




The City of Winnipeg
Winnipeg Sewage Treatment Program

Civil Design Guideline

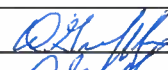
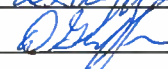
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CAUTION

This document is currently in a draft state. All design shall be based upon the approved issue of this document, which will be provided prior to award.

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1 INTRODUCTION

This document identifies the standard design requirements that are applicable to any civil work within the City of Winnipeg wastewater treatment facilities.

1.1 Scope of the Standard

These design requirements will apply to the following facilities:

- Wastewater treatment plants

1.2 Application

The scope and intent of this document is intended to convey general design guidance and expectations regarding architectural systems. This document does address specifics related to design type, selection, and configuration; however the indicated requirements are presented without knowledge of the specific building implementation. It is not within the scope of this document to provide detailed design direction, and it will be the responsibility of the respective civil designers to fully develop the civil details with general conformance to the concepts presented herein. This standard shall not be construed as comprehensive engineering design requirements or negate the requirement for professional engineering involvement. Any design must be executed under the responsibility and seal of the respective engineer in each instance, and must be performed in conformance with all applicable codes and standards, as well as good engineering practice.

Existing facilities do not necessarily comply with this standard. The expectations regarding application of this standard to maintenance and minor upgrades at existing facilities must be assessed on a case-by-case basis; however general guidelines for application are presented as follows:

- All new buildings and sites are expected to comply with this standard.
- All major upgrades to a building or site are expected to comply with this standard; however, in some cases compromise with the configuration of the existing facility design may be required.
- All minor upgrades should utilize this standard as far as practical for new work; however, in some cases compromise with the configuration of the existing facility design may be required.

1.3 Deviations from Standard

It is expected that there will be occasional situations where the design engineer will propose a deviation from this design guideline. The rationale for potential deviations from the design guideline may include:


- Evolution of technology,
- Updates to standards and regulations,
- Practical limitations due to existing conditions on site, or
- Significant cost benefits to the City due to specific project constraints.

For each proposed deviation from this standard, fully complete a *WSTP Standards Deviation Form* and submit to the City project manager for approval. Do not proceed with the proposed deviation unless approval is received from the City project manager.

1.4 Acronyms and Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standard Institute
AWWA	American Water Works Association
CSA	Canadian Standards Association
NBC	National Building Code
TAC	Transportation Association of Canada
WSTP	Winnipeg Sewage Treatment Program

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2 GENERAL

2.1 Design Codes and Standards

The requirements of the latest issue of the following codes, standards and regulations shall apply to civil design:

- National Building Code of Canada with Manitoba Amendments (NBC)
- Geometric Design for Canadian Roads, Transportation Association of Canada (TAC)
- AASHTO Guide for Design of Pavement Structures
- Water Supply for Public Fire Protection, Fire Underwriters Survey
- Canadian Standards Association (CSA)
- American National Standard Institute (ANSI)
- American Water Works Association (AWWA)


2.2 Other City Standards

1. While not exclusive, ensure that the following City Standards are adhered to:
 - 1.1 Water Demand Estimation and Design Guidelines
 - 1.2 Wastewater Flow Estimation and Servicing Guidelines
 - 1.3 Storm Water Management Criteria
 - 1.4 City of Winnipeg Transportation Standards Manual
 - 1.5 2010 City of Winnipeg Accessibility Design Standard
 - 1.6 City of Winnipeg Standard Construction Specifications
 - 1.7 City of Winnipeg Listings of Approved Products
 - 1.8 Water and Waste Department Identification Standard

2.3 Units

All drawings and documentation shall use the International System of Units (SI units). Imperial units will be provided in parenthesis after the metric unit, where requested or appropriate. Specific requirements are as follows:

1. All building dimensions are to be in millimeters.
2. All elevations are to be in meters, in the format EL. ###.### (example EL. 273.520).

