

Technical Memo

To: Mike Greer, City of Bismarck

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Project: City of Bismarck – Stormwater Design Standards Manual (SWDSM) Update

Subject: **TM 501 Performance Requirements & Design Standards - DRAFT**

Date: October 13th, 2016

1.0 Recommendations

The goals of the Performance Requirements and Design Standards recommendations are as follows:

1. Make it easier to navigate the Stormwater Design Standards Manual to determine the requirements applicable for a project;
2. Clearly and concisely define the Performance Requirements, and
3. Summarize the Design Standards for commonly used construction and post-construction best management practices.

We recommend that the updated Stormwater Design Standards Manual (SWDSM) include the Performance Requirements and Design Standards as detailed in the attached draft chapters of the SWDSM. The general findings and recommendations are summarized below:

1. Performance Requirements are generally defined as items or criteria that must be documented by analysis.
2. Design Standards are generally defined as how the construction and post-construction BMPs implemented for specific projects are to be constructed, operated and maintained.
3. Post-Construction Peak Discharge Compliance – BMPS Performance Requirements are recommended to include:
 - a. Peak discharge control requirements to mitigate the post-construction runoff from the 2, 5, 10 and 100-year 24-hour events.
 - b. Analysis and reporting requirements for the following scenarios:
 - i. Scenario 1 - Master Plan based on Current Rainfall and NRCS HSG Hydrologic Soil Group (HSG) with no change;
 - ii. Scenario 2 - Master Plan based on Current Rainfall and NRCS HSG with a change;
 - iii. Scenario 3 - Master Plan Based on TP 40 Rainfall and Old NRCS HSG;
 - iv. Scenario 4 - Master Planned Regional Facilities Not Constructed; and
 - v. Scenario 5 - Projects not within a Master Planned Area.
 - c. Detention and Retention BMPs Stormwater Management Plan (SWMP) reporting requirements that include:
 - i. Defining minimum SWMP summary tables requirements;

- ii. Minimum SWMP Outlet Structure Figure\Detail requirements
 - iii. Require that when infiltration is proposed to be utilized as an engineered outlet that:
 - iv. Applicant note infiltration will be utilized on the Mandatory Stormwater Scoping Sheet, and
 - v. Analysis and design shall include a City approved site specific geotechnical investigation.
4. Post-Construction Peak Discharge Compliance – BMPs Design Standards are recommended to include:
- a. Detention BMPs shall have:
 - i. Minimum freeboard requirements based on the tributary area to the detention BMP;
 - ii. Minimum orifice size requirement, recommend 4-inch diameter;
 - iii. BMPs that utilize an engineered outlet consisting of infiltration shall include an underdrain that is connected to the Public Storm Sewer System;
 - iv. A dedicated drainage easement, or be platted as an undevelopable lot, that fully contains the detention basin maximum pool, embankment, outlet protection and other elements as required by the City Engineer.
 - 1. Easements shall be noted as “Public” (maintained by the City of Bismarck or other approved public entity) or “Private” (maintained by the applicant).
 - 2. Public Easements must be approved by the City.
 - 3. Private Easements must have a provision to allow access by the City to allow for maintenance of derelict BMPs.
 - 4. Post-Construction BMPs constructed on undevelopable lots will only be allowed when platted as Common Interest Lots that are attached to benefiting parcels. Use of Common Interest Lots must be approved by the City.
 - b. Adopt basic Geotechnical\Hydrogeologic Report Requirements as a starting point of expectations for site specific infiltration systems
5. Post-Construction Water Quality Compliance – BMPS Performance Requirements are recommended to include:
- a. Post-construction water quality BMPs performance requirements that reference the City’s MS4 permit.
 - b. Analysis and reporting requirements for the following scenarios:
 - i. Scenario 1 Master Plans with Water Quality Post Construction BMPs with no change;
 - ii. Scenario 2 Master Plans with Water Quality Post Construction BMPs with a change;
 - iii. Scenario 3 Master Plans without Post-Construction Water Quality BMPs;
 - iv. Scenario 4 Master Planned or Local Post-Construction Water Quality BMPs Not Yet Constructed;
 - v. Scenario 5 Master Plans Require Onsite Post-Construction Water Quality BMPs
 - vi. Scenario 5 Projects not within a Master Planned Area
 - c. Define minimum reporting requirements for prescriptive BMPs (those included in the MS4 permit) and alternative BMPs (not included in the MS4 permit).
6. Post-Construction Water Quality Compliance – BMPS Design Standard are recommended to include:

