering site
  - Flow analysis at each discharge location of site

### 2.2 Summary Tables of the Existing Hydrologic Data

(Refer to Appendix A for the supporting Analysis and Data)

*Table 2.2. A – Existing Site Subcatchment Hydrology*

	Area (acres)	2 Year Storm – 2.9” (cfs)	10 Year Storm – 4.2” (cfs)	100 Year Storm Event – 6.2” (cfs)
Subcatchment “A”				
Thru				
Subcatchment “Z”				
Total Subcatchments Area				
Discharge Flow Rate Off Site (cfs)				
*Point “A”				
Thru				
*Point “Z”				

Note: \* Account for all surface water discharges crossing property boundary.

*Table 2.2.B – Existing Subcatchment Hydrologic Breakdown*

Subcatchment I.D. #	Area (acres)	Impervious	Pervious	CN	TC	Drains	
						On Site	Off Site

2.3 Existing Wetlands/On-Site Detention.

*Table 2.3.A – Existing Wetland/On Site Ponding Data*

Run Off Storage Wetland/Depression I.D. #	Drainage Area (acres)	100 Year Storm Event		
		$Q_{IN}$ (cfs)	$Q_{OUT}$ (cfs)	Peak Elevation (ft)

- a. Describe the location, size, contributing drainage area, and type of each wetland located on the property.
- b. Describe any existing on-site drainage detention areas including location, contributing drainage area, high and normal water elevations, bounce in the 2, 10, and 100 year storm events and outlet configuration.
- c. Culvert inlets and/or area inlets may be required to provide stage-storage-discharge data for offsite impact considerations.

2.4 Existing Storm Sewer System

- a. Describe any existing on-site storm sewer ponding, catch basins, and storm sewer piping. The description should include the condition, size, and capacity of the existing system.
- b. Describe the existing public storm sewer system that the site outlets. The description should include a discussion of any known deficiencies in the system. Includes discussion(s) on downstream adequacy and stability.

2.5 Existing Regional Pond and/or Existing On Site Pond

*Table 2.5.A – Storm Water Management Plan - Regional Pond Data*

Regional Pond ID #	Site Area		Site CN		2 Year Flow		10 Year		100 Year	
	SWMP		SWMP		SWMP		SWMP		SWMP	

*Table 2.5.B – Existing On Site Water Treatment Pond or Water Feature*

On Site Ponding I.D. #	Drain Area (acres)	<u>2 Year</u>			<u>10 Year</u>			<u>100 Year</u>		
		Q <sub>IN</sub> (cfs)	Q <sub>OUT</sub> (cfs)	Peak Elev. (ft)	Q <sub>IN</sub> (cfs)	Q <sub>OUT</sub> (cfs)	Peak Elev. (ft)	Q <sub>IN</sub> (cfs)	Q <sub>OUT</sub> (cfs)	Peak Elev. (ft)

- a. Describe the existing regional pond. The description should include the contributing drainage area, normal and high water elevation, bounce in the 2, 10, and 100 year storm, and any know deficiencies.
- b. Provide a breakdown of the existing regional pond assumptions for the site improvements in question



## **SECTION 3.0 - Proposed Conditions**

### 3.1 Proposed Site Conditions

(Refer to Appendix B for the Proposed Conditions and Drainage Map)

- a. Describe the Proposed Land Use.
- b. Proposed Site Cover Break Down
  - Type of cover/vegetation
  - Percent impervious
  - CN or C values and how they were determined
- c. Hydrologic Analysis
  - Detailed summary of variables and coefficients used
  - Analysis nodal i.d.'s match what is shown on the drainage map.
  - Account for off site water entering site
  - Flow analysis at each discharge location of site. Includes impact(s) on downstream adequacy and stability.

*Table 3.1. A – Proposed Site Subcatchment Hydrology*

	Area (acres)	2 Year Storm – 2.9” (cfs)	10 Year Storm – 4.2” (cfs)	100 Year Storm Event – 6.2” (cfs)
Subcatchment “A”				
Thru				
Subcatchment “Z”				
Total Subcatchments Area				
Discharge Flow Rate Off Site (cfs)				
*Point “A”				
Thru				
*Point “Z”				

Note: \* Account for all surface water discharges crossing property boundary.

*Table 3.1.B – Proposed Site Subcatchment Hydrologic Breakdown*

Subcatchment I.D. #	Area (acres)	Impervious	Pervious	CN	TC	Drains	
						On	Off

3.2 Storm Water Runoff Treatment – On Site Pond or Regional Pond? (See section 4 for detailed pond design information.)

*Table 3.2.A – Storm Water Management Plan - Regional Pond Data*

Regional Pond ID #	Site Area		Site CN		2 Year Flow		10 Year		100 Year	
	SWMP	Proposed	SWMP	Proposed	SWMP	Proposed	SWMP	Proposed	SWMP	Proposed