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3 GENERAL SITE DEVELOPMENT REQUIREMENTS

3.1 Overall Site Layout

1. Provide an overall site layout design considering all civil and building works, as well as requirements of other disciplines.
 - 1.1 Include all inter-building electrical services.
 - 1.2 Include all inter-building mechanical services.
2. Coordinate site layout requirements to include both current and future site development requirements.
3. Coordinate the site arrangement to minimize fill and/or excavation costs while maintaining efficiency of project construction, operation, and maintenance.
4. Ensure oil and chemical storage areas are designed to contain spills.

3.2 Flood Protection

1. Unless otherwise indicated by the City, design flood protection systems to protect all facilities from a 100-year flood event.

3.3 Sanitary Sewers


1. Design sanitary sewers and drains for the entire facility.
2. Ensure that sewers are drained into or upstream of the headworks facility.

3.4 Fencing

1. Design a permanent perimeter fence around the entire facility.
2. Permanent fencing shall be chain link fencing, in accordance with CW 3550-R3.
 - 2.1 Fencing to be a minimum of .65 m high without top guard.
 - 2.2 Fencing shall have a top guard consisting of 600mm tall outrigger at 45 degree angle, facing outward with 3 strands of 13,5 gauge barbed wire.
3. Gates:
 - 3.1 Provide gates on all access roads.
 - 3.2 Gates must provide an opening to the full width of the access road.
 - 3.3 Gates must be able to be secured (locked) in either an open or closed position.
 - 3.4 Gates which are expected to be open and closed more than twenty times per week shall be electric actuated.
4. Design temporary fencing for construction areas.


3.5 Landscaping

1. Design landscaping for all new and modified areas of the facility.

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2. Low maintenance landscaping is preferred.
3. Include aesthetic landscaping in publically accessible areas of the facility (i.e. next to Administration Building).

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4 WATER MAIN DESIGN CRITERIA

4.1 General Requirements

1. These requirements apply to potable water mains from the municipal water supply.
2. Provide new water mains to service new structures (where service is required). Ensure water service to modified structures is suitable for the required service in those structures.
3. Provide water meters as required.
4. Water mains shall be designed according to the City of Winnipeg "Water Demand and Design Guidelines".

4.2 Hydraulic Design

4.2.1 Fire Flow Analysis

1. Required fire flow shall be determined based on the Fire Underwriters Survey criteria.
2. The fire flow shall be provided at minimum residual pressure of 140 kPa (20 psi) during maximum day demand.

4.3 Installation Requirements

4.3.1 Depth of Cover

1. Minimum ground cover for water mains shall be 2.5 m.
2. Where it is not possible to achieve 2.5 m of cover, water main and water service shall be insulated according to the City of Winnipeg standard detail SD-018 "Watermain and Water Service Insulation".

4.3.2 Pipe Strength


1. Pipes shall be selected according to CSA, ANSI or AWWA standards for the relevant materials.

4.3.3 Fire Hydrants

1. Hydrants shall be AWWA Standard C502 Dry-Barrel Fire Hydrants.
2. Hydrants shall be spaced with 75 m radius of protection.
3. Hydrants shall be installed at water mains dead ends.

4.3.4 Valves

1. Maximum distance between valves shall be 150 m.
2. Minimum two valves shall be installed at each water main tee.
3. Minimum three valves shall be installed at each water main crossing.

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4.3.5 Water Services

1. Minimum size of fire service shall be 150mm.
2. Valves for fire and fire-domestic services shall be installed 1 m from the City water main.

4.3.6 Materials

1. Materials for pipes, joints and fittings shall be in accordance with "Approved Products for Underground Use within the City of Winnipeg".
2. Bedding and backfill materials shall be according to the City of Winnipeg Standard Construction Specification CW 2030 "Excavation Bedding and Backfill".