- a. Minimum design standards for the commonly utilized post-construction water quality BMPs including extended dry detention basins, wet detention ponds, infiltration, filtration and manufactured flow through devices.
 - b. Allowing design engineers to reference Design Standards from accepted BMP manuals;
 - c. Developing a City specific BMP manual in the future to address local conditions and expand the prescriptive BMP menu.
7. Drainage and Conveyance – Performance Standards are recommended to include:
- a. Streets, Inlets and Storm Sewer Pipe:
 - i. Major Storm event for all facilities will be the 100-year 24-hour event.
 - ii. Streets, inlets and storm sewer pipes designed for the 5-year 24-hour minor storm event.
 - iii. Revised allowable street flow depths and inundation areas for the 5-year 24-hour and 100-year 24-hour events based on street functional classification.
 - iv. Define “Street Cross Flow” and “Street Overflow” as two separate criteria situations.
 - v. Maintain the existing allowable street cross flow from the existing SWDSM (see Table 6-4 in the attached).
 1. Clarify the definition of “cross-flow” to be the runoff contained in the street right-of-way, flowing longitudinal to the right-of-way, that crosses the right-of-way in a valley gutter or due to the street crown being lowered.
 2. Cross-flow is not the same as street embankment overtopping at culvert crossings.
 - vi. Storm sewer pipe capacity for the Minor Storm should result in an HGL less than 0.5-foot above the crown of the pipe.
 - vii. Minimum storm sewer reporting requirements to include:
 1. Pipe calculations that state the design peak flow rates and design information for each pipe run, such as size, slope, length, material type, and Manning’s coefficient;
 2. Velocities at design flow for each segment of proposed pipe;
 3. Hydraulic grade line (HGL) at each inlet, manhole, angle point, and outlet;
 4. Depth from finish grade to pipe invert for each segment of proposed pipe; and
 5. When there is a significant change in slope of the pipe through a manhole or other structure, the HGL at the structure assuming the velocity approaches zero.
 - b. Culverts:
 - i. Minor storm for culvert analysis and design be the 25-year 24-hour event.
 - ii. Adopted a simplified version of the State stream crossing standard for allowable headwater at a culvert.
 - iii. Street Embankment Overtopping at a Culvert Crossing:
 1. No overtopping for any street section during the 25-year 24-hour storm.

2. Local streets less than 6-inches measured from the highest point on the ROW section during the 100-year 24-hour storm
 3. Collectors and Arterials no overtopping during the 100-year 24-hour storm
 - c. Engineered Open Channels
 - i. Freeboard requirements for open channels that distinguish between a fully excavated channel and situations where berming is used to create a channel (or design flowline) above, the adjoining ground surface.
 - ii. Culvert outlet protection and channel lining resistance based on allowable velocity and shear stress requirements.
8. Drainage and Conveyance – Design Standards are recommended to include:
 - a. Design considerations for valley gutters:
 - i. The minimum grade of the valley gutter shall be 0.5 percent at the flow line.
 - ii. When valley gutters are used to redirect surface flow greater than 90-degrees (change direction) the design engineer shall include an analysis of the HGL and EGL to determine if a significant change in water surface elevation occurs due to a reduction in velocity.
 - b. The following minimum design standards for catch basins and inlets:
 - i. Parking Lots and Private Property: Catch basins installed in parking lots or private pervious areas shall meet the following minimum requirements:
 1. Catch Basin Capacity: Provide 150% of the Minor Storm design flow at each inlet;
 2. Max Ponding Depth: 18-inches during the Major Storm
 3. Minimum Freeboard: 1-foot to adjacent buildings finished floor elevations during the Major Storm.
 4. Overflows: Not uncontrolled (overflow) discharge to the public street right-of-way during the Major Storm event.
 - c. Private Streets: Meet the requirements of Public Streets.
 - d. Public Street Right-of-Ways: Inlets installed in public street right-of-ways shall meet the following minimum design standards:
 - i. On-Grade Inlets:
 1. Inlet Capacity: Can use 100% of the computed inlet capacity (i.e. ignore clogging); and
 2. Minimum Inlet Size: Type 36”
 - ii. Sag Inlets:
 1. Inlet Capacity: Provide 150% of the Major Storm capacity at the allowed ponding depth;
 2. Minimum Inlet Size: Type 72”
 - e. Maintain the storm sewer manhole spacing standards from the existing SWDSM (review Table 6-18 in the attached draft chapter language).
 - f. Clarify the storm sewer manhole sizing standards as there is a conflict between the existing SWDSM and the City Standards Specification. (Table 6-19)
9. Construction Stormwater Control – Performance Requirements include:

