



VOLUME 3 DRAINAGE

VOL. 3-05 DRAWING REQUIREMENTS, APPROVALS, AND ASSET ACCEPTANCE/TRANSFER

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TERMS OF USE

The “City of Edmonton Design and Construction Standards Volume 3: Drainage”, henceforth known as “Volume 3”, is made available for use in the City of Edmonton effective as of May, 2025. Volume 3-05: Drawing Requirements, Approvals and Asset Acceptance/Transfer has been developed to establish standards and guidelines which align with EPCOR’s expectations in the design and construction of drainage infrastructure within the City of Edmonton. Volume 3-05 is presented as accurate and complete as of the effective date and all care has been taken to confirm the accuracy of the information contained herein. The views expressed herein do not necessarily represent those of any individual contributor. No part of these standards absolves any user from the obligation to exercise their professional judgment and follow good practice. Should any user have questions as to the intent or accuracy of any specification or drawing herein, or concern that conflict may exist between the manufacture’s or suppliers’ recommended installation procedures and Volume 3-05, the user is advised to seek clarification by sending an email to DRENG@epcor.com.



Section	Changes
	Deleted all tables of Vol. 3-01, 3-02, 3-03, 3-04, 3-05 and 3-06 which showed the description of each sub-volume when split Volume 3 in 2021.
Document Wide	Replace “manhole(s)” with “maintenance hole(s)”.
All	Replace “EPCOR Drainage Services” with “EPCOR Water Services”.
4.0	The drainage product approval process was rewritten.



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1.0 DETAILED ENGINEERING DRAWINGS

This section outlines the requirements for the submission of detailed engineering drawings for approval by the City pursuant to the terms of Servicing Agreements between the City and the Developer for new subdivision development.

1.1 **Prerequisites to Review of Engineering Drawings by the City**

1.1.1 Neighbourhood Design Report (NDR)

A NDR for the development area, defining the basis for detailed design of the sewer and drainage system components may be required. The City may refuse to undertake review for approval of detailed engineering drawings in the absence of an approved NDR.

1.1.2 Inspection of Existing Infrastructure

Prior to the submission of detailed engineering drawings, inspection of existing infrastructure (the tie-in points and one facility upstream and downstream of existing infrastructure which has passed 10 years after FAC) shall be conducted if the existing infrastructure is to be connected to or possibly affected by future construction activity. This aids in determining the condition of existing infrastructure and in identifying existing features that may not be recorded in order to minimize impacts on design. It also determines whether the existing infrastructure is suitable for connection (refer to Section 5.6.10 - Vol. 3-01: Development Planning Procedure and Framework). The Developers are to contact the City to determine the specific requirements based on the scope of work, location, etc. during pre-engineering and NDR.

1.1.3 Detailed Submission Requirements

In order for review for the approval of detailed engineering drawings to be undertaken by the City, the submission of the drawings shall be accompanied by support documents as described below.

i. Hydraulic calculations

The Developer shall provide all storm and sanitary hydraulic calculations and documentation for justification of the pipe sizes and hydraulic structures presented in the engineering drawings. The calculations and support documentation shall be to the satisfaction of the Engineer and may include:

- A copy of the approved NDR including relevant computer simulation output for SWMF designs and storm and sanitary sewer design computations;
- Storm sewer rational method design computations;
- Sanitary sewer design computations;
- When not provided within the NDR, calculations to support designs for hydraulic structures, including but not limited to outfalls to watercourses or wet ponds, inlets to sewers or wet ponds, outlets from wet ponds, drop maintenance holes and structures, and junctions and pumping stations.

ii. Geotechnical reports

The Developer shall provide copies of all soil and geotechnical reports prepared for the subdivision.

iii. Trench loading calculations

The Developer shall provide all trench loading calculations for sewer mains with greater than 7.0 m of cover over the top of the pipe. Refer to Section 4.4 - Vol. 3-03: Design Guidelines.

iv. Crossing permit drawings

The Developer shall also submit approved drawings for permits for any oil or gas pipeline, power transmission main, or railway crossings. Refer to Volume 1: General, Chapter 1, Section 10.

v. Project cost information

- The Developer shall submit with the drawings a detailed breakdown of the costs of the storm

and sanitary system as shown on the plans, based on accepted bids or tenders, for use by the City in preparation of the development cost analysis for the Development Servicing Agreement.