4.3.7 Separation Distances between Water and Sewer Mains

1. Parallel Installation:
 - 1.1 Minimum horizontal distance between water main pipe and any gravity sewer pipe shall be 3.0 m.
2. Crossings:
 - 2.1 Minimum vertical distance between the outside of water main pipe and outside of any gravity sewer pipe shall be 450 mm.

4.3.8 Installation of Water Mains

1. The following items shall be specified in accordance with the City of Winnipeg Standard Construction Specifications:
 - Bedding and Backfill
 - Pressure/Leak Testing
 - Disinfection

4.3.9 Abandonment of Existing Water Mains

1. Abandonment of existing water mains shall be according to the COW Specification CW 2110 "Water mains" within the limits shown on the drawings.
2. Sections of abandoned water mains within excavation limits (including existing water mains and previously abandoned water mains) shall be removed.
3. The ends of remaining water main sections shall be plugged and abandoned according to CW 2110.

5 ROAD DESIGN CRITERIA

5.1 General Requirements

1. Provide a comprehensive design for all roads and parking lots required for the facility.
2. Include in the design:
 - 2.1 All permanent roadways and parking lots.
 - 2.2 All temporary construction access roads, construction laydown areas and contractor parking lots.
3. Horizontal and vertical alignments for roads shall be designed according to the TAC standards. Design speed shall be 40 km/h for construction access road. Horizontal alignment for temporary construction roads shall be developed.
4. Perform simulations to evaluate truck movements around the facility.
 - 4.1 Standard of acceptance is AutoTURN simulation.
5. Avoid mixing vehicle and pedestrian traffic.
6. Provide a traffic management plan for construction and operation, as per Section 9.3.1.

5.2 General Road Design


5.2.1 Road Type and Design Life

1. Selection of road type shall be as per Table 5-1.

Table 5-1 : Sewage Treatment Plant Road Type Selection

Location	Typical Usage Level (Vehicles per day)	Road Type	Pavement Material
Main Plant Entrance to Administration Building	Any	Primary	Concrete
Connection to municipal roads	20 or more	Primary	Concrete
Interior plant roads	20 or more	Primary	Concrete
Interior plant roads	5 to 19	Secondary	Concrete or Asphalt
Approaches to Buildings	5 to 19	Secondary	Concrete or Asphalt
Other	< 5	Gravel	Gravel
Construction Roads	Any	Gravel	Gravel

2. Primary roads shall be designed and constructed as follows:
 - 2.1 Concrete pavement.
 - 2.2 Minimum 30-year design life.

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3. Secondary roads shall be designed and constructed as follows:

- 3.1 Asphalt or concrete pavement.
- 3.2 Minimum 20-year design life.

5.2.2 Pavement Structure

1. Concrete or asphalt pavement surface thickness (concrete or asphalt) shall be determined according to the AASHTO Guide for Design of Pavement Structures based on the traffic movement data obtained from the City of Winnipeg.

5.2.3 Side Walks


- 1. Design sidewalks for all pathways between buildings routinely utilized by Operations personnel.
- 2. All sidewalks shall be concrete.
- 3. Concrete sidewalks shall be minimum 1.5 m wide with 100 mm thick slab according to the COW detail 10 SD-228A. Thickness of sub-base course shall be 300 mm.

5.2.4 Parking Lots

- 1. Parking lot pavement:
 - 1.1 Administration and Workshop areas (all sizes): concrete.
 - 1.2 Parking lots for greater than ten vehicles: asphalt or concrete
- 2. Layout:
 - 2.1 Minimum Parking Stall Width: 2.8 m
 - 2.2 Minimum Parking Stall Length/Depth: 6.1 m
 - 2.3 Minimum Parking Aisle Width: 7.0 m
- 3. Parking lot shall include number of barrier free parking stalls according to the 2010 City of Winnipeg Accessibility Design Standard. This is expected to only be applicable for the Administration Building.
- 4. Minimum requirements for concrete parking lot pavement:
 - 4.1 To be developed
- 5. Minimum requirements for asphalt parking lot pavement:
 - 5.1 Subbase Course: 450 mm of 50mm granular material
 - 5.2 Base Course: 150 mm of 19mm granular material
 - 5.3 Pavement Surface: 100mm of asphalt