*Table 3.2.B – Proposed On Site Water Treatment Pond or Water Feature*

On Site Ponding I.D. #	Drain Area (acres)	<u>2 Year</u>			<u>10 Year</u>			<u>100 Year</u>		
		Q <sub>IN</sub> (cfs)	Q <sub>OUT</sub> (cfs)	Peak Elev. (ft)	Q <sub>IN</sub> (cfs)	Q <sub>OUT</sub> (cfs)	Peak Elev. (ft)	Q <sub>IN</sub> (cfs)	Q <sub>OUT</sub> (cfs)	Peak Elev. (ft)

### 3.3 Summary Table on the Proposed Hydrologic Data

*Table 3.3.A – Proposed Hydrologic Data*

(Refer to Appendix B for the supporting Analysis and Data)	Area (acres)	2 Year Storm (cfs)	10 Year Storm (cfs)	100 Year Storm Event (cfs)
Drainage Area “A”				
Drainage Area “B”				
Drainage Area “C”				
Total all Drainage Areas				

### 3.4 Wetlands/On-Site Detention

*Table 3.4.A – Proposed Wetland/On Site Ponding Data*

Run Off Storage Wetland/Depression I.D. #	Drainage Area (acres)	100 Year Storm Event		
		Q <sub>IN</sub> (cfs)	Q <sub>OUT</sub> (cfs)	Peak Elevation (ft)

- a. Describe the impacts of the proposed project to any existing wetlands or on-site detention. Include a description of any necessary modifications to the wetland(s) and/or on-site detention to accommodate any change in storm water runoff.
- b. Describe any proposed new wetlands. The description should include the location, size, and hydraulic capacity of the wetland.
- c. Describe any proposed new on-site detention.
- d. Model any infiltration areas, depressions, and depressed inlets as ponds.
- e. Verify that the bounce in the 100 year storm event is contained within the property or an easement.
- f. Culvert inlets and/or area inlets may be required to provide stage-storage-discharge data for off site impact considerations.

- g. *Note: The high water level of an existing detention basin cannot be raised without permission. Changes to wetlands will require additional permits and authorization prior to work beginning.*

3.5 Storm sewer system/culvert analysis (Please see section 1005.2 – 1005.5 of the *Engineering Standards* as provided by the City of Rochester Public Works Department)

Summary of the Proposed Storm Sewer Design (*Next Page, See Table 3.5.A – Storm Sewer and Inlet Analysis*)

a. Storm Pipe

- Describe the methodology used for pipe sizing.
- Storm sewer piping must be designed to have capacity adequate for the 10 year storm. State in the report if the system will be able to handle the 10 year storm.
- Provide the supporting analysis showing that the system can handle the 10 year storm without surcharging the system in Appendix B.

b. Inlet capacity – 10 year capture or other storm event(s) as the site may require.

- Describe the methodology used for inlet capacity analysis.
- State whether the inlets capture the 10 year storm or if gutter spread results in bypass which exceeds the City standards.
- Provide the supporting analysis for each catch basin where bypass of the catch basin would enter the public right of way in Appendix B. The analysis should take into account the cross and longitudinal slopes, grate type and orientation, spread and depth.
- Verify that the depth at Emergency Overflow labeled on the plans matches the maximum depth shown on the analysis.
- Just as the plans must show the flow routing of any bypass, the bypass must be accounted for in the design calculations in this report.
- The analysis must account for HGL/Tailwater where pertinent.



3.6 Open Channel/Drainage Way Sizing (Please see section 1005.6 of the *Engineering Standards* as provided by the City of Rochester Public Works Department)

*Table 3.6.A – Open Channel/Drainage Swale Data*

Channel ID	Drainage Area (acres)	Max Slope (%)	Min Slope (%)	10-Year Flow/Velocity	10-Year Max Depth (ft)	25-Year Flow//Velocity	25-Year Max Depth (ft)	100-Year Flow//Velocity	100-Year Max Depth (ft)	Hard Armoring (Type)
A										
B										

- a. Open Channel is to carry 25 year storm event flow rate.
- b. The 100 year storm event flow rate HGL/EGL elevation(s) shall be confined within channel easement/R.O.W.
- c. Confirm that the 100 high water level is contained within a Drainage easement.
- d. Describe the Flow rate, velocity and associated shear stress for each drainage swale.
- e. Provide information showing the limits of necessary hard armoring based on the calculated velocities and shear stresses.
- f. Provide the supporting analysis and data in Appendix B.

3.7 Velocity and Hard Armoring

*Table 3.7.A – Discharge Outlet Velocity Data*

Outlet Location I.D. #	10 Year		100 Year		Shear Stress	Armoring Type
	Q (cfs)	V (fps)	Q (cfs)	V (fps)		

- a. Describe the contributing drainage area and the 10 & 100 year discharge rates.

- b. Describe the Flow rate and Velocity of each swale and pipe outlet.
- c. Provide information showing the limits of necessary hard armoring based on the calculated velocities and shear stresses.
- d. Provide the supporting analysis and data in Appendix B.

## **SECTION 4.0 - Storm Water Treatment**

*(Required if discharging to an existing or proposed storm water management pond to determine proper compliance with the current regulations.)*

### 4.1 Regional Pond

- a. Provide Existing Regional Pond ID number and the calculated acceptable flow rate(s) from the proposed site.
- b. New Regional Pond - shall meet the City of Rochester Storm Water Management Plan. See City of Rochester Public Works Department for the current Storm Water Master Plan and detailed design criteria.

