Winnipeg

# The City of Winnipeg

## Winnipeg Sewage Treatment Program

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# Architectural Design Guideline

Document Code:

Revision: 00

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| Approved By: | Duane Griffin, Branch Head - Wastewater Planning & Project Delivery | Aug 20, 2015<br>Date |

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| REVISION REGISTER | | | | |
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| **Rev.** | **Description** | **Date** | **By** | **Approved** |
| 00 | Issued for Use | 2015-08-18 | C. Reimer | D. Griffin |
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# 1 INTRODUCTION

This document identifies the standard architectural design requirements that are applicable to any 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 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 architectural designers to fully develop the architectural details with general conformance to the concepts presented herein. This standard shall not be construed as comprehensive architectural / engineering design requirements or negate the requirement for professional architectural / engineering involvement. Any design must be executed under the responsibility and seal of the respective architect / 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 are expected to comply with this standard.
- All major upgrades to a building 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 architect / 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 |
| AHJ | Authority Having Jurisdiction |
| CMU | Concrete Masonry Unit |
| FRP | Fibreglass Reinforced Plastic |
| NBC | National Building Code |
| NFC | National Fire Code |
| NFPA | National Fire Protection Association |
| OSHA | Occupational Safety and Health Administration |
| PPE | Personal Protective Equipment |
| STC | Sound Transmission Class |
| UL | Underwriters Laboratory, Inc. |
| ULC | Underwriters' Laboratories of Canada |
| WSTP | Winnipeg Sewage Treatment Program |

# 2 GENERAL

## 2.1 Design Codes and Standards

All designs shall comply with municipal, provincial, and national codes and bylaws. This includes but is not limited to:

- Manitoba Building Code (National Building Code of Canada with Manitoba Amendments)
- Manitoba Energy Code (National Energy Code with Manitoba Amendments)
- National Fire Code of Canada (NFC)

## 2.2 Referenced Standards

The following standards are to be referenced during the design; however application of these standards shall not necessarily be comprehensive:

- National Fire Protection Association (NFPA) standards, including:
  - NFPA 101 Life Safety Code
  - NFPA 820 Fire Protection in Wastewater Treatment and Collection Facilities

## 2.3 Other City Standards

1. While not exclusive, ensure that the following City Standards are adhered to:
   - 1.1 Water and Waste Department Identification Standard
   - 1.2 City Of Winnipeg Accessibility Design Standards (For Administration Buildings)

## 2.4 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).

# 3 BUILDING CODE CLASSIFICATION

All facilities will be designed in accordance with applicable codes for life safety, fire protection, and occupational health and safety. Only buildings having administration functionality will be designed in accordance with building code requirements for accessibility for persons with disabilities. Industrial and normally-unoccupied facilities are exempt by the building code from complying with such requirements.

It is expected that existing buildings were designed in compliance with the codes and standards applicable at that time. Renovations within existing building and upgrades limited to the equipment replacement should not typically affect building Use Group and Occupant Load classification as defined in the National Building Code of Canada (NBC). The type of the alteration and repairs within existing buildings must be reviewed with the Authorities Having Jurisdiction (AHJ) to define which areas might need further upgrades to meet current codes and standards. Ensure that buildings renovations and upgrades are carried out with the indicated design intent to maintain the degree of safety within all existing areas.

Where new structures need to be attached to existing buildings, firewall separation may need to be provided. Ensure that the proposed design approach will satisfy the requirements of applicable building code in terms of fire safety and protection for both new and adjacent existing structures.

# 4 BUILDING COMPONENTS

## 4.1 Exterior Treatment and Materials

1. Design structure exteriors to be practical and functional with emphasis on durability and minimum maintenance requirements.
2. Ensure exteriors are complementary to existing structures on the site.
3. Consider the use of local construction materials and techniques where practical and cost effective.

## 4.2 Exterior Walls

1. Design exterior walls using cavity wall construction with Concrete Masonry Unit (CMU) or concrete backup wall faced with air barrier, insulation, air space, and wall facing of either:
   - Face brick
   - Architectural Concrete Masonry Unit (ACMU)
   - Stone
   - Metal siding
2. Select the facing material based on the appearance of adjacent buildings, material cost and durability.
3. Design insulation to meet the greater of the following:
   3.1 The requirements and recommendations of the National Energy Code; or
   3.2 A minimum R value of 20
4. Wall insulation requirements do not necessarily apply to tank walls.