- This cost information shall be updated and resubmitted after initial review or approval of the drawings, if necessary, to account for revisions. A cost analysis is not prepared until after confirmation of the costs by the Consultant and until after an initial review of the development engineering drawings.

1.2 Engineering Drawing Requirements

1.2.1 Plan Standards

All construction plans shall conform to the plan standards outlined in Volume 1: General, Chapter 1.

1.2.2 Detail Content Requirements

Further to the requirements of Volume 1: General, Chapter 1, Section 8, the engineering drawings shall include details to address the following specific requirements:

- i. Detail plans - plans and profiles shall be provided to show:
 - The location of streets and rights-of-way and sewers.
 - The ground profile, proposed final road grade, size and type of pipe, length and grade of pipe between adjacent maintenance holes, invert and surface elevation at each maintenance hole.
 - All maintenance holes shall be numbered on the plan and correspondingly numbered on the profile. The numbering on extensions should be in accordance with the overall numbering system. This numbering system shall correspond to storm or sanitary calculation sheets.
- ii. Special details - detail drawings, to a scale that clearly shows the nature of the design, shall be furnished to show the following particulars:
 - All structures and storm sewer outlets.
 - Details of all sewer appurtenances such as special maintenance holes or junctions, inspection chambers, inverted syphons, sampling devices, and weirs.
 - Details of special bedding for pipe where the design includes high flow velocities. Where poor foundation conditions are identified in advance of construction, details and limits of special subgrade improvements are to be shown on the engineering drawings. When unsatisfactory conditions are encountered during the progress of construction, the Engineer shall be advised of the conditions and measures being taken in advance of their implementation. These measures shall be subject to approval. The details and scope of application of special subgrade improvements shall be shown on the as-built submission of engineering drawings.
 - Specific details of all proposed LID measures in accordance with the City of Edmonton *Low Impact Development - Best Management Practices Design Guide* and Section 5.0 - Vol. 3-02: Stormwater Management and Design Manual.
 - The details must also include specific information on the LID measures including size of the catchment area, size of the LID measure footprint, the depth and volume of amended soils, and the amended soil mix parameters. The details must also include information on the under drain pipe size, length, slope, material as well as coordinates and invert elevations for the under drain pipe at key locations (i.e. at ends, connections, bends etc.) (See Section 5.10 - Vol. 3-02: Stormwater Management and Design Manual).
- iii. Lot grading plans

Refer to Section 6.4 - Vol. 3-02: Stormwater Management and Design Manual.
- iv. Project specific ESC Plan designed in accordance with the ESC Guidelines. Address ESC of LID features and reference checklists. For more information, refer to the *Low Impact Development Construction, Inspection, and Maintenance Guide*.

1.3 Statutory Requirements for Approvals by Other Authorities

1.3.1 It shall be a responsibility of the Consultant undertaking a development project to comply with the statutory requirements governing the work. The Consultant shall obtain all approvals from the authorities having jurisdiction, including but not limited to those mentioned below.

1.3.2 Where these standards refer to bylaws, acts, regulations, and standards, this shall mean the most recent edition or amendment of the referenced document.

1.3.3 Where due to amendment of statutory requirements, conflicts or inconsistencies with these standards arise, the Consultant is to be responsible for satisfying the more stringent requirement and shall refer the discrepancy to the Engineer.