5.2.5 Road Removals

- 1. Removal of concrete pavement and concrete curbs shall be performed according to the City of Winnipeg Standard Construction Specifications CW 3110 "Sub-Grade, Sub-Base and Base Course Construction" and CW 3230 "Full-Depth Patching of Existing Pavement Slabs and Joints"
- 2. Removal of gravel roads shall be performed according to the City of Winnipeg Standard Construction Specifications CW 3110 "Sub-Grade, Sub-Base and Base Course Construction".

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6 SITE DRAINAGE CRITERIA

6.1 General Requirements

1. Provide a comprehensive site drainage design.
 - 1.1 The general site grading will establish a working surface for operating and construction areas, provide positive drainage from buildings and structures, and provide adequate soil coverage for underground utilities.
2. On-site drainage will be accomplished through gravity flow whenever possible. The surface drainage system will consist of gentle slopes.
3. The site will be graded away from structures with an appropriate slope for drainage. Minimum standard of acceptance is 2% slope.
4. Design temporary facilities for site and excavation drainage during construction.

6.2 Ditches

1. New ditches will be built and existing ditches shall be regarded or filled according to the City of Winnipeg Standard Construction Specifications CW 3170 "Earthwork and Grading" and CW 3110 "Sub-Grade, Sub-Base and Base Course Construction".
2. Ditches capacity shall be determined based on the peak flow calculated with the Rational Method using time of concentration of 10 minutes with coefficient "C" values provided in Table 6-1 below.

Table 6-1 : Coefficient "C" Values

Surface Type	C Value
Roof	0.9
Concrete / Asphalt pavement	0.9
Gravel Pavement	0.85
Lawn	0.35

3. Ditches shall be designed with a maximum side slope of 4 to 1, minimum bottom width of 1.0 m and minimum longitudinal slope of 0.1%.
4. Ditch sides and bottom surfaces shall be covered with erosion control blanket.

6.3 Culverts


1. New culverts will be built and existing culverts shall be removed according to the City of Winnipeg Standard Construction Specifications CW 3610 "Installation of Culverts".
2. Culvert sizing shall be determined based on the peak flow calculated with the Rational Method and using time of concentration of 10 minutes using coefficient "C" values provided in Table 6-1.
3. Minimum culvert size shall be 450 mm.

4. Culvert size shall be calculated using Chézy-Manning formula with roughness coefficient n values provided in Table 6-2 below.

Table 6-2 : Manning's Roughness Coefficient

Pipe Material	Manning's n
450 mm	0.015
600 mm CSP	0.016
750 mm CSP	0.017
900 mm CSP	0.018

5. CSP pipe thickness shall be 2 mm.

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7 SITE EXCAVATION DESIGN CRITERIA


1. Maximum excavation side slope shall be 1 to 4.
2. Maximum slope of access ramp to the bottom of excavation shall be 1 to 7.
3. Excavation slopes shall be protected with 6 mm thick polyethylene plastic sheets.

8 MISCELLANEOUS REMOVALS

8.1 Trees and Shrubs

1. Removal of trees and shrubs shall be according to the City of Winnipeg Standard Construction Specifications CW 3010 "Clearing and Grubbing".