## 4.3 Roofs

1. Ensure that the design arrangements of roofs, canopies, fascias, parapets, overhangs, or other roof elements will be in harmony with the massing and materials of the structures, and to control runoff and direct drainage away from equipment, doorways, sidewalks, ramps, or other occupied areas.
2. For flat roofs, provide with a with Modified Bitumen Roofing assembly. Ensure slopes to drains are provided with tapered insulation. Design overflow roof drains or scuppers to satisfy building code requirements.
3. For sloped roofs, design using an insulated metal roofing assembly.
4. Design roof assemblies to achieve a minimum R value of 40 and meet the requirements of the National Energy Code, whichever is greater.
5. Where required for equipment removal and replacement, provide removable skylights.
6. Consider the use of insulated aluminum or FRP dome covers over circular process tanks as an alternate to a conventional building roof and make a recommendation based upon the best lifecycle cost for the City.

7. Provide access to all roof levels via maintenance access hatches or exterior caged ladders.
8. Ensure travelled pathways on the roof are protected by concrete pavers.

## 4.4 Exterior Doors, Windows, and Louvers

1. General Requirements
   - 1.1 Design sills, thresholds, flashing, and trim to prevent water penetration to the interior of the building.
   - 1.2 Provide corrosion-resistant hardware, accessories, fasteners, and operating mechanisms.
2. Exterior doors
   - 2.1 Use extruded aluminum sections with factory-applied protective coatings.
   - 2.2 Ensure locksets and keying arrangements match the existing keying systems with a minimum of 6 pins
3. Windows
   - 3.1 Use extruded aluminum sections with factory-applied protective coatings.
   - 3.2 Provide glazing with tinted, insulated glass. Use tinted, insulated tempered glass for exterior doors, sidelights and transoms.
4. Equipment and vehicle doors
   - 4.1 Provide motorized operation for doors frequently utilized by personnel (weekly or more frequent).
   - 4.2 Provide manual backup for emergency hand operation of motorized doors.
5. Louvres
   - 5.1 Provide extruded aluminum sections with factory-applied protective coatings.
   - 5.2 Provide storm-proof louvre assemblies complete with bird screens, filters, dampers, blank-off panels, acoustical treatment, or other required features. Design louvres to prevent infiltration of rain and provide positive drainage to the exterior.

## 4.5 Open Grating Platforms, Railings, Ladders and Guardrails

1. Provide permanent access ladders and working platforms as required for operation and maintenance of equipment, instrumentation, and other systems. Permanent installations are required where:
   - 1.1 Operations or maintenance access is required at a typical frequency of once a month or greater; or
   - 1.2 The hazard / risk of performing the work is not within City safe work standards.
2. Select the material for interior and exterior open grating stairs, platforms, railings, and guardrails based on the specific local conditions and exposure to corrosive materials.
3. See Table 4-1 for a general guideline of materials.

**Table 4-1 : Open Grating Platforms, Railings, and Guardrails Materials**

| Location | Material | Notes |
|---|---|---|
| Exterior | Aluminum | |
| Interior with no / minimal chlorine content | Aluminum | |
| Areas with corrosive chemicals such as chlorine | FRP (Fibreglass Reinforced Plastic) | Ensure anti-slip surface finish is provided. |

4. Ensure adequate fall restraint provisions for the servicing of any roof top equipment such as condensing units and around tanks or locations where there is a significant drop in elevation.

## 4.6 Interior Treatment and Materials

1. Design structure interiors to be practical and functional with emphasis on durability with minimum maintenance requirements.
2. Consider using local construction materials and techniques where practical.
3. Design interior components and finishes with minimum flammability and smoke developed characteristics.

### 4.6.2 Interior Walls

1. Design interior walls within process areas of concrete or concrete masonry units (CMU). Where sound isolation is required, design with a minimum STC of 50.
2. Design interior walls within administrative/personnel areas of metal stud framing with sound attenuation blankets and applied gypsum board as finish materials with a minimum STC of 50.
3. Where required for fire separations, design walls in accordance with recognized tested ULC assemblies.

### 4.6.3 Floors

1. Select floor and base materials based on a minimum maintenance requirements and durability.
2. Provide a hard surface flooring material in process areas. Provide bases of suitable material and height to protect wall finishes.
3. Locker rooms, washrooms and shower areas: Ceramic tile as floor and base finish in washroom areas.
4. Design floors, ramps, and steps with non-slip finishes. Provide abrasive nosing inserts.
5. Access ramps shall be designed to have a maximum slope of ≤5% to ensure safe access for mobile maintenance equipment.
6. Provide anti-slip finish in areas where the floors may be slippery, such as polymer preparation rooms.
7. Provide floor slopes to drains in areas where process cleanup and hosedown may be required.