1.3.4 Alberta Environmental Protection and Enhancement Act (AEPEA)

i. Letter of Authorization requirement

- Pursuant to the AEPEA, the City will apply on behalf of the City for Letters of Authorization from Alberta Environment and Protected Areas (AEPA) to permit the construction of sewer and drainage infrastructure for the areas of subdivisions approved by the City of Edmonton Subdivision Authority. Construction of the sewer and drainage infrastructure for a specific development shall not commence prior to the issuance by AEPA of a Letter of Authorization including the development area.
- After approval by the Engineer, the City may require the engineering drawings to be submitted to AEPA to meet the requirements under the AEPEA and/or the Water Act and to other authorities whose approval must be obtained prior to commencement of any construction.

ii. Special features - Letter of Authorization

- When a development proposal includes the construction of any infrastructure classified as a "special feature" by AEP, a Letter of Authorization must be obtained from them prior to the commencement of construction. Special features include SWMFs, storm system outlets to a natural watercourse, and sanitary system or storm drainage pumping stations.
- It is the responsibility of the Developer, through the Consultant, to do all that is necessary to obtain the Letter of Authorization on behalf of the City from AEP.

1.3.5 Water Act

Pursuant to the Water Act, a license is required for drainage facilities involving the impoundment of water for the purpose of water management, or the diversion of water, or the discharge of water to a watercourse. The Consultant shall be responsible for applying to AEP for a drainage license when required and for obtaining the necessary approvals prior to the construction of those facilities.

1.3.6 Restricted Development Area Regulation

Any surface disturbing activity or change in land use within areas governed by the Restricted Development Area Regulations further to The Department of the Environment Act requires the consent of the Minister of the Environment and Parks. Applications are to be made to the Land Use Branch, Environmental Assessment Division, AEPA. They may refer proposals to other affected branches for review.

1.3.7 Public Lands Act

Where a proposed facility may encroach on crown lands, a License of Occupation would be required under the Public Lands Act. Construction of an outfall discharging to a major watercourse is an example of this.

1.3.8 Navigable Waters Protection Act

Should an improvement involve crossing over or under a "navigable water," such as the North Saskatchewan River, either a permit or an exemption from the requirement must be obtained from the appropriate federal department.

1.3.9 River Valley Bylaw No. **7188**

Development or construction that would impact designated areas within the North Saskatchewan River valley and within the Edmonton ravine system requires further assessment and review to the requirements of and in accordance with Bylaw No. 7188. The River Valley bylaw approval should be obtained prior or concurrent to the review of the engineering drawings.

1.3.10 Edmonton Garrison Zoning Regulations

The Department of National Defence (DND) have regulations for height restrictions, bird hazard mitigation, and noise attenuation that impact areas adjacent to and under the flight paths for the Edmonton Garrison. Contact Planning Services, Planning and Development for DND's requirements.

1.4 Post Approval Submission Requirements

After engineering drawing approval and prior to commencement of construction, the following information shall be provided to the City:

- E-plan of the approved engineering drawings;
- Construction cost estimates that include separate costs for storm sewers, sanitary sewers, foundation drainage sewers, sanitary services, storm sewer services, and/or foundation drainage services as applicable;
- A schedule of the proposed construction including start date and estimated duration of construction.

1.5 Design Revisions after Approval of Engineering Drawings

Any changes to the sewer component of the engineering drawings are to be approved by the Engineer prior to construction of the affected portion. Refer to Volume 1: General, Chapter 1, Section 8.7 for the procedure to obtain approval of revisions to approved engineering drawings.

2.0 AS-BUILT DRAWING REQUIREMENTS

This section outlines the requirements for submission of detailed "as-built Plan of Record (POR)" with regard to drainage sewer systems and facilities.

2.1 Requirements for Submission of As-Built Drawings at CCC and FAC Stages

Refer to Volume 1: General, Chapter 1 for general information in regard to the requirements for CCC and FAC as-built drawings for sewers.

2.1.1 CCC First Submission

Detailed engineering CCC information is to be provided to EPCOR Water Services by the Consultant. The CCC information is to be provided electronically in the form of one PDF drawing file and a Consultant Data Loading (CDL) file both submitted to EPCOR Water Services via Citrix. If the Consultant is unable to access CDL program, the Consultant shall produce one PDF drawing file at CCC and FAC.

Any revisions and field changes approved by the Engineer in CCC drawings must be identified and shall be marked in red or highlighted in yellow.

2.1.2 FAC Final Submission

The detailed engineering "as-built Plan of Record (POR)" information must be received and approved by EPCOR Water Services before FAC is to be issued.