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9 CIVIL DESIGN TEAM RESPONSIBILITIES

9.1 General

1. Responsibility for deliverables
 - 1.1 All drawings and other deliverables related to a design are the responsibility of the civil designer / engineer.
2. Ensure all civil design deliverables are sealed by a qualified professional civil engineer.
3. Completeness of drawings:
 - 3.1 All drawings shall be comprehensive in nature to allow for effective use in construction.
4. Update of existing drawings:
 - 4.1 If the project is an addition, expansion, upgrade or modification to an existing site or facility, existing drawings may require up-dating. Coordinate with the City to understand the specific requirements. Typical requirements include.
 - Update existing site plans.
5. Design reviews:
 - 5.1 Issue the design documents to the City for review at appropriate intervals in accordance with the City's expectations.
 - 5.2 Incorporate all WSTP comments into the design. Where a WSTP comment is not accepted by the design team, provide a complete response, including rationale, to the City Project Manager.
6. As-Built Drawings:
 - 6.1 All design deliverables shall be updated to "as-built" status at the end of the project. The "as-built" documents shall incorporate contractor mark-ups, inspections performed by the design team, change orders, RFIs, and other communication between the Contractor and Design Team.
 - 6.2 Unless otherwise specified by the City and agreed to by the Design Team, as-built drawings are not required to be sealed (Otherwise known as record drawings).
7. External, 3rd Party Consultants:
 - 7.1 Expertise and assistance may be required, from external 3rd party specialized consultants, outside of the primary civil design team.
 - 7.2 The design team shall be responsible for monitoring the activities and progress of each 3rd party consultant.
 - 7.3 It is the responsibility of the design engineer to ensure that the deliverables follow all City standards and guidelines.
8. Site Visits:
 - 8.1 The design team is responsible for ensuring that a sufficient number of site visits occur to facilitate the understanding of specific field conditions or status of existing facilities and buildings.

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9. Demolition Requirements

- 9.1 It is generally required that the civil designer / engineer is responsible for associated demolition works required to implement the scope of work. Clearly indicate all demolition requirements on the drawings and in the specifications.
- 9.2 Where demolition requirements are significant, create dedicated demolition drawings.

9.2 Drawings

Provide a comprehensive set of drawings to detail the civil construction requirements. The drawings indicated in this section are minimum requirements for new construction, unless otherwise approved by the City.

9.2.1 General Requirements

1. All civil drawings are to be produced on a standard A1 size drawing.
2. All civil drawings shall be to scale.
3. All dimensions required for construction shall be shown.
4. Indicate north direction on all plan drawings.
5. Provide scale bars on drawings to allow for simplified scale takeoff on the drawings.
6. Differentiate new work from existing work via bold lines.

9.2.2 Legend

1. Provide a legend drawing showing the symbols and abbreviations utilized. Ensure that the legend is consistent with the City's practices and other disciplines.

9.2.3 General Notes Drawing


1. Provide a general notes drawing.
2. Content
 - 2.1 Include general construction notes.
 - 2.2 Provide key design criteria

9.2.4 Existing Site Plan

1. Provide a detailed site plan of the existing facility, prior to construction.
2. Content
 - 2.1 To be developed.

9.2.5 New Site Plan

1. Provide an overall site plan showing all buildings and major services.
2. Content
 - 2.1 To be developed.

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9.2.6 Yard Piping Plan


1. Provide detailed plans showing all piping in the yard.
2. Content
 - 2.1 Include all existing piping.
3. Format
 - 3.1 Scale of drawing not to exceed 1:250.

9.2.7 Grading Plan

1. Provide detailed yard grading plan including all slopes and elevations.
2. Content
 - 2.1 To be developed.

9.2.8 Plan and Profile Drawings

1. Provide a comprehensive set of drawings to detail the plan and profile of all buried services and surface grades and roadwork.
2. Content
 - 2.1 To be developed.

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9.3 Other Documents

9.3.1 Traffic Management Plan

1. Provide a traffic management plan for construction and operation, for all facility upgrades where traffic is affected.

9.4 Civil Design Calculations

1. Provide detailed design calculations in accordance with the relevant codes and authorized local and national bodies taking into account the most unfavorable conditions. Design calculations shall be submitted with the design drawings as part of the review cycle to allow for parallel review. At minimum, the following calculations shall be submitted to the City for review:
 - 1.1 Water main service size calculations.
 - 1.2 List to be completed.