- a. Preparation of a site specific SWPPP where;
 - i. Small Site CSMP utilize the simplified application as the site specific SWPPP; and
 - ii. Large Site CSMP prepare a site specific SWPPP based on the ND General Construction Permit and/or requirements in the SWDSM
 - b. Define final stabilization for a Small Site CSMP as:
 - i. All soil disturbing activities for the project have been completed and all soils have been stabilized by a permanent surface covering. For “grass” vegetated areas, soils will be considered stabilized when a uniform perennial vegetative cover with a density of 70 percent is achieved;
 - ii. Down gradient perimeter control for individual lots has been implemented and the residence has been transferred to the homeowner; and
 - iii. The permittee has distributed a “Stormwater Fact Sheet” to the homeowner to inform the homeowner of the lot specific need for drainage patterns and maintenance of the final stabilization.
 - c. Define Large Site CSMP final stabilization as:
 - i. All soil disturbing activities for the project have been completed and all soils have been stabilized by a permanent surface covering. For “grass” vegetated areas, soils will be considered stabilized when a uniform perennial vegetative cover with a density of 70 percent is achieved;
 - ii. All drainage ditches, constructed to drain water from the site after construction is complete, have been stabilized to preclude erosion;
 - iii. All temporary erosion prevention and sediment control BMPs (such as silt fence) have been removed and disposed of in a proper manner; and
 - iv. All sediment has been removed from conveyances and temporary sedimentation basins that will be used as permanent water quality management basins. Sediment must be stabilized to prevent it from being washed into basins, conveyances or drainage ways discharging off-site, or to surface waters or adjacent properties. The cleanout of permanent basins must be sufficient to return the basin to design capacity.
10. Construction Stormwater Control – Design Standards include:
- a. Minimum design standards for commonly implemented construction BMPs.
 - b. Allow applicants to utilize additional BMPs from a commonly accepted BMP manual and recommended performance and design standards of the referenced BMP manual are followed.

2.0 Project Purpose

The City of Bismarck (City) has commissioned AE2S|HDR to assist in reviewing and updating the Stormwater Design Standards Manual (SWDSM) that was originally adopted in 2000. The objective of this study (Project) is to provide the City with an updated SWDSM and recommendations for modifications to other pertinent items such as Title 14.1 of the Code of Ordinances and the City’s Standard Construction Specifications and Standard Drawings. To accomplish this objective, the Project has been split into several tasks through which a series of technical memorandums will be developed, culminating in a final updated SWDSM. Project tasks are as follows:

1. Project Management & Kick-off Meetings;
2. Title 14.1 Ordinance and MS4 Permit Review (TM 200);

3. Procedures Review and Recommendations (TM 300);
4. Analysis Methodology Review and Recommendations (TM 400);
5. Design and Performance Review and Recommendations (TM 501);
6. Stormwater, Erosion Control, and Restoration Standard Specifications and Standard Details Review and Recommendations (TM 502); and
7. Updated Stormwater Design Standards Manual.

The purpose of this document (Technical Memorandum 501) is as follows:

- a. Summarize the recommended chapters and sections relating to the Performance Requirements and Design Standards for Post-Construction Peak Discharge Compliance, Post-Construction Water Quality Compliance layout; Drainage & Conveyance, and Construction Stormwater Control
- b. Summarize the recommended changes on how information is organized; and
- c. Summarize the existing Performance and Design Standards.

The draft findings and recommendation of this TM will be reviewed with City Staff and presented at a public input meeting. Comments received will be incorporated into the final version of TM 501. The recommendations of the final TM will be incorporated into the revised SWDSM

3.0 Existing Performance Requirements & Design Standards

The existing guidance on Performance and Design Standards is provided within Chapter 4 through Chapter 11 of the existing SWDSM. Many of the design standards sections of the existing SWDSM are still valid and will be incorporated into the revised SWDSM.

The existing manual include a significant amount of technical performance and analysis methodology that is available in other widely accepted and accessible resources. It is recommended that the “how-to” portion of the existing SWDSM be replaced with specific performance and reporting requirements for the post-construction stormwater facilities proposed by the design engineer for the purpose of obtaining a PCSMP.

Attachments Draft SWDSM Chapters 4, 5, 6, and 7 – Performance Requirements & Design Standards