- i. A complete set of as-built POR drawings shall be submitted 3 months prior to FAC approval.
- ii. All changes to drawings from CCC to FAC are to be identified and submitted to EPCOR Water Services.
- iii. All errors/deficiencies identified by EPCOR Water Services on CCC first submission must be addressed and corrected.
- iv. As-built lot corner, swale, and drainage route elevations are to be shown on the lot grading plan. The specific approval of the City is required for changes of design elevations from those shown

on the lot grading plan as approved by the City. Refer to the Lot Grading Guidelines.

- v. All Department License of Occupation (DLO) approvals when required are to be submitted to EPCOR Water Services with the package as mentioned in Section **2.1.2.i** above.
- vi. As-built drawings of pump station/lift station are to be submitted in both CAD and PDF files.

2.1.3 Checking of Detailed Engineering “As-Built POR” Information

- i. As part of the recording process, EPCOR Water Services reviews CCC and FAC information to ensure sufficient information is included for the establishment of permanent records. If deficiencies are found, and if necessary, files are returned to the Consultant for revision and resubmission.
- ii. When the CCC first submission is received, a letter of “Received” will be sent to the Consultant.
- iii. When the FAC final submission is approved, a letter of “Approval” will be forwarded to the Consultant.

2.2 Detail Requirements for As-Built Drawings

The following minimum requirements are to be addressed in the preparation of as-built plans:

2.2.1 Location of drainage facilities, for example maintenance holes, CBs, and the end of pipe stubs.

Cadastral real world coordinates are to be provided based on the Alberta survey control system.

Note: Coordinates shall be given to the centreline of each maintenance hole, CB, or pipe stub, not to the centreline of any cover.

2.2.2 Maintenance Holes, Oversized Maintenance Holes, Drop Maintenance Holes, and Tunnel Access Maintenance Holes:

- Size;
- Type - e.g. round, eye;
- Description - e.g. access;
- Directional offset from the centreline of sewer to the centreline of maintenance hole - e.g. 4.5 m E. of centreline of sewer;
- At the connection to tunnel give the size and invert elevation of the pipe section connecting the drop or access maintenance hole to the tunnel;
- Elevation of bottom of maintenance hole;
- Oversize maintenance hole transition top slab elevation;
- Location - give coordinates. See Section **2.2.1**.

2.2.3 Rims and Inverts:

- Rim elevations only if in place;
- Elevations of all inverts, including previously constructed maintenance holes and pumping stations to which the new line is connected.

2.2.4 Alignments of Centreline of Trench or Tunnel:

- Perpendicular tie to property line;
- Azimuth where necessary.

2.2.5 Curves:

- Radius;
- Central angle;
- Sub-tangent;
- Length of curve;
- BC and EC Cadastral coordinates.

2.2.6 Distances to be Checked Between:

- Maintenance holes;
- Centrelines of chambers;
- Outfalls;
- BCs and ECs of curves;
- Points where sewer changes grade;
- Underground drop structures, or similar;
- Points where size of pipe changes.

2.2.7 Sewer Pipes and CB Leads:

- Size;
- Invert elevation at each end of pipe;
- Type or shape – e.g. round, eye, monolithic;
- Material - e.g. concrete, tile;
- Pipe strength;
- slope of pipe;
- Bedding type;
- Trench foundation improvements noting ballasting, subdrainage, or geotextiles installed - provide detailed cross sections and limits;
- Locations (see Section **2.2.1**) are to be given for all horizontal and vertical bends in sewer pipe and forcemains - accurate bend locations must be determined during construction before the trench is backfilled.

2.2.8 Structures such as Chambers, Pumpwells, and Wing Walls.

- Location – see Section **2.2.1**;
- Verification of construction as per plan, referring to drawing number;
- Any changes are to be noted, with a description and a sketch if constructed without plan or major changes.

2.2.9 Special Construction

- Reconnecting of CBs - verification or a sketch;
- Cross connections - sketch, inverts, and pipe size;
- Plugs – placement, e.g. E. side of maintenance hole;
- Weirs - elevation of the top, placement and a sketch description of any similar construction.

