Linear infrastructure testing and acceptance manual for water and wastewater assets

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Glossary

ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
ACI	American Concrete Institute
CCTV	Close Circuit Television
CSA	Canadian Standards Association
CCD	Charge-Coupled Device
Capital Project	Infrastructure project where Region is the proponent
DI	Ductile Iron
Development Project	Infrastructure project where private developer is the proponent
DWQMS	Drinking Water Quality Management System
ESC	Erosion and Sediment Control
E. COLI	Escherichia Coli
HDPE	High Density Polyethylene
HPC	Heterotrophic Plate Count
ID	Identification
MECP	Ministry of Environment, Conservation and Parks
MSSQL	Microsoft Structured Query Language
MPEG	Moving Picture Experts Group
NTSC	National Television System Committee
NTU	Nephelometric Turbidity Unit

OPSS	Ontario Provincial Standard Specifications
PCCP	Pre-Stressed Concrete Cylinder Pipe
PVC	Polyvinyl Chloride
PVCO	Molecularly Oriented Polyvinyl Chloride
RCP	Reinforced Concrete Pipe
Smooth-Walled Pipe	Typically thermoplastic pipes including PVC, PVCO and HDPE
SP	Special Provision
Vendor	Contractor with prime responsibility for performance of the work
WWIMS	Wastewater Integrated Management System
WWQMS	Wastewater Quality Management System
W&WW	Water and Wastewater

1. Introduction

This manual outlines the general procedures and requirements for testing, acceptance and commissioning of newly constructed water and wastewater linear infrastructure for all types of projects (Development and Capital) within the Region of Peel (Peel). This document is intended to establish a clear and consistent approach to testing and acceptance requirements and provide a clear point of reference outlining a cohesive approach for Peel staff, Consulting Engineers, Contractors and Developers. The manual contains the following sections:

- General requirements
- Testing and acceptance requirements for new water infrastructure
- Testing and acceptance requirements for new wastewater infrastructure
- Testing and acceptance for linear infrastructure rehabilitation (under development)
- Testing and acceptance for linear infrastructure asset condition baselining (under development)

This manual describes the testing methods, general sequencing, and performance requirements for testing and acceptance of linear infrastructure. It is not intended to provide design criteria or supplement or replace construction specifications. This manual is to be used in conjunction with all current Region design and construction standards and specifications, and project-specific contract documents and specifications. It shall be reviewed by all users to understand the Region's requirements for testing and acceptance of newly constructed water/wastewater linear assets.

For a summary of applicable requirements by asset type, refer to Acceptance Test Applicability **Table 1**, **Table 4** and **Table 5** included within the document. Additional details of each type of test are included in relevant sections of this document.

2. General

2.1. General requirements

The Vendor is responsible for delivering a fully tested and commissioned system to the Region. The Vendor constructing the new assets shall bear the complete cost and responsibility to supply all labour, equipment, and materials necessary to perform the tests required as well as the completed documentation required by this manual. As applicable the Vendor shall also bear the complete cost and responsibility to remove and dispose of, in a manner keeping with best industry practices, regulatory requirements and specifications, all equipment and materials used to perform the required tests.

The vendor shall confirm that the most recent versions of all references and submittal templates are used.

All testing work shall be completed in accordance with the requirements of this manual and shall be completed in a manner respecting all regulatory requirements. Care and concern to ensure all testing and commissioning activities are completed to applicable health and safety and environmental requirements whether they be regulatory or not, shall be the complete responsibility of the Vendor completing the testing and commissioning activities. The Vendor shall be solely responsible for all impacts caused by the Vendor's execution of the work and the Vendor shall be responsible for ensuring that during all phases and stages of the work, adequate protection and contingency plans are in place should an incident or accident occur, caused by or associated with, the work being performed. This includes temporary erosion and sediment control measures as well as any monitoring or treatment required based on the differing conditions for each phase of the Vendor's plan. Plans should include details not just for each phase of the work but also for the periods of transition between the phases of the work.

In cases of conflict or contradiction between requirements of this manual and other requirements, regulatory in nature or otherwise, the more stringent of the requirements shall apply in all cases. Where differences of opinion exist regarding interpretation of conflicting or contradictory requirements, the Region shall, in its sole discretion, review and clarify which requirements shall be considered the most stringent.

All testing shall be performed under the observation of Regional Water and Wastewater Staff or their designates. Any tests not witnessed by Regional Water/Wastewater staff or their designates shall be repeated so they can be witnessed by Regional Staff or their designates. All costs associated with the requirement to repeat any testing and commissioning activities shall be the complete responsibility of the Vendor performing the testing and commissioning. Results for tests conducted without coordination and attendance by the Region or their designate will not be accepted.

The Vendor shall be responsible for scheduling all testing and commissioning with Regional Water and Wastewater Staff or their designate a minimum of fourteen calendar days prior to the planned testing and commissioning activity being scheduled. Vendors are responsible for ensuring availability and scheduling of the necessary parties prior to scheduling any testing or commissioning activities.

2.2. Backflow prevention and metering

Where potable water is required for testing, water may be supplied from a temporary backflow-protected connection to the Region's potable water system. All connections shall be made in accordance with Region Standard Drawings 1-7-7 and 1-7-8 as applicable. All Users shall note that the Region does not consider a direct connection to a hydrant to be a suitable source for commissioning purposes for potable water supply. All backflow preventers shall be compliant with applicable regulatory requirements and Regional Standards. Backflow prevention devices and water meters shall be supplied and installed in accordance with Regional standards. Under no circumstances shall a double check valve assembly be considered an acceptable backflow prevention device when connecting to the Region's potable water system.

All Vendor supplied backflow preventers and meters shall be tested and commissioned by a Licenced Plumber following installation and prior to opening any valves between the potable water system and the non-potable asset being tested and commissioned. Testing shall be witnessed by Regional staff or their designate. Regional certified operators must be present to operate Region owned valves and hydrants to provide source feed for backflow preventer. Details shall be included and submitted on the Backflow Prevention Device Test Report form (Appendix A).

Where backflow preventers and meters are supplied by the Region, confirmation that the devices have been tested and commissioned according to Regional DWQMS requirements shall be confirmed prior to installation of these devices.

Vendors, in conjunction with witnessing Regional Water and Wastewater Staff or their designate, shall record meter readings before any water is used, at the start and end of each day, as well as prior to and upon completion of any individual testing activity. The meter readings shall be included on all forms where indicated, and where not indicated shall be recorded and submitted as part of the inspecting party's project-level daily notes. Records of these readings shall also be kept by the Vendor in case of any disputes regarding meter readings.

A Region permit, including associated fees is required for all connections to regional potable water assets. Under no circumstances shall any Vendor make connections to hydrants connected to the Region's potable water system without the written approval of the Region's Water and Wastewater Operations Director and ORO responsible for the system being connected to.

2.3. Discharge and disposal of water during testing and commissioning

Vendors performing testing and commissioning activities shall be solely responsible for the discharge and disposal of any water, potable or non-potable (including sewage and/or effluent if applicable), required by the testing and commissioning activity being completed.

Vendors shall, as part of the planning and execution of the work, review discharge locations and shall ensure compliance with all standards and regulatory requirements related to the area being discharged to.

Vendors shall be solely responsible for securing the necessary permits from the Region, City or other Regulatory Agency (MECP, Conservation Authority etc.) including costs unless provided in the applicable contract documents.

Vendors shall consult and review Regional and City/Town Sewer-Use Bylaws for specifics related to discharge to municipal sewer systems.

Consideration and planning to ensure compliance with all natural environment discharge requirements where discharge to a natural environment will occur shall be the sole responsibility of the Vendor in question. Any potential impact to natural features should be identified and mitigation measures, compliant with regulatory requirements or good industry practice, shall be implemented prior to the discharge of any water. Vendors shall consult with the applicable Municipal, Provincial and/or Federal or other regulatory agencies for requirements and details on discharging to

the natural environment and shall include these details in their plans and submissions.