### 4.2 On Site Storm Water Treatment Pond Compliance (Public or Private)

*Table 4.2.A. – Pond Design Criteria*

Design Requirements	Drainage Area (acres)	Dead Storage (ac-ft)	Water Quality Volume (ac-ft)	Additional Sediment Storage Requirements (cf)	Skimmer Structure	Peak Bounce Elevation (100-year)	EOF Elevation	Outlet & Overflow Armoring
City								
MPCA								
Actual								

- a. Design Summary
  - (Refer to Section 1005.7 of the *Engineering Standards* as provided by the City of Rochester Department of Public Works.)
  - Current MPCA Standards (including impaired and special waters requirements).
  - Provide design data used to size the private on-site pond to meet City standards.



- Provide analysis of the regional pond showing that the pond has adequate capacity for the change in storm water flow. If the regional pond does not have adequate capacity, provide recommendations for improvements to provide adequate capacity.
- a. Hydrologic Analysis
  - Detailed summary of variables and coefficients used
  - Analysis nodal i.d.'s match what is shown on the drainage map.
  - Account for off site water entering site
  - Flow analysis at each discharge location of site. Includes discussion(s) on downstream adequacy and stability.

#### 4.3 Other approved alternative treatment(s)

- a. Design criteria
- b. Summary
- c. Supporting information for infiltration (size requirements, infiltration rates, ground water elevation)

*(USE Appendix C if needed for Supporting Information)*

## **SECTION 5.0 – Miscellaneous Data & Figures**

5.1 Provide an aerial photo of the site and surrounding area.

- a. Site boundary clearly shown
- b. Minimum of 1 mile radius shown with all receiving water bodies identified.
- c. With impaired waters and wetland shown. (NPDES requirements are addressed in Section 4)

*Note: if an impaired or protected water is located within 1 mile the site must meet NPDES/MPCA standards:*

1. *All exposed soil stabilized no later than 7 days.*
2. *Temporary sediment basin may be required.*
3. *Undisturbed buffer zone of 100 LF from the special water must be maintained.*
4. *Must provide treatment of water quality volume of 1" over new impervious.*
5. *Where site conditions allow, 1/2" of the water quality volume must be infiltrated.*
6. *The permanent storm water management system must be designed such that pre and post-project run off rate and volume from 1 and 2 year 24-hour precipitation events remain the same or are reduced.*

5.2 Soils Map

5.3 Miscellaneous figures, pictures and data that supports the project design.

- a. Downstream out fall location and current condition/stability photo(s)

*(USE Appendix D if needed for Supporting Information)*

## **SECTION 6.0 - Supporting Information from Prior Drainage Reports/Studies**

- 6.1 Summarize any prior drainage reports or studies being used as supporting information. Provide photocopies of any pertinent sections specifically used as supporting documentation from approved document.

*(USE Appendix E if needed for Supporting Information)*

## **APPENDIX A (Existing Conditions)**

### A.1 Existing Conditions Drainage Figure

1. General figure notes:
  - a. Clearly delineate All catchments
  - b. Subcatchments are clearly shown and labeled.
    - Catchments are labeled same as drainage map and grading plan?
    - Account for off site water entering site
  - c. Extents shown on drainage figure are to encompass the complete drainage areas (on site and off site) that drain onto the site.
  - d. Clearly show the existing ponding/storage locations and provide information on the 100 y ear HWL at each location. Include appropriate EO elevation and routing.
  - e. Please utilize the same nodal I.D. numbering system used in the hydrologic/hydraulic analysis on the drainage figure(s).
  - f. Show the existing storm water management system(s) (i.e., ponds, ditches, wetlands and storm sewer piping).
  - g. Place drainage routing arrows.
  - h. North arrow and scale.

### A.2 Existing Conditions Analysis & Supporting Data

## **APPENDIX B (Proposed Conditions)**

### B.1 Proposed Conditions Drainage Figure

1. General figure notes:
  - a. Clearly delineate All catchments
  - b. Subcatchments are clearly shown and labeled.
    - Catchments are labeled same as drainage map and grading plan?
    - Account for off site water entering site
  - c. Extents shown on drainage figure are to encompass the complete drainage areas (on site and off site) that drain onto the site.
  - d. Clearly show the proposed ponding/storage locations and provide information on the 100 y ear HWL at each location. Include appropriate EO elevation and routing.
  - e. Please utilize the same nodal I.D. numbering system used in the hydrologic/hydraulic analysis on the drainage figure(s).
  - f. Show the proposed storm water management system(s) (i.e..ponds, ditches, wetlands and storm sewer piping).
  - g. Place drainage routing arrows.
  - h. North arrow and scale.

### B.2 Proposed Conditions Analysis & Supporting Data

## **APPENDIX C (Storm Water Treatment)**

### C.1 Storm Water Treatment

## **APPENDIX D (Miscellaneous Data & Figures)**

### D.1 Miscellaneous Supporting Data

## **APPENDIX E (Supporting Information)**

### E.1 Supporting Information