2.2.10 Lot Grading Information:

- All lot corner elevations are to be confirmed.
- Swales and drainage route locations (see Section **2.2.1**) are to be provided at the beginning and end of the swale, as well as any horizontal or vertical bends;
- Swale and drainage route invert and channel edge elevations at property line crossings.

2.2.11 Stormwater Storage Facilities:

- Stage-storage volume and stage-area curves and tables of the values;
- The high water level (HWL) design event basis;
- Elevations at pond bottom, normal water level (NWL), 5 year level, 25 year level, 100 year level, and HWL;
- Storage volumes at NWL, 5 year level, 25 year level, 100 year level level, HWL, and freeboard level;
- Area at pond bottom, NWL, 5 year level, 25 year level, 100 year level, HWL, and freeboard level;
- Freeboard elevation;
- Notation indicating the elevation of the lowest allowable building opening for lots abutting the wet pond;
- Depth of pond and forebay at NWL, 5 year level, 25 year level, 100 year level, and HWL;
- Length of shoreline at NWL, 5 year level, 25 year level, 100 year level, and HWL;
- Pond and forebay area in ha at NWL, 5 year level, 25 year level, 100 year level, and HWL;
- Contributing basin size in ha;
- Measurements to locate submerged inlets, outlets, and sediment traps are to be referenced to identifiable, permanent features which are not submerged at NWL.

2.2.12 Culverts:

- Location (see Section **2.2.1**) at each end of culvert
- Material;
- Diameter;
- Invert at each end;
- Slope.

2.2.13 General Information:

- Name of the Contractor;
- Start date;
- Completion data;
- Unusual ground conditions.

3.0 PROJECT ACCEPTANCE

This section describes the Developer's responsibilities with regard to certification and documentation of quality control and system performance when applying to the City/EPCOR Water Services for acceptance of sewer and drainage improvements constructed under the terms of a Servicing Agreement.

3.1 Developer Requirements at Construction Completion and Final Acceptance

Prior to or concurrent with an application for a CCC, and a FAC, the Developer is to address the following requirements:

3.1.1 Material Inspection and Testing Certification

Certifications for all materials used are to be submitted as detailed in Volume 1: General, Chapter 2.

3.1.2 Leakage Testing Results

Leakage testing for CCC shall be conducted in accordance with the requirements of Section 27 - Vol. 3-06: Construction Specifications and the results of testing shall be submitted. Leakage testing for FAC shall conform to the requirements of Section **3.3** herein.

3.1.3 Pre-Inspection by the Consultant

Prior to requesting inspection of sewer and drainage systems by EPCOR or application for a CCC or FAC, the Consultant shall inspect the improvements and verify that the works are complete and functional, in accordance with the approved engineering drawings and the requirements of these standards.

3.1.4 Commissioning of Special Structures/Facilities (Applicable for CCC)

- i. Where the improvements include special structures or devices, the Consultant shall fully test the operation and function of these facilities to prove that they comply with the design specifications, including fail safe response, fault, and status monitoring. For all such structures, the Consultant shall submit a commissioning report to the Engineer in advance of or concurrent with a request for a construction completion inspection or application for a CCC. This report shall identify the scope of the testing performed and the specific measurement and parameter values recorded. The report is to bear the stamp of the professional engineer responsible for the project and include a statement that the facility meets all of criteria specified in the approved design reports and engineering drawings.
- ii. Specific requirements for commissioning of particular special structures are outlined below. Similar requirements shall apply to other types of special structures as may be determined by the Engineer.
 - Pumping stations - the commissioning report for a pumping station is to include, but not necessarily be limited to, the following items:
 - a) Test results and calibration of all major equipment including pumping pressures and rates, power consumption of drivers, and power supply voltage and amperage.
 - b) A checklist and verification of operability of all valves, gates, air release and blowoff valves, and lifting equipment.
 - c) A ventilation system balancing report. See Section 2.13.5 - Vol. 3-04: Pump Station and Forcemain Design Guidelines.
 - d) A completed checklist of the testing of all auxiliary devices including the lighting, heating, plumbing, and electrical utility systems.
 - e) A copy of the commissioning report for a pumping station is to be included in the O&M manual to be provided. Refer to Section 2.17.1 - Vol. 3-04: Pump Station and Forcemain Design Guidelines.
 - Stormwater management storage facilities - the commissioning report for a SWMF is to include, but not necessarily be limited to, the following items:
 - a) A complete checklist of all operating features, including valves, flow gates, and control and measurement devices, with verification of the proper function of such features.
 - b) Flow control mechanisms or devices are to be tested in the installed condition, calibrated and verified to function in accordance with the design specifications.