Any remediation or clean up costs related to the discharge of water or sewage/effluent/other fluid or medium, to natural features shall be the sole responsibility of the Vendor performing the testing and commissioning work in question.

Special care and concern should be taken on sites where erosion and sediment control are a potential risk. Overland discharge routes should be reviewed in detail and where required proper erosion and sediment control measures shall be installed prior to the discharge of any water to these locations and to ensure no downstream impacts are caused by the testing and commissioning work being completed. Vendors shall ensure the full drainage path to the sewer or natural feature is respected and appropriate measures are put in place all areas upstream of the final discharge location to protect all areas from being negatively impacted by the Vendor's work.

2.4. Groundwater

For the purposes of selecting infiltration versus exfiltration leakage testing for non-pressure designed sanitary sewer systems, groundwater elevations shall be established through review of the site-specific hydrogeological investigation and report. If an investigation is not performed or supporting record information is not available for determining groundwater levels, direct readings from the nearest monitoring well/piezometer or historical data/studies may be used to determine the groundwater level, at the discretion of the Region. All data shall be reviewed by a Professional Geoscientist or Professional Engineer licensed to practice in Ontario.

2.5. Project testing and commissioning plan

The Vendor shall develop a written plan for the testing and commissioning activities according to this manual. The commissioning plan shall be submitted by the Vendor at least 14 days prior to the commencement of testing and commissioning activities for review, and generally shall consist of the following:

- Detailed plans, setting forth step-by-step descriptions of the procedures proposed by the Vendor for the systematic testing of all equipment and systems
- Sequence and schedule for each testing activity
- Sample forms for documenting the results of field tests

- Calibration plan for all instrumentation, including flowmeters, and pressure gauges
- Identify requirements for any supporting systems or equipment, temporary systems or work, and the presence of the subcontractors' and manufacturers' representatives
- Relevant health and safety practices/procedures for commissioning activities; including, but not limited to, use of personnel protection equipment, confined space entry procedures and traffic protection plans as well as emergency response plan for spills
- Relevant permits and approvals from the Region, City or Regulatory Agency (MECP, Conservation Authority etc.)
- Erosion and Sediment Control (ESC) plans for all phases of the plan including any ESC measures required at the discharge location if required
- Details on any treatment being used including details on cleaning, replacement or monitoring of treatment equipment and materials for functionality.

Vendors must be approved by the Region to undertake watermain disinfection activities. Following is the link to the checklist of requirements for vendors performing water disinfection works in Peel Region.

peelregion.ca/construction/disinfection-requirements-checklist.asp

Approval to proceed with testing activities shall be contingent upon approval of the commissioning plan and obtaining relevant approvals and clearances from applicable authorities.

The Vendor will make all arrangements for testing, coordinate all personnel involved, issue all required notifications, perform all commissioning tests, record results, make all necessary adjustments and retest as necessary until equipment and systems perform as intended and are proven to meet the requirements included in this manual. The Vendor will sign and submit all test results. Testing shall only be performed in the presence of the Regional Representative or their designate. Testing activities which haven't been witnessed by the Region or their Designated Representative will not be accepted.

The Vendor shall provide completed testing and commissioning documentation forms for all equipment and systems as outlined in this manual to the Regional Lead upon completion of any testing and commissioning.

3. Water

3.1. General

All newly constructed watermain shall be commissioned and pass all tests as outlined in the document herein. The Vendor shall complete any pre-commissioning start-ups/checks prior to commencing commissioning activities. Testing and acceptance shall be performed under the observation of Regional Water and Wastewater Staff or their designates; and shall be completed prior to placing infrastructure into service. Refer to **Table 1** for summary of testing requirements and sequencing by asset type. Test details are provided below.

Table 1: Water pipeline and chamber acceptance test applicability

Asset		Acceptance Test										
Class	Type	CCTV Inspection	Flushing	Swabbing [1]	Hydrostatic Pressure Test	Valve Testing Including Tapping Sleeves [2]	Chlorination	Bacterial Testing/Sampling	Tracer Wire Test	Visual Chamber Inspection	Chamber Infiltration [3]	Chamber Exfiltration [3]
	Document Reference	3.2.1	3.2.2	3.2.3	3.2.4	3.2.5, 3.2.6	3.2.7	3.2.8	3.2.9	3.3.1	3.3.2	3.3.3
Watermain [4]	50mm Copper		yes		yes		yes	yes	yes			
	PVC or PVCO ≤ 400mm		yes	yes	yes	yes	yes	yes	yes			
	HDPE		yes	yes	yes	yes	yes	yes	yes			
	PCCP ≥ 400mm, < 600mm	yes	yes		yes	yes	yes	yes	yes			
	PCCP ≥ 600mm	yes	yes		yes	yes	yes	yes	yes			
Chambers	Pre-Cast Concrete Chambers									yes	yes	yes
	Cast-In-Place Concrete Chambers									yes	yes	yes

[1] For smooth walled pipes 400mm diameter and larger, CCTV may be considered in lieu of swabbing at Region's discretion
[2] Testing applies to All valves 400mm and above and all tapping sleeves 100mm and above
[3] Complete either a chamber exfiltration or a chamber infiltration test depending on the site-specific groundwater levels
[4] Alternative pipe materials shall be tested according to project-specific requirements and manufacturers specifications

3.2. Watermain

3.2.1. CCTV

All new PCCP watermains 400mm diameter and above shall be inspected by CCTV prior to flushing, hydrostatic testing, and disinfection, to visually confirm pipe condition, cleanliness, joint grouting and readiness for testing and commissioning. The camera, transporter, and related CCTV equipment utilized, shall be previously used for watermain inspections only, suitable for size of pipeline to be inspected and able to view full circumference of internal pipe joints.

The Vendor shall be responsible to ensure entire length of new watermain is inspected, with consideration for access requirements for inspection equipment and range limitations.

The Vendor shall provide a CCTV inspection plan for review prior to installation of any watermain. The plan shall identify any segments that cannot be inspected by CCTV methods from proposed permanent access points (such as valve chambers and drain chambers) due to vertical or horizontal pipe deflections or other considerations. The Vendor's CCTV Plan shall outline an approach to ensure that all new watermain is inspected by CCTV or an acceptable alternative testing methodology approved by the Region for sections identified as not to be able to be inspected by CCTV.

Written approval from the Region or their Designate following review of the CCTV reports must be received prior to continuing with additional required testing and commissioning of the watermain. If the CCTV investigation reveals any deficiencies with the watermain, the Vendor will be required to correct deficiencies and conduct additional CCTV investigations at no additional cost to the Region until the Region or their Designate are satisfied with the condition of the watermain.

Inspection requirements

The inspection shall be a continuous unedited examination of the entire length of watermain between access points. Identifying features at each entry point shall be clearly visible at the start of the inspection and the picture shall be in focus from the point of observation to a minimum of two pipe diameters ahead. The image shall remain in focus with adequate lighting to produce an accurate view of the watermain allowing the correct observations to be reported. The maintained location of the CCTV camera shall be on or as near as practicable to the central axis of the pipeline.

The inspection recording will have the continuous chainage indicated at the bottom right corner of the screen, the upstream and downstream valve chamber or access point IDs of the section being inspected indicated on the top left corner of the screen, as well as the date and time at the bottom right corner of the screen. These items are to be displayed on the screen at all times.

The Vendor will ensure the camera lens is free from debris to ensure high picture quality. The camera lens shall be kept clean during the entire inspection. Video with excessive fog or debris on the lens will not be accepted and the watermain must be re-inspected at the Vendor's own expense.

Cable counter accuracy and calibration set point measurements are to be completed for each camera/crawler combination for each watermain size inspected with results documented. Counter to be zeroed when center of crawler is located at the beginning of start point reference feature, e.g. opening threshold of access flange, pipe joint, etc.

Each inspection unit shall utilize a sufficient number of guides and rollers such that, when surveying, all cables are supported away from sharp corners and prevent exceedance of recommended bend radii reducing risk of damage. Furthermore, all umbilical cables and lines used to measure the equipment location within the watermain should be maintained in a taut manner and set at right angles, where possible, to run through or over the measuring equipment. This will help to support the cable throughout inspection and prevent cable damage.