### 4.6.4 Ceilings

1. Ceilings will be designed to be integrated with the building services and lighting systems. Where required, provide ceiling materials and finishes that enhance the acoustic properties of the spaces.
2. Ensure that exposed structural elements in process areas are coated with the appropriate protection system.
3. Provide suspended acoustical tile ceilings in administrative areas.

### 4.6.5 Interior Doors, Frames, Sidelights, Transoms, and Windows:

1. Design interior doors, frames, sidelights, transoms, and windows of appropriate materials to meet fire-ratings (as applicable) and corrosion resistance of the environment. General standards of acceptance are as follows:
    - 1.1 Use painted steel components within general interior applications and fire-rated assemblies.
    - 1.2 Use corrosion resistant components in applications where additional corrosion resistance is required.
        - 1.2.1 Consider the use of aluminum components in spaces with moderate $H_2S$ gases, but no chlorine content.
2. Provide glazing in the upper half of all interior doors except for bathrooms, janitor closets and private offices.
3. Provide clear tempered glazing for all interiors where glazing is not required to be labelled as a fire separation.
4. Provide corrosion-resistant hardware, accessories, fasteners, and operating mechanisms.
5. Ensure room identification is provided on all interior doors.

### 4.6.6 Roof Access, Hatches and Floor Doors

1. Specify roof access hatches and floor doors as manufactured items.
    - 1.1 This does not eliminate the requirement of the engineer to fully detail out the configuration, dimensions, opening mechanism and other relevant details.
2. Unless in an area with chlorine content, design single or double leaf units to utilize aluminum components.
3. Provide for locking.
4. Design units subject to vehicle traffic for AASHTO H-20 loading, as a minimum. Higher ratings shall be provided based on the vehicles utilized.
5. Ensure that the units can be safely operated by personnel without the use of special equipment, such as a portable crane. Access hatched shall be hinged and manual lifting weight shall be limited to 23kg (50lb).

## 4.6.7 Painting and Protective Coatings

1. Where practical, the design should include factory finishes of interior items.
2. Provide field-applied finishes and protective coatings to all other building elements that are not supplied with factory-applied protective coatings.
3. Ensure coatings provide long-term service use with minimum maintenance requirements.

## 4.6.8 Chemical Resistant Coating Systems

1. In secondary containment areas, design chemical resistant coating systems to provide a minimum of 48-hour immersion protection against spills or leaks of stored chemicals.
2. Concrete coating systems shall include primer, fibreglass mat, saturant, and two trowel-applied coats of vinyl ester resin with silica filler.
3. Provide anti-slip finish on all horizontal surfaces with chemical resistant coating systems.

## 4.6.9 Noise Control

1. Perform noise calculations as indicated in Section 5.4.1. Coordinate with other disciplines as required.
2. Design appropriate acoustical treatment for areas subject to elevated noise levels.
3. Design the following spaces with indicated maximum ambient noise levels:

| | | |
|---|---|---|
| 3.1 | Administration & Office Spaces | 50 dBA |
| 3.2 | Main Control Room | 50 dBA |
| 3.3 | Control Rooms (Other than main) | 55 dBA |
| 3.4 | Electrical Rooms | 60 dBA |
| 3.5 | Server Rooms | 70 dBA |

4. Design all installations to meet the noise exposure limits as defined by the Manitoba Workplace Safety and Health Regulation (217/2006). An excerpt is included below for reference:

***Hearing protection***

*12.3 If a worker is or is likely to be exposed to noise in a workplace that exceeds 80 dBA Lex but does not exceed 85 dBA Lex, the employer must*

*(a) inform a worker about the hazards of the level of noise; and*

*(b) on the request of the worker, provide him or her with*

*(i) a hearing protector that complies with CAN/CSA Standard-Z94.2-02, Hearing Protection Devices X Performance, Selection, Care, and Use, and*

*(ii) information about the selection, use and care of the hearing protector.*

***Control measures if exposure exceeds 85 dBA Lex***

*12.4(1) When a noise exposure assessment conducted under this Part indicates a worker is exposed to noise in the workplace that is more than 85 dBA Lex, and if reasonably practicable, an employer must implement sound control*

*measures that reduce the noise to which the worker is exposed to 85 dBA Lex or less.*

*12.4(2) When it is not reasonably practicable to implement sound control measures, or the sound control measures implemented by an employer do not reduce the worker's noise exposure to 85 dBA Lex or less, an employer must*

*(a) inform the worker about the hazards of the level of noise;*

*(b) provide the worker with*

*(i) a hearing protector that*

*(A) complies with CAN/CSA Z94.2-02, Hearing Protection Devices X Performance, Selection, Care, and Use, and*

*(B) reduces the worker's noise exposure to 85 dBA Lex or less, and*

*(ii) information about the selection, use and care of the hearing protector; and*

*(c) at the employer's expense, provide the worker with the following audiometric tests:*

*(i) an initial baseline test as soon as is reasonably practicable but not later than 70 days after the worker is initially exposed to that noise level,*

*(ii) a further test at least once every year after the initial baseline test.*

5. The acceptable noise level depends on the time of the exposure and the noise source. Absolute maximum noise exposure limits are indicated in Table 4-2; however these limits do not necessarily indicate minimum design requirements.