3.1.5 A copy of the commissioning report shall be included within the O&M manual to be provided. Refer to

Section 4.4 - Vol. 3-02: Stormwater Management and Design Manual.

3.1.6 Surface Grading Verification (Applicable for CCC)

- i. The Consultant is to provide certification to verify that the surface grading requirements for the development have been established. "Established" means that all lot corner elevations and swale invert profiles and cross sections are within a tolerance of -70 mm to -200 mm below the design elevation, measured on clay. Whenever site-specific constraints prevent the establishment of specific surface elevations prior to the proposed date for CCC application for surface grading and swales, deficiencies are to be noted on the certification. In these cases, the applications shall be accompanied by written confirmation of the intent to rectify the surface grading deficiencies prior to final acceptance for sewer and drainage improvements and a commitment to coordinate with all other parties so that the interim surface grading deficiencies do not result in misinterpretation by others of the final grading requirements.
- ii. Refer to the Lot Grading Guidelines.

3.1.7 Erosion and Sediment Controls (ESC)

- i. The consultant shall ensure the implementation of the ESC Plan during construction and post-construction stages in accordance with the ESC Guidelines and Field Manual until the FAC is signed off.
- ii. Inspection of the ESC BMPs and installations shall be performed to ensure they are functioning adequately. Maintenance shall be carried out as required on failing ESC measures.

3.2 Inspection of Completed Systems by EPCOR

3.2.1 Cleaning of the System

When the works are completed and prior to requesting inspection of sewers by the EPCOR's inspector, the Developer is to ensure that the system to be inspected is thoroughly clean and free from mud or any other obstructions. Unsatisfactory conditions shall be remedied to the satisfaction of the Engineer or the inspector at the Developer's expense.

3.2.2 Inspection by EPCOR upon CCC and FAC Application

Upon application by the Developer for a CCC, and also for a FAC for an improvement, the EPCOR's inspector conducts visual inspections of the improvement, provided that the Developer has reasonably complied with the requirements of Section 3.1.

3.2.3 Inspection Prior to Completion of Total Systems

In response to reasonable requests from the Developer, at the discretion of the Engineer, the EPCOR's inspector may inspect portions of the sewer and drainage improvements in advance of formal application for a CCC. This is to identify and correct deficiencies in underground works in advance of the construction of surface improvements or with regard to seasonal considerations. The Engineer shall not be obliged to conduct piecemeal inspections for acceptance of work in progress, or to provide separate or advanced approval of a CCC or a FAC for any portion of the sewer and drainage improvements constructed under the terms of a single servicing agreement. The City will approve a CCC or a FAC only upon completion of all portions of each separate improvement itemized within the servicing agreement.

3.2.4 Wet Well Inspection Prior to Operation

A wet well inspection must be done by EPCOR Water Services before flooding with sewage in order to inspect proper seating/fastening of the pump and for any garbage left by the contractor in the well that could cause clogging in the future.

3.3 Inspection and Testing of Sewers

3.3.1 Manual Visual Inspection

All sewers greater than 1200 mm in diameter, and all maintenance holes, CBs leads, CBs, and appurtenances shall be subject to visual inspection by the Engineer or an authorized inspector at CCC,

and where feasible to do so at FAC. Manual walk-through inspections shall conform to Section 23 - Vol. 3-06: Construction Specifications. Where manual walk-through inspections are not feasible to be carried out at FAC, sewer inspection shall be carried out by CCTV methods meeting the technical requirements of Section 23 - Vol. 3-06: Construction Specifications.

Acceptance criteria for sewer pipe at both CCC and FAC shall conform to the requirements of Clause 3.12 – Visual Inspection and Acceptance Criteria, Section 13 - Vol. 3-06: Construction Specifications.