If a deficiency, branch connection or service is noted, the camera is to halt and perform a detailed (pan-and-tilt) inspection of the area is to be recorded. Pan-and-tilt operations will be done slowly so that all details of items noted in the report are fully captured. All branch connections are to be viewed as far as possible into the branch. Pan-and-tilt operations shall be undertaken when the camera is adjacent to a deficiency, branch connection or service, e.g. 90 degrees.

Camera system

The cameras, transmission cables, and digital video recording equipment utilized shall produce colour video inspection records that comply with Canadian Standards Association (CSA) PLUS 4012-10 requirements, namely a minimum recorded resolution of 420 lines with National Television System Committee (NTSC) size of 720 x 480 at 29.97 frames per second.

The colour charge-coupled device (CCD) cameras used in the inspections shall be a pan and tilt view type capable of radial rotation of 360°, lateral rotation of 275°, and of producing a continuous picture resolution of not less than 400 lines at the periphery of the picture. The resolution will be confirmed for a minimum of a RS Resolution Chart (Retina Type).

The cameras shall be equipped with a self-contained, adjustable, directed light source compatible with the lens angle and dispersed to create even distribution of the light around the pipe perimeter without the loss of contrast, flare out of picture, shadowing, and/or creation of "hotspots".

The adjustment of focus and iris must be remotely operated and allow optimum picture quality to be achieved at all times.

The camera must be self-propelled and must be transported in a stable condition through the watermain during inspection. Vendor shall be completely responsible for selecting equipment, and planning and executing the work, to respect the vertical and horizontal bends being installed. The mounting of the camera shall be adjusted such that the central axis of the camera lies at a point equidistant between the invert and obvert of the pipe. In all instances, when transporting the camera through the watermain the camera lens must be positioned on and looking along the central axis of the pipe. The inspections shall be captured in colour Moving Picture Experts Group (MPEG-4) from the live video source to the computer hard drive with no frame loss. One complete single digital file shall be submitted for each inspection.

The equipment and cables utilized shall be capable of inspecting a minimum pipe length of 750m without reversal and up to 1500m with reversal.

The inspections shall be captured in colour Moving Picture Experts Group (MPEG-4) from the live video source to the computer hard drive with no frame loss. One complete single digital file shall be submitted for each inspection.

The digital video files shall be named using the Agency's GIS Mapping references and shall be labelled as follows:
"RoadName_PipeDiameter_System_StartPointID_StartPointSta_
EndPointID_EndPointSta_Date (yyyymmdd)_Time(hhmm)".

For example:

"KennedyRoad_750_WM_VC12_Sta4+132_90DEGELB_Sta4+286_
20210828_1437"

Digital video files shall meet the following minimum requirements:

- MPEG-4 Requirements:
  - Picture Size: National Television Standards Committee (NTSC) 702 x 480 @ 29.97 frames per second
  - Data/Bit Rate: 4 Mbps
  - Codec Format: H.264

GraniteNet CCTV Inspection System, Version 5.8 (using MSSQLExpress version 2022) shall be used to perform all inspections. Please note that any upgrades to GraniteNet will be communicated to the Vendor and they must be able to upgrade within 30 days. The video and text report window shall be visible on the screen side by side, and text report should follow advancing video. At the same time, Regional staff shall be able to go to any location of the video by selecting items from the report screen. The video window shall be scalable to allow user to change its size to fill up as much of monitor screen as possible. The GraniteNet scoring module must be used during the recording of the inspections. Should the video fail to meet these specifications, as determined by the Region or their Designate, the Vendor shall be required to re-inspect the line to produce an acceptable quality video at no additional cost to the Region

The inspection recording will have a continuous chainage indicated, date and time, as well as the start and end point of the watermain section displayed on the screen at all times except when observations are being noted. The display .GNS file shall be provided by Peel and must be used to ensure consistency across all inspections.

References

- Transmission Main CCTV - Post-Construction R0 CLEAN
- Contract-specific specifications and special provisions

Submittals

- CCTV Inspection Plan
- Interim CCTV Footage for Review
- Final Video and Reporting

3.2.2. Flushing

All watermains (any size) including temporary watermains, fire hydrant leads, dead ends, and all service pipes (100mm diameter and greater) on public and private property shall be flushed prior to pressure testing and disinfection. Standard

procedure for testing, equipment requirements, and specifications shall be in accordance with the requirements of the MECP Watermain Disinfection Procedure and AWWA C651.

For development projects, the Region or their designate shall be responsible for watermain flushing. For capital projects, flushing shall be carried out by a specialized Vendor approved by the Region.

Watermains shall be flushed using potable water at a minimum velocity of 0.91m/s until discharge turbidity measures less than one (1) NTU. Where source water turbidity exceeds one (1) NTU (as sampled upstream of the watermain being flushed), flush until discharge water turbidity matches source water turbidity

Where minimum flushing velocity can not be achieved, watermains may be flushed with a minimum of three (3) times the pipe volume. For large diameter watermains, 1200mm and greater, alternative flushing methodologies may be considered on a project-specific basis, where such measures satisfy applicable regulatory requirements and are approved by the Region.

Sequencing and methodology for flushing shall be included as part of the site-specific testing and commissioning plan.

References

- MECP Watermain Disinfection Procedure
- AWWA C651

Submittals

- Backflow Prevention Device Test Report (Appendix A)
- Pre- and post-project water meter readings (Appendix D, E or as required)

3.2.3. Swabbing

All new smooth-walled watermains (PVC, PVCO and HDPE pipes) shall be swabbed prior to testing and disinfection. CCTV inspection in lieu of swabbing may be approved on a project-specific basis for pipes 400mm in diameter and larger.

A minimum of two swabs shall be passed through each new hydrant and the ends of the new watermain until swabs emerge clean and discharge turbidity measures less than one (1) NTU. Where source water turbidity exceeds one (1) NTU (as sampled upstream of the watermain being flushed), flush until discharge water turbidity

matches source water turbidity. A flow rate of 0.5 - 1.0 m/s shall be maintained using potable water.

Only new and clean polyurethane foam swabs (density: 23 kg/m^3) with a minimum diameter of one size larger than the watermain pipe diameter and a length of 1.5 times the swab diameter will be permitted for use. Swabs must be clearly numbered before insertion for tracking of their retrieval and point of deployment location recorded.

Swabbing shall be carried out by a specialized Vendor and approved by the Region. Sequencing and methodology for swabbing and flushing shall be included as part of the site-specific testing and commissioning plan.

References

- MECP Watermain Disinfection Procedure
- AWWA C651
- OPSS.MUNI 441

Submittals

- Backflow Prevention Device Test Report (Appendix A)
- Pre- and post-project water meter readings

3.2.4. Hydrostatic pressure test

All watermains (any size) including temporary watermains, fire hydrant leads, dead ends, and all service pipes (100mm diameter and greater) on public and private property shall be hydrostatically pressure tested with potable water prior to disinfection. Minimum test pressure shall be 1035kPa (150psi) for a test duration of two (2) hours.

The entire system being tested shall be maintained at or above the test pressure throughout the duration of the test. The maximum pressure at any point in the test section shall not exceed pipe pressure rating.

Pressure test shall be undertaken in accordance with the procedures outlined in OPSS.MUNI 441, AWWA M9, and project-specific requirements as modified herein. A staged hydrostatic testing procedure is required for polyethylene pipe. Test sequencing and methodology shall be included as part of the project-specific testing and commissioning plan.

All permanent piping, valves and appurtenances shall be installed prior to undertaking the hydrostatic pressure test.

Supply, install and remove all temporary valves, fittings and appurtenances required for pressure testing. Fill the test section slowly with water making sure that all air is removed from the pipeline. Allowable make-up water and pressure drop during the hydrostatic pressure test are listed in **Table 2**.