**Table 4-2 : Noise Exposure Level Limits**

| Noise Level dbA | Maximum Permitted Daily Duration (Hours) (1) |
|---|---|
| 85 | 8 |
| 88 | 4 |
| 91 | 2 |
| 94 | 1 |
| 97 | 0.5 |
| 100 | 0.25 |

***Notes:***

*1. Table 4-2 is based upon Canadian Center for Occupational Health and Safety requirements. The table is provided for reference and does not necessarily indicate minimum design requirements.*

6. The following shall be utilized as guidance regarding application of Manitoba Workplace Safety and Health Regulation clause 12.4(2), which provides an exemption regarding practicality of sound control measures.

   6.1 The requirements of Table 4-3 are considered to be minimum requirements where acoustical treatment, noise reduction and/or reduction of worker exposure are required.

   6.2 Where the calculated noise exposure for any space is above 85 dB after any proposed mitigation, provide complete documentation indicating the design rationale and demonstrating impracticability of further noise reduction.

      6.2.1 Include operating assumptions.

      6.2.2 Include applicable information from manufacturers.

      6.2.3 Include calculations.

   6.3 Design installations with high noise levels such that operational and maintenance activities in the space are minimized. For example, additional automation, locating control panels outside the room and providing a window to view the equipment from outside the room may reduce noise exposure.

   6.4 Cost factors may be utilized as an argument regarding practicality only where approved by the City.

**Table 4-3 : Acoustical Treatment Minimum Requirements**

| Typical Operational Use (1) | Maximum Noise Level dbA | Noise Level Without Treatment dbA | Acoustical Treatment / Noise Reduction Required | Hearing Protection PPE Requirements |
|---|---|---|---|---|
| Occupancy >= 2h / day | 85 | <= 85 | No | N/A |
| | | > 85 | Yes | |
| Occupancy: 1 – 1.9h / day | 88 | <= 88 | No | Mandatory (2) |
| | | > 88 | Yes | |
| Occupancy: 0.5 – 0.9h / day | 91 | <= 91 | No | Mandatory (2) |
| | | > 91 | Yes | |
| Occupancy: 0.26- 0.5 / day | 94 | <= 94 | No | Mandatory (2) |
| | | > 94 | Yes | |
| Occupancy: 0.01- 0.25 / day | 97 | <= 97 | No | Mandatory (2) |
| | | > 97 | Yes | |
| Unoccupied spaces | 115 | > 115 | Yes | Mandatory (2) |

***Notes:***

*1. Operational Use is based upon typical daily operations, not including infrequent maintenance or special operating scenarios.*

*2. As per the Manitoba Workplace Safety and Health Regulation, hearing protection PPE is required for all spaces with a noise level above 85 dBA.*

*3. Hearing protection is not readily available for noise levels above 115 dB, and thus shall be considered an upset maximum limit for noise exposure for any space, regardless of occupancy.*

7. Where practical, select / specify / design equipment such that noise is reduced at the source.

   7.1 Utilize acoustical equipment covers where appropriate / required.

8. Design acoustical wall and ceiling panels to reduce ambient noise levels in rooms requiring acoustical treatment, in accordance with Table 4-3:

   8.1 The type and location of the acoustical panels shall be incorporated into the design drawings. This may require that an acoustical sub-consultant be utilized during the design phase.

   8.2 Coordinate the location of the panels with the equipment, piping and ducting, cabling, lighting etc.

   8.3 Ensure that the acoustical panels do not impede operation or maintenance activities.

9. For very high noise areas, consider whether access to the space should be provided with a vestibule to buffer the noise.

10. Spaces with noise levels above 85 dBA shall not be pathways through the plant required to access or egress from a space. For example, it shall not be required to pass through a noisy compressor room to reach a quieter mechanical room to change a filter.