Maintenance holes, CBs, and other appurtenances shall show no evidence of structural damage at CCC nor evidence of premature material degradation at FAC.

3.3.2 Sewer Inspection by CCTV Methods

- i. CCTV inspection of the sanitary and storm sewer improvements shall be completed in accordance with Section 23 - Vol. 3-06: Construction Specifications and the associated inspection results submitted to the Engineer prior to application for a CCC and a FAC.
- ii. This shall include all sewers not subject to visual walk-through inspections. The Consultant shall review every CCTV inspection and provide to the Engineer a written summary indicating any deficiencies detected, including recommendations for repair. The interpretation of the CCTV inspection shall remain the responsibility of the Consultant.
- iii. Any additional CCTV inspection of sewers to verify the Consultant's interpretation or to inspect deficiency repairs shall be done at the Developer's expense.
- iv. If CCTV inspection reveals that any of the conditions noted in Section **3.3.1** Manual visual inspection exist, then these deficiencies shall be remedied to the satisfaction of the Engineer.

3.3.3 Leakage Testing

All leakage tests shall be conducted after the service connections to the main have been installed. Service connections include in-line tees, wyes, and saddles.

No leakage testing other than visual interpretation of the CCTV inspections is required to comply with Leakage Testing Criteria at FAC.

i. Minimum requirement for leakage testing

Leakage tests shall be conducted on 10% of all sanitary sewers unless a further requirement for testing is defined below. The Engineer shall choose those sewers to be tested after construction is complete.

ii. Additional leakage testing in case of test failure

In the event that initial leakage tests described within the Construction Specifications reveal deficiencies in the 10% of the system tested, then in addition to retesting after repairs have been carried out, an additional 10% of the system shall be tested. Should this additional testing reveal further deficiencies, then the remainder of the system shall also be tested for leakage. All deficiencies detected shall be repaired and the system retested for leakage. The cycle of testing and repair shall be repeated until leakage from the system is within the allowances specified in the Construction Specifications.

iii. Sanitary sewers below the groundwater table

All sanitary sewers that are anticipated to be below the groundwater table at any time of year are to be tested for leakage.

iv. Sanitary sewers located near top of bank

All sanitary sewers situated within top of bank as defined in the subdivision plan shall be tested for leakage.

v. Storm sewers designed for surcharge

Storm sewers which are designed to operate under surcharged conditions for extended periods of time, for instance in the case of an outlet from a SWMF with flow controlled at the downstream

end, may be required to be tested for leakage at the Engineer's discretion.

3.3.4 Methods for Leakage Testing

Leakage testing shall be conducted in accordance with Section 27 - Vol. 3-06: Construction Specifications.

3.3.5 Leakage Testing Acceptance at FAC

As it is not feasible to conduct leakage tests at FAC, acceptance shall be based on visual acceptance criteria based on the results of the CCTV inspections. The CCTV inspections shall be reviewed for any infiltration type defect observations using the nomenclature noted in the EPCOR Closed-Circuit Television Inspection Manual and the National Association of Sewer Service Companies (NASSCO)'s Pipeline Assessment Certification Program (PACP) Reference Manual.

Any observed infiltration greater than the "seeper" level of infiltration shall be rectified at the Developer's expense. Rectification of infiltration type deficiencies can be made utilizing approved grouting or trenchless point repair techniques. The Consultant shall make a recommendation to the City/EPCOR on an appropriate method of defect rectification in accordance with the methods outlined in Section 13 - Vol. 3-06: Construction Specifications, Clause 13.12.4 (Flexible Pipe Defects) or 13.12.5 (Rigid Pipe Defects) for infiltration through pipe defects or Clause 13.12.6 for infiltration through Joint Defects and an appropriate monitoring period to confirm that the defects were adequately rectified.

3.3.6 Easements and Restrictive Covenants

All easement, restrictive covenant, and right-of-way documents indicated on the engineering drawings, shall be registered against the properties and on file at the Land Titles Office before CCC for the development is issued.

4.0 PRODUCT APPROVAL PROCEDURE