Table 2: Makeup water and pressure drop for hydrostatic pressure test of watermains

Pipe Material	Makeup Water Allowance for Hydrostatic Pressure Test (litre/km)	Allowable Pressure Drop (psi)
PVC, PVCO	Zero	Zero
PCCP – Transmission	Zero	Zero
PCCP – Sub-Transmission	Zero	Zero
PCCP – Distribution	Zero	Zero
HDPE	Per OPSS.MUNI 441 - Table 1	

If hydrostatic pressure test fails, the Vendor will be required to repair all deficiencies and retest until satisfactory results are attained.

Where make-up water is permitted (i.e. for HDPE pipe), test procedure shall be strictly followed with make-up water added only at the end of the test period. Gradual or intermittent additional of make-up water during the test period shall not be permitted.

For Capital projects, the Vendor is responsible to complete hydrostatic pressure testing. For Development projects, the Region or their designate shall undertake pressure testing.

References

- OPSS.MUNI 441
- AWWA M9

Submittals

- Backflow Prevention Device Test Report (Appendix A)
- Watermain Test Report (Appendix B)

3.2.5. Valve testing

All valves shall be pressure tested at watermain test pressure to demonstrate a leak tight seal.

Mainline isolation valves 400mm and larger shall be tested from both sides of the valve at watermain test pressure for a minimum of 15 minutes. Allowable leakage shall be as per Section 3.1.4 Hydrostatic Pressure Test, adjusted for length of pipe included the valve test.

Vendor shall provide the services of a factory-trained representative to inspect, operate, test and adjust all specialty valves (i.e. pressure reducing valves) and isolation valves 600mm in diameter and greater. Where such services are provided, the Vendor shall submit a field report describing, the inspection undertaken, verification of installation and adjustments made.

Details of valve testing shall be included in the site-specific testing and commissioning plan.

References

- Valve manufacturer's recommendations

Submittals

- Site-specific testing and commissioning plan
- Watermain Test Report (Appendix B)
- Supplier start-up reports

3.2.6. Tapping sleeves and valves

All tapping sleeves and valves 100mm diameter and larger shall be subjected to a hydrostatic pressure and leakage test prior to undertaking the live tap. Using clean potable water, pressurize the tapping sleeve and valve to test pressure for minimum 15 minutes. Minimum test pressure for tapping sleeves and valves shall be line pressure, or as recommended by tapping sleeve and pipe manufacturers.

References

- Pipe and tapping sleeve manufacturer's recommendations

Submittals

- Backflow Prevention Device Test Report (Appendix A)
- Watermain Test Report (Appendix B)

3.2.7. Chlorination

All watermain (any size) within the right-of-way including temporary watermain and service pipes (100mm diameter and greater) shall be disinfected prior to placing into service.

The disinfection procedure, chlorination concentration requirement, and recharge protocol shall meet the minimum requirements of the latest versions of OPSS.MUNI 441, AWWA C651, MECP Watermain Disinfection Procedure, and Region's latest specifications and standard drawings.

An initial residual chlorine concentration of 50mg/L shall be achieved and shall not drop below 25mg/L during the test. Potable water maybe supplied from a temporary backflow-protected connection to the existing distribution system or other supply source approved by the Region.

For Capital projects, the Vendor shall retain the services of a specialist company, approved by the Region, who is fully experienced in disinfecting various diameter pipes and valves and potable water piping, including fixtures and fittings. For Development projects, the Region or their designate shall be responsible for chlorination activities.

The Vendor/ Specialist Company or the Region/ Designate shall be responsible to supply all labor, water, chemicals and chemical metering equipment, pumps, gauges, caps, stoppers, air release cocks, pipe work and other apparatus and all ancillary items required to complete disinfection. All temporary items from the site are to be removed upon completion by parties performing the test. The Vendor/ Specialist Company or Region/ Designate shall be responsible for sampling and testing for adequate chlorine concentrations and will advise the Region of the acceptability of the chlorine concentrations after 24 hours of contact. Any approved party performing the required test must have the ability to verify chlorine decay in the field, prior to requesting the Region to collect the initial microbiological samples.

A project-specific disinfection plan shall be prepared that shows, as a minimum, a schedule, methodology to be used, chlorine residual testing and monitoring procedures.

References

- OPSS.MUNI 441
- AWWA C651
- MECP Watermain Disinfection Procedure

Submittals

- Backflow Prevention Device Test Report (Appendix A)
- Watermain Test Report (Appendix B)
- Continuous Feed Watermain Disinfection Plan (Appendix C)
- Continuous Feed Method Watermain Disinfection (Appendix D)
- Slug Method Watermain Disinfection (Appendix E)
- Pre- and post-project water meter readings

3.2.8. Microbiological sampling/testing

All newly installed watermain shall be microbiologically sampled and tested prior to acceptance. The Region shall be responsible for taking at minimum, the number of samples for microbiological testing at frequencies indicated in the latest versions of OPSS.MUNI 441, AWWA C651, MECP Watermain Disinfection Procedure, and the Region's latest standard specifications and drawings. All testing parameters shall be in accordance with the most stringent of the latest version of AWWA C651, MECP Watermain Disinfection Procedure or the Region's minimum testing parameters. All samples for new watermains shall be tested for Total Coliform, Escherichia Coli (E. Coli), Background Colony Counts, and Heterotrophic Plate Count (HPC). Sample results must meet the parameter levels outlined in **Table 3**.

Table 3: Microbiological testing requirements and corrective actions

Microbiological Parameter	Total Coliform	E. Coli	Background Colony Counts	HPC
Standard (Passed Sample)	0 CFU/100ml	0 CFU/100ml	≤ 50 CFU/100ml	≤250 CFU/100ml
Corrective Action for Initial Sample Failure	Swab, Re-chlorinate, Flush and Resample Entire System	Swab, Re-chlorinate, Flush and Resample Entire System	Swab, Flush and Resample Entire System	Swab, Flush and Resample Entire System
Corrective Action for 24-hour Sample Failure	Swab, Re-chlorinate, Flush and Resample Entire System	Swab, Re-chlorinate, Flush and Resample Entire System	Flush and Resample Respective Blow-off	Flush and Resample Respective Blow-off

Samples that do not meet the parameters noted above will result in a failed test. If samples do not pass the first attempt the Vendor or Regional designate shall be responsible to perform additional measures to remove any contamination or objects by method/procedures outlined above and then request that the Region resample. If samples fail on the second attempt, the Vendor will be required to re-submit their procedure for disinfection to include the new requirements recommended by the specialty company. No additional sampling will be performed until the re-submission is accepted by the Region and actions addressed in the methodology are completed.

The Vendor or Regional designate shall provide all temporary sampling points (blow-offs) from the permanent infrastructure to allow sampling by the Region without requiring confined space entry.

References

- OPSS.MUNI 441
- AWWA C651
- MECP Watermain Disinfection Procedure

Submittals

- Microbiological lab test results

3.2.9. Tracer wire continuity

Tracer wire shall be installed, and continuity shall be tested for all non-metallic and concrete pressure pipe installation to confirm that the tracer wire system is intact and effective. Testing procedure, equipment requirements and specifications shall follow the Region's latest standard specifications and drawings.

The tracer wire system shall be tested for functionality at a frequency of 512 Hz consistent with industry standards for new installation. The tracer wire system shall be tested twice by the Vendor to confirm proper functionality prior to testing by the Region.

The first test by the Vendor shall be performed once all tracer wire is installed and extents brought up to the surface before connection to the existing system (Phase 1 Test).

The second test by Vendor shall be performed after completing connections of the new tracer wire to the existing system (Phase 2 Test). The Vendor shall repair any breaks or faults identified, and testing shall be repeated. The Vendor shall produce a signed Tracer Wire Certification Report stating findings and conclusions.

Faults or continuity challenges during testing of the new tracer wire system as part of the aforementioned Phase 1 Test procedure performed by either the Vendor or Region will not be accepted. Faults or continuity challenges during the aforementioned Phase 2 Testing procedure may be accepted at the sole discretion of the Region if results indicate the problem is solely attributed to the existing tracer wire system beyond (not directly at) the newly installed connections.