11. For spaces with noise levels above 85 dBA the designer shall:

   11.1 Provide and document administrative controls to minimize worker exposure to the high noise levels.

   11.2 Minimize the instrumentation and other maintainable equipment within the noisy space. For example, control panels shall be located outside the noisy area. Coordinate with other disciplines as required.

# 5 ARCHITECTURAL DESIGN TEAM RESPONSIBILITIES

## 5.1 General

1. Responsibility for deliverables

   1.1 All drawings and other deliverables related to a design are the responsibility of the design architect / engineer.

2. Ensure all architectural deliverables are sealed by a qualified professional architect / 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 building floor plans.
   - The update of architectural detail drawings for existing works is not expected to be required.

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 architectural deliverables shall be updated to "as-built" status at the end of the project. The "as-built" documents shall incorporate contractor mark-ups and all relevant information from 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 architectural / design team.

   7.2 Areas where an external 3rd party consultant may be utilized, with permission from the City, are:

   - Fire protection systems.
   - Acoustic systems

   7.3 The design team shall be responsible for monitoring the activities and progress of each 3rd party consultant.

   7.4 It is the responsibility of the design architect/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.

9. Demolition Requirements

   9.1 It is generally required that the architect / 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.

## 5.2 Drawings

The drawings indicated in this section are minimum requirements for new construction, unless otherwise approved by the City.

### 5.2.1 General Requirements

1. Provide scale bar on all scaled drawings to allow for measurement takeoff and avoid any potential confusion regarding scale, regardless of the format or size reproduction of the document.
2. Show a north arrow on all plan drawings.

### 5.2.2 Legend

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

### 5.2.3 Building Code Matrix

1. Provide a building code matrix for all new and modified buildings.

### 5.2.4 Life Safety Plan

1. Provide a life safety plan showing all occupied areas of the facility along with egress paths and distances to the nearest exit.

### 5.2.5 Floor Plans

1. Provide detailed floor plans for all building elevations.
2. Ensure all rooms are identified in a manner consistent with the Identification Standard.

   2.1 Ensure that the proposed room numbering coexists with the existing room numbering at the facility.

### 5.2.6 Elevation Drawings

1. Provide detailed building elevation drawings for all building exterior faces.
2. Ensure all exterior materials are clearly identified.

### 5.2.7 Stair Plan and Sections

1. Provide a comprehensive set of building stair plans and section drawings.
2. Ensure all materials of construction and dimensions are clearly identified.

### 5.2.8 Building Section and Detail Drawings

1. Provide a comprehensive set of building section and detail drawings to fully describe the construction of the building.
2. Ensure all materials of construction and dimensions are clearly identified.

### 5.2.9 Schedule Drawings

1. Provide a room finish schedule.
2. Provide a louvre schedule.
3. Provide a door schedule complete with hardware data and room identification requirements.
4. Provide a hatch schedule.

### 5.2.10 Window Elevation Drawings

1. Provide window elevation drawings for all large multi-panel windows.

### 5.2.11 3D Model

1. When 3D design is required by the City, or proposed by the Consultant, this section shall be complied with in its entirety. 3D models and associated drawings are not mandatory for all projects.
2. The 3D model shall include all architectural elements to allow for full representation of the entire facility, including all other disciplines.
3. In addition to the 3D model provide:
    - 3.1 3D elevation and section drawings to convey the complete building configuration.
    - 3.2 3D detail drawings of all areas with significant interdisciplinary coordination requirements.

## 5.3 Fire Safety Plan

1. Prepare drawings to be updated or included in the facility Fire Safety Plan, in accordance with the Guidelines for Preparation of Fire Safety Plans and Required Maintenance Procedures for all buildings coming under the Manitoba Fire Code, as adopted by the Fire Prevention By-Law 150/2004. The drawings required are as follows:

    1.1 Site plan showing at minimum: gas shut-off, electrical shut-off, fire hydrant, and muster/meeting points. Provision of this plan is required where the project work modifies the site plan in any way.

    1.2 Fire plan drawings for each level of each building showing at minimum emergency exits, fire alarm pull stations, fire extinguishers, fire alarm control panels, fire dept. access, electrical shut-off, gas shut-off, self-contained breathing apparatus, primary exit routes, emergency generator location. Provision of these drawings is required for any building where the project work modifies the fire safety plan in any way.

2. Incorporation of the drawings provided and packaging of the complete fire safety plan will be by the City.

## 5.4 Calculations

### 5.4.1 Noise Calculations

Coordinate with other disciplines and provide noise calculations, based upon design equipment and materials, for all rooms and spaces with noise levels above 80 dBA. Coordinate with other disciplines as required. The calculations are to be performed and presented to the City during the detailed design stage, prior to construction.