Prior to commencing testing, the Vendor shall prepare a testing methodology for review and acceptance by the Region.

References

- None

Submittals

- Peel Tracer Wire Continuity Test Form (Appendix F)
- Specialist subcontractor's continuity test report

3.3. Chambers

3.3.1. Visual inspection

All chambers shall be visually inspected to ensure that structures and all components within have been constructed in accordance with the contract documents and the Region's latest standard specifications and drawings. Final visual inspection and signoff shall only be conducted following the complete installation of all structures, process equipment, and appurtenances; and once the watermain has been placed into service. A digital photographic record and documentation of the inspection shall be provided to the Region for approval. The Vendor shall ensure that the inside of the structures are clean and dry such that a full/thorough visual inspection can be completed; as well as provide confined space access, entry, and rescue plans as required for the purposes of inspection. The Vendor shall address any deficiencies and be responsible for re-inspection.

References

- None

Submittals

- Water – Chamber Visual Inventory Form (Appendix G)

3.3.2. Infiltration test

Water infiltration leakage testing shall be completed on all newly installed pre-cast chambers where groundwater level is 750 mm or more above the crown of the pipe within the chamber prior to watermain commissioning. Testing shall be per OPSS.MUNI 407 as modified herein and shall be completed after chamber assembly and backfill. **No visible infiltration will be permitted.**

The Vendor shall be responsible for keeping chambers dry for 48 hrs prior to inspection. All visible leaks shall be repaired by the Vendor though methods approved by the Region and re-inspected at no additional costs. Vendor shall provide confined space access as required for inspections.

Prior to commencing testing, the Vendor shall prepare and provide the testing methodology for review and acceptance by the Region.

References

- OPSS.MUNI 407

Submittals

- Water Chamber Leakage Test Form (Appendix H)

3.3.3. Exfiltration test

Water exfiltration leakage testing shall be completed on all newly installed pre-cast chambers where groundwater level is lower than 750mm above the crown of the pipe within the chamber prior to watermain commissioning. Standard testing procedure, equipment requirements and specifications for testing pre-cast chambers shall follow OPSS.MUNI 407 and as modified herein. Pre-cast chambers shall be filled full of water and the distance the surface of water drops over the one (1)-hour test period measured. **Leakage shall not exceed a rate of three (3) litres/hour/meter of water depth.** Structures failing the test shall be repaired and retested, as required, until the test results are within the limits specified.

Cast-in-place structures shall be tested in accordance with ACI 350-01 prior to watermain commissioning. Cast-in-place chambers shall be filled full of water and the distance the surface of the water drops over the test period measured. **Allowable leakage shall not exceed 0.0125% of chamber volume per day.** Test duration shall be at least the theoretical time required to lower the water surface 10mm, assuming a loss of water at the maximum allowable rate. The Region may waive

exfiltration testing requirements, at its sole discretion if the structure was designed in accordance with ACI 350-06.

Where exfiltration testing is undertaken in structures with electrical and instrumentation components, all such components shall be rated for corresponding submergence, or shall be installed after exfiltration testing is completed.

All visible leaks shall be repaired regardless of test results through methods approved by the Region.

Prior to commencing testing, the Vendor shall prepare and provide the testing methodology for review and acceptance by the Region.

References

- OPSS.MUNI 407
- ACI 305-01
- ACI 350-06

Submittals

- Water Chamber Leakage Test Form (Appendix H)

4. Wastewater

4.1. General

All new constructed wastewater infrastructure shall be commissioned and pass all tests as outlined in the document herein. The Vendor shall complete any pre-commissioning start-ups/checks prior to commencing commissioning activities. Testing and acceptance shall be performed under the observation of Regional Water and Wastewater Staff or their designates; and shall be completed prior to placing infrastructure into service. Refer to **Table 4** and **Table 5** for summary of test requirements and sequencing by asset type. Test details are provided below.

- Non-pressure
  - Non-Pressure Design 200mm – 525mm (pipe and chamber): Hydrostatic pressure **testing not required** for pipe or chamber. Pipe and chamber joints shall be designed to withstand 13psi min pressure rating. Testing requirement details as per Linear Infrastructure Testing and Acceptance Manual for Water and Wastewater Assets.
- Medium-pressure
  - Medium Pressure Design 600mm – 1200mm (pipe only/ chamber non-pressure): Hydrostatic pressure **testing not required** for pipe or chamber. Pipe joints shall be designed to withstand 30psi min pressure rating. Pipe to chamber joints shall be designed to withstand 13psi min pressure rating. Testing requirement details as per Linear Infrastructure Testing and Acceptance Manual for Water and Wastewater Assets.
- Full-pressure
  - Full Pressure Design 600mm and above (pipe and chamber): Hydrostatic pressure **testing required** for pipe or chamber. Pipe and chamber joints shall be designed to withstand 50psi min at the spring line of the pipe

Note: Refer to Peel Linear Wastewater Standards for pressure design classification and additional details needed for correct design implementation.

Table 4: Wastewater pipeline acceptance test applicability

Asset		Acceptance Test									
Class	Type	Cleaning & Flushing	CCTV Inspection	Infiltration	Exfiltration	Low Pressure Air[4]	Hydrostatic Pressure Test	Flow Control Gate Leakage Test	Mandrel Test	Valve Testing	Tracer Wire
	Document Reference	4.2.1	4.2.2	4.2.3	4.2.4	4.2.5	4.2.6[1,3] 4.3.3[2]	4.2.7	4.2.8	4.3.4	4.3.5
Non -Pressure Gravity[3]	Polyvinyl Chloride (PVC), or High Density Polyethylene (HDPE) 200mm to 525mm	yes	yes	yes	yes	yes		yes	yes		
	Reinforced Concrete Pipe (RCP) 300mm to 525mm	yes	yes	yes	yes			yes			
	Fiberglass Pipe (FRP) 200mm to 525mm	yes	yes	yes	yes			yes			
Medium -Pressure Gravity[3]	Polyvinyl Chloride (PVC[6]) Polyvinyl Chloride (PVCO[5]), or High Density Polyethylene (HDPE) 600mm to 1200mm	yes	yes	yes	yes			yes	yes		
	Concrete Pressure Pipe (PCCP-AWWA C30*X*) 600mm to 1200mm	yes	yes	yes	yes			yes			
	Concrete HDPE Composite 600mm to 1200mm	yes	yes	yes	yes			yes			
	Fiberglass Pipe (FRP) 600mm to 1200mm	yes	yes	yes	yes			yes			

Asset		Acceptance Test									
Class	Type	Cleaning & Flushing	CCTV Inspection	Infiltration	Exfiltration	Low Pressure Air[4]	Hydrostatic Pressure Test	Flow Control Gate Leakage Test	Mandrel Test	Valve Testing	Tracer Wire
	Document Reference	4.2.1	4.2.2	4.2.3	4.2.4	4.2.5	4.2.6[1,3] 4.3.3[2]	4.2.7	4.2.8	4.3.4	4.3.5
	Reinforced Concrete Pipe (RCP) 600mm to 1200mm	yes	yes	yes	yes			yes			
Full-Pressure Gravity[3]	Concrete Pressure Pipe 600mm and greater	yes	yes				yes	yes			
	Fiberglass Pipe (FRP)600mm and greater	yes	yes				yes	yes			
Forcemain[3]	Polyvinyl Chloride (PVC) or High Density Polyethylene (HDPE) 100mm to 525mm	yes	yes				yes			yes	yes
	Concrete Pressure Pipe (PCCP-AWWA C30*X*) 600mm and greater	yes	yes				yes			yes	yes

[1] Hydrostatic Pressure Test for PCCP Gravity Sewer
[2] Hydrostatic Pressure Test for Wastewater Forcemain; including testing of all valves on forcemain
[3] Alternative pipe materials shall be tested according to project-specific requirements and manufacturers specifications
[4] Low pressure air testing shall only be permitted on flexible pipes equal to or less than 300mm in diameter and at the Region's discretion
[5] PVCO allowable for medium- pressure in 600mm only
[6] PVC allowable for medium-pressure 600mm – 900mm only

Table 5: Wastewater maintenance holes and chamber acceptance test applicability

Asset		Acceptance Test			
Class	Type	Visual Inspection	Chamber Exfiltration[1]	Chamber Infiltration[1]	Hydrostatic Pressure Test
	Document Reference	4.4.1	4.4.2	4.4.3	4.4.4
Maintenance Holes and Chambers	Non-pressure Design Pre-Cast (Peel 2-5 standard drawing series) or Cast-in-Place Concrete Maintenance Holes	yes	yes	yes	
	Medium-pressure Design Pre-Cast (Peel 2-5 standard drawing series) or Cast-In-Place Concrete Maintenance Holes	yes	yes	yes	
	Full-pressure Design Maintenance Holes or Chambers (Peel 2-7 Standard Drawing Series)	yes			yes
	Vortex and other Specialized Structures (test based on type of structure design)				
	Pre-Cast Concrete Chambers (Forcemains)	yes	yes	yes	
	Cast-In-Place Concrete Chambers (Forcemains)	yes	yes	yes	

[1] Complete either an exfiltration or an infiltration test for pre-cast chambers depending on the site-specific groundwater levels.

4.2. Gravity sewer

4.2.1. Cleaning and flushing

All newly installed sanitary sewer pipes shall be cleaned and flushed using a combination hydro-jet cleaner. Standard procedures, equipment requirements and specifications shall follow OPSS.MUNI 411 and the Region's latest standard specifications.

Cleaning equipment shall be capable of removing foreign materials and obstructions from the sewers and maintenance holes. Source water shall be clean and free from oil, acid, alkali, organic matter, or other deleterious substances. Cleaning and flushing shall commence at the upstream end of pipe sewer system and progress to the downstream end. The passage of debris from one section of sanitary sewer pipe to another shall not permitted. Cleaning and flushing shall continue for each section of sanitary sewer pipe until no further debris is flushed from the pipe, and the sewer section is free of impediments to flow. A minimum of 95% of the sanitary sewer pipe circumference shall be clean and free of debris. All materials generated are the responsibility of the Vendor and shall be removed from the sanitary sewer system and disposed of in a manner consistent with all applicable acts, regulations, and Region requirements.

During cleaning operations, satisfactory precautions shall be taken to ensure water flow volumes and pressures shall not cause damage to the sanitary sewer system, pipes, service connections, or result in flooding of private or public property. Water flow volumes and pressures shall be appropriate for the material and design of the sewer system pipes being flushed. Maximum allowable water pressure is 11,000 kPa to prevent damage to new sewer infrastructure. Where new sewers are connected to existing services and piping, it may be necessary to reduce pressures to less than 7,000 kPa to prevent water damage to homes.

Proposed cleaning method and procedures, including management of discharge water and debris shall be submitted by the Vendor for approval by the Region.

References

- OPSS.MUNI 411
- NASSCO -Sewer Cleaning Specification Guide
- Peel Wastewater Linear Design Standards

Submittals

- Proposed cleaning methods and procedures
- Non-Pressure Designed Sanitary Sewer Inspection Form (Appendix I)

4.2.2. CCTV

CCTV inspections shall be carried out on all sanitary sewer pipes by the Vendor as per the contract documents and the specifications outlined in Peel's CCTV specifications. GraniteNet CCTV Inspection System, Version 5.8 (using MSSQLExpress version 2022) shall be used to perform all inspections.

References

- CCTV Inspection and Flushing Specifications for Sewers and MHs May 20, 2025
- Peel Wastewater Linear Design Standards

Submittals

- CCTV Inspection Plan
- Interim CCTV Footage for Review
- Final Video and Reporting
- Non-Pressure Designed Sanitary Sewer Inspection Form (Appendix I)

4.2.3. Infiltration test

All newly constructed non-pressure (200mm-525mm) and medium-pressure (600mm-1200mm) designed mainline sanitary sewer pipes and service connections (plugged watertight at property line prior to service switchover) shall be inspected and tested for water tightness. An infiltration test shall be conducted on all sewer pipes where groundwater level is 750mm or more above the pipe crown for the entire length of the test section. Testing procedures, equipment requirements, and specifications shall follow OPSS.MUNI 410 and the Region's latest standard specifications and drawings.

Discontinue dewatering operations at least three (3) days before conducting the test to allow for groundwater levels to stabilize. A V-notch weir or other suitable device shall be installed at the downstream end of the test section. The upstream end of the test section and all service laterals, stubs and fittings shall be plugged. Infiltrating water shall be allowed to build up behind the weir until the flow through the V-notch has stabilized. Several tests (minimum three (3)) at 15-30 minutes intervals shall be performed to ensure that the flow through the weir is steady and not changing. **The**

rate of infiltration shall not exceed 0.075 litres/millimeter diameter/100 metres of sewer pipe/hour. There shall be no visible infiltration from maintenance holes included within the test section permitted.

Where unsatisfactory test results are achieved, pipe sewer test sections shall be repaired and retested at Vendor's expense.

Prior to commencing testing, the Vendor shall prepare and provide the testing methodology for review and acceptance by the Region.

References

- OPSS.MUNI 410
- Peel Linear Wastewater Standards

Submittals

- Non-Pressure Designed Sanitary Sewer Inspection Form (Appendix I)

4.2.4. Exfiltration test

All newly constructed non-pressure (200mm-525mm) and medium-pressure (600mm-1200mm) designed mainline sanitary sewers pipes and service connections shall be inspected and tested for water tightness. A water exfiltration test shall be conducted on all sewer pipes where groundwater level is less than 750mm below the pipe crown for the entire length of the test section. Testing procedures, equipment requirements and specifications shall follow OPSS.MUNI 410 and the Region's latest standard specifications.

Water shall be added to the pipeline until water level in the upstream manholes within the test section is minimum 750mm over the crown of the highest pipe section or at least 750mm above the existing groundwater level, whichever greater. Source water shall be clean and free from oil, acid, alkali, organic matter, or other deleterious substances. Maximum head at any point in the test section is eight meters. An absorption period of 24 hours shall be allowed prior to starting the test. After one (1) hour of testing, the distance from the frame to the surface of the water shall be measured and leakage calculated. **The maximum allowable leakage shall not be in excess of 0.075 litres/millimeter diameter /100 metres of pipe sewer/hour. An allowance of three (3) litres/hour/meter/ head above the invert for each maintenance hole included in the test section shall be given.** All pipe sewer test sections shall be repaired and retested, as required, where unsatisfactory test results are achieved.

Prior to commencing testing, the Vendor shall prepare and provide the testing methodology for review and acceptance by the Region.

References

- OPSS.MUNI 410
- Peel Linear Wastewater Standards

Submittals

- Non-Pressure Designed Sanitary Sewer Inspection Form (Appendix I)

4.2.5. Low pressure air

The Region may allow or require testing by use of low pressure air where water is not readily available (or during seasonal restrictions), or the differential head in the test section is greater than 8.0 m, or freezing temperatures exist. This does not preclude the need for a water test, in accordance with OPSS.MUNI 410.

Testing with low pressure air will only be considered for PVC, PVCO and HDPE pipe installations up to 300 mm.

For Non-Pressure design classification and Medium-Pressure design classification pipes up to 300 mm, air testing shall be in accordance with OPSS 410 and ASTM F1417. Ground water must be below the crown of the pipe. The Contractor is responsible for ensuring that the test is conducted in a safe manner and that no one be inside a maintenance hole while testing is completed.

Tests shall be completed between two consecutive maintenance holes or to a stub end where the sewer does not terminate with a maintenance hole. All laterals and cleanouts are to be sealed prior to test.

Air testing will not be allowed in maintenance holes or chambers.

References

- OPSS.MUNI 410 and ASTM F1417-11
- Peel Linear Wastewater Standards

Submittals

- Non-Pressure Designed Sanitary Sewer Inspection Form (Appendix I)

4.2.6. Hydrostatic pressure test

All new full-pressure designed gravity sewers, 600mm diameter and above, shall be hydrostatically pressure tested for a duration of two (2) hours at a minimum pressure of 345kPa (50psi) at the centerline of pipe at the highest invert point of the section being tested. Standard testing procedure, equipment requirements, and specifications shall be in accordance with AWWA M9 and Region's latest standard specifications and drawings. Test sections shall be filled with water and air removed from the pipeline. Source water shall be clean and free from oil, acid, alkali, organic matter, or other deleterious substances. A 24 hour absorption period may be permitted before commencing the test, with makeup water being added to refill the line. Allowable makeup water volumes are listed in **Table 6**.

Table 6: Make-up water allowance for hydrostatic pressure testing of pressure-designed gravity sewer

Pipe Material	Make-Up Water Allowance for Hydrostatic Pressure Test
ANSI/AWWA C300, C301, C303	1 L/mm dia./km pipe/24hr
ANSI/AWWA C302	4.6 L/mm dia./km pipe/24hr

The AWWA M9 test procedure shall be strictly followed with make-up water added only at the end of the test period. Gradual or intermittent additional of make-up water during the test period shall not be permitted. The pressure test shall be restarted each time makeup water is added during the two-hour testing period. No leakage will be permitted. Pipe sections where leakage is in excess of the allowable makeup allowance will indicate a failure. All leaks shall be located and repaired, and the test section shall be retested until satisfactory results are obtained. The Vendor shall be responsible for providing equipment for testing.

Prior to commencing testing, the Vendor shall provide the testing methodology including the location and breakpoints of all tests for review and acceptance by the Region.

References

- AWWA M9
- Peel Linear Wastewater Standards

Submittals

- Test Report for Pressure Designed Sanitary Sewer (Appendix J)

4.2.7. Open channel flow control gate leakage test

All newly installed open channel flow control gate devices including but not limited to slide, sluice, stop and weir gates (devices) shall be field tested to demonstrate proper operation and leak tight seal. Standard testing procedure, equipment requirements and specifications shall be in accordance with AWWA C513, C560, C561, contract documents, the manufacturer's recommendations and Region's latest standard specifications. Vendor shall provide the services of a factory-trained representative to inspect, operate, test, and adjust as required the newly installed devices. The Vendor shall submit field report describing, in detail, the inspection undertaken, verification of installation, and any field adjustments made.

Undertake a gate leakage test at design head pressure (per the contract documents) using water. Source water shall be clean and free from oil, acid, alkali, organic matter, or other deleterious substances. **Allowable leakage shall not exceed 1.24 L/min/m of seating perimeter.** Any evidence of excessive leakage beyond the allowable rate indicates failure. Devices shall be adjusted or repaired and retested, as required, until satisfactory test results are achieved.

Prior to commencing testing, the Vendor shall provide the testing methodology for review and acceptance by the Region.

References

- AWWA C513
- AWWA C560
- AWWA C561
- Peel Linear Wastewater Standards

Submittals

- Non-Pressure Designed Sanitary Sewer Inspection Form (Appendix I)

4.2.8. Mandrel deflection/ovality testing

Mandrel deflection/ Ovality testing shall be carried out on all newly constructed flexible sewer pipes. Standard practice for testing, equipment requirements, and specifications shall follow OPSS.MUNI 438, OPSS.MUNI 410, and the Region's latest standard specifications and drawings.

Allowable deflection/ ovality per pipe diameter is as follows:

- **For pipes 100mm to 525mm in diameter: 7.5% of the base inside diameter of the pipe.**
- **For pipes greater than 525mm in diameter: 5.0% of the base inside diameter of the pipe.**

The mandrel test equipment shall be circular in shape and equipped with an odd number of evenly spaced arms or prongs (minimum nine (9)). Contact length of the mandrel shall be no less than outlined in OPSS.MUNI 410. The mandrel shall be checked with a "go-no-go" proving ring with a diameter equal to the allowable deflection/ ovality per pipe diameter +/- 0.1mm prior to testing. Any section of pipe that does not allow the mandrel to pass shall be considered to have failed the deflection test. All sections of pipe that fail the deflection test shall be repaired and retested; re-rounding of the installed will not be accepted.

References

- OPSS.MUNI 438
- OPSS.MUNI 410
- Peel Linear Wastewater Standards

Submittals

- Non-Pressure Designed Sanitary Sewer Inspection Form (Appendix I)

4.2.9. Lined gravity pipes (under development)

This section is under development and will be incorporated into a future version of this document.

4.2.10. Alternative pipe materials (under development)

This section is under development and will be incorporated into a future version of this document.

4.3. Forcemain

4.3.1. Cleaning and flushing

All newly installed forcemains shall be flushed and thoroughly cleaned with water to remove dirt and debris prior to pressure testing. Standard testing procedure, equipment requirements, and specifications shall be in accordance with OPSS.MUNI

412, the Region's latest standard specifications and drawings, and the contract documents.

Forcemains shall be flushed at a minimum velocity of one (1) m/s until discharge is clear of visible debris or colour. The Vendor shall provide all equipment and water required (including required permitting) for this operation. Source water shall be clean and free from oil, acid, alkali, organic matter, or other deleterious substances. All materials generated from cleaning are the responsibility of the Vendor to dispose of in a manner consistent with all applicable acts, regulations and Region of Peel Requirements.

Sequencing and methodology for flushing shall be included as part of the site-specific testing and commissioning plan.

References

- OPSS.MUNI 412
- Peel Linear Wastewater Standards

Submittals

- Wastewater Forcemain Inspection Form (Appendix K)

4.3.2. CCTV

All new forcemains 600mm diameter and above shall be inspected by CCTV following pipe flushing and pressure testing to visually confirm pipe condition, cleanliness and readiness for commissioning. CCTV inspection shall be carried out in accordance with contract documents and requirements outlined in Peel's CCTV specifications, and as noted herein.

The camera utilized shall be suitable for size, material, and design of pipeline to be inspected and able to view full circumference of internal pipe joints. CCTV inspection shall be completed following complete installation of the forcemain. The Vendor shall be responsible to ensure entire length of new forcemain is inspected, with consideration for access requirements for inspection equipment and range limitations. The Vendor shall provide a CCTV inspection plan for review prior to installation of any sanitary sewer forcemain. The plan shall identify any segments that cannot be inspected by CCTV methods from proposed permanent access points (such as valve chambers and drain chambers) due to vertical or horizontal pipe deflections or other considerations. The Vendor's CCTV Plan shall outline an approach to ensure that the entire length of the new forcemain is inspected by CCTV

or provide industry acceptable alternative inspection methodology for sections not able to be inspected by available CCTV methodologies.

All equipment for inspection and deliverables shall meet requirements set out in the Peel CCTV specifications and any project specific SPs. CCTV video files and reports shall be in compliance with NASSCO and other noted Peel requirements, and fully compatible with the Region's utilized GraniteNet Software Platform

CCTV footage and inspection report must be provided to the Regional Representative or their designate for review. Allow minimum 72hrs for CCTV review. Any issues identified by the CCTV inspection must be addressed by the Vendor and additional CCTV inspection shall be completed to confirm resolution of any observed issues or deficiencies prior to this pipe becoming inaccessible due to vertical or horizontal pipe deflections or other considerations. Written approval from the Region or their Designate following review of the CCTV reports must be received prior to pressure testing and commissioning the forcemain. If the CCTV investigation shows evidence of dirt or debris in the forcemain beyond acceptability of the Region, the Vendor will be required to conduct additional cleaning and CCTV investigations, both at no additional cost to the Region until the Regional or their Designated Representative are satisfied with the cleanliness of the forcemain.

References

- CCTV Inspection and Flushing Specifications for Sewers and MHs
- NASSCO

Submittals

- CCTV Inspection Plan
- Interim CCTV Footage for Review
- Final Video and Reporting
- Wastewater Forcemain Inspection Form (Appendix K)

4.3.3. Hydrostatic pressure test

All newly installed forcemains shall be hydrostatically pressure tested at 1.5 times the operating line pressure at the highest pipe invert point of the test section for a duration of two (2) hours or as specified in the contract documents. Standard testing procedure, equipment requirements and specifications shall be in accordance with the procedures outlined in OPSS.MUNI 412, OPSS.MUNI 441, AWWA M9, and the Region latest specifications and drawings and the contract documents.

For the hydrostatic pressure test, fill the test section slowly with water making sure that all air is removed from the pipeline. Source water shall be clean and free from oil, acid, alkali, organic matter, or other deleterious substances. A period of 24 hours shall be allowed before starting the test (except for PVC pipe). Allowable make-up water and pressure drop during the test are listed in **Table 7**.

Table 7: Make-up water allowance and allowable pressure drop for hydrostatic pressure testing of wastewater forcemains

Pipe Material	Makeup Water Allowance for Hydrostatic Pressure Test (litre/km)	Allowable Pressure Drop (psi)
PVC, PVCO	Zero	Zero
PCCP (AWWA C301 and C303)	Zero	Zero
HDPE	Per OPSS.MUNI 441 – Table 1	–

Where make-up water is permitted (i.e. for HDPE pipe), test procedure shall be strictly followed with make-up water added only at the end of the test period. Gradual or intermittent additional of make-up water during the test period shall not be permitted.

Vendor to ensure that the entire system being tested is at the minimum test pressure, and that the maximum pressure at any point along the test section does not exceed the pressure rating of the pipe and associated appurtenances. If hydrostatic pressure test fails, the Vendor will be required to repair all deficient parts of section and retest until satisfactory results are attained. Supply, install and remove all valves, fittings, appurtenances, etc. required for pressure testing.

Test sequencing and methodology shall be included as part of the site-specific testing and commissioning plan.

References

- OPSS.MUNI 412
- OPSS.MUNI 441
- AWWA M9
- Peel Linear Wastewater Standards

Submittals

- Wastewater Forcemain Inspection Form (Appendix K)

4.3.4. Valve testing

All forcemain valves shall be inspected for proper installation and operation; and hydrostatically pressure tested to demonstrate a leak tight seal per the Region's latest standard specifications and drawings and the manufacturers recommendations.

Vendor shall ensure that all valves including small diameter chamber and speciality valves are installed prior to field inspection and pressure testing. Vendor shall provide the services of a factory-trained representative to inspect, operate, test, and adjust as required, the newly installed valves; and submit a field report verifying the installation and outlining, in detail, the inspection undertaken and adjustments made.

All forcemain valves shall be pressure tested at forcemain test pressure to demonstrate a leak-tight seal. All mainline isolation valves shall be tested from both sides at full test pressure for minimum 15 minutes and demonstrate zero (0) pressure drop. Leak testing of valves may be combined with pipe hydrostatic pressure testing.

Details of inspection and a sequence for testing of valves shall be included in the site-specific testing and commissioning plan.

References

- Specific Requirements included within Contract Documents

Submittals

- Wastewater Forcemain Inspection Form (Appendix K)

4.3.5. Tracer wire

Tracer wire shall be installed, and its continuity shall be tested, for all non-metallic and concrete pressure pipe installation to confirm that the tracer wire system is intact and effective. Testing procedure, equipment requirements and specifications shall follow the Region's latest standard specifications and drawings.

The tracer wire system shall be tested for functionality at a frequency of 512 Hz consistent with industry standards for new installation. The tracer wire system shall be tested twice by the Vendor to confirm proper functionality prior to testing by the Region.

The first test by the Vendor shall be performed once all tracer wire is installed and extents brought up to the surface before connection to the existing system (Phase 1 Test).

The second test by Vendor shall be performed after completing connections of the new tracer wire to the existing system (Phase 2 Test). The Vendor shall repair any breaks or faults identified, and testing shall be repeated. The Vendor shall produce and a signed Tracer Wire Certification Report standing findings and conclusions.

Faults or continuity challenges during testing of the new tracer wire system as part of the aforementioned Phase 1 Test procedure performed by either the Vendor or Region will not be accepted. Faults or continuity challenges during the aforementioned Phase 2 Testing procedure may be accepted at the sole discretion of the Region if results indicate the problem is solely attributed to the existing tracer wire system beyond (not directly at) the newly installed connections.

Prior to commencing testing, the Vendor shall prepare a testing methodology for review and acceptance by the Region.

References

- Contract Documents

Submittals

- Specialist Continuity Test Report
- Tracer Wire Continuity Form (Appendix F)
- Wastewater Forcemain Inspection Form (Appendix K)

4.4. Maintenance holes and chambers

4.4.1. Visual Inspection

All maintenance holes and chambers shall be visually inspected to ensure that structures and all components within have been constructed in accordance with the contract documents and the Region's latest standard specifications and standard drawings. Final visual inspection shall only be conducted following the installation and waterproofing of the chambers and the complete installation of all structures, process equipment, and appurtenances within. Standard testing procedure, equipment requirements and specifications shall be in accordance with the procedures outlined in OPSS.MUNI 432, OPSS.MUNI 434, OPSS.MUNI 435, Peel Linear Wastewater Standards, latest Region standard specifications and drawings, and the contract documents. Visually inspect Vortex or other Specialized Structures installed within maintenance holes as required per the manufacturer's guidelines and recommendations to confirm installation and operation.

A digital photographic record and documentation of the inspection shall be provided to the Region. The Vendor shall ensure that the inside of the structures are clean and dry such that the Region can complete a full visual inspection; as well as provide confined space access and rescue plans as required for the purposes of inspection. The Vendor shall address any deficiencies identified and be responsible for re-inspection.

References

- OPSS.MUNI 432
- OPSS.MUNI 434
- OPSS.MUNI 435
- Peel Linear Wastewater Standards

Submittals

- Wastewater – Maintenance Hole Inventory (Appendix L)

4.4.2. Exfiltration test

As noted in Table 5, all applicable newly installed maintenance holes and chambers shall be tested for leakage through exfiltration water testing after assembly and backfill where groundwater level is lower than 750mm above the crown of the pipe of the section begin tested. Maintenance hole structures shall be tested in conjunction with required testing of newly installed non-pressure and medium pressure design gravity pipe systems per outlined in Section 4.2.4 when/where applicable. Testing practices, equipment, and specifications shall follow OPSS.MUNI 407 and Peel Linear Wastewater Standards. Cast-in-place structures shall be tested in accordance with ACI 350-01 and Peel Linear Wastewater Standards.

For testing of pre-cast maintenance holes and chambers, plug all opening and fill structures with water. After 1 hour has elapsed, the distance the surface of the water has dropped shall be measured and the rate of leakage calculated. **Leakage shall not exceed a rate of three litres/hour/meter of head above lowest pipe invert.** Structures failing the test shall be repaired and retested, as required, until the test results are within the limits specified.

Cast-in-place chamber shall be filled with water and distance the surface of the water drops over the test period measured. **Allowable leakage shall not exceed 0.0125% of storage volume per day.** The test period shall be at least the theoretical time required to lower the water surface 10mm, assuming a loss of water

at the maximum allowable rate. The Region may waive exfiltration testing requirements, at its sole discretion if the structure was designed in accordance with ACI 350-06.

All visible leaks shall be repaired regardless of test results through methods approved by the Region.

Prior to commencing testing, the Vendor shall prepare and provide the testing methodology for review and acceptance by the Region.

References

- OPSS.MUNI 407
- ACI 350-06
- Peel Linear Wastewater Standards

Submittals

- Wastewater Structure Leakage Test Form (Appendix M)

4.4.3. Infiltration test

As noted in Table 5, all applicable newly installed maintenance holes and chambers shall be tested for leakage through a water infiltration test when groundwater level is greater than 750mm above the crown of the pipe of the test section. Maintenance hole structures shall be tested in conjunction with required leakage testing of newly installed non-pressure and medium-pressure design gravity pipe systems per outlined in Section 4.2.3 when/where applicable. Testing practices, equipment, and specifications shall follow OPSS.MUNI 407 and Peel Linear Wastewater Standards. No visible infiltration will be permitted. The Vendor shall be responsible for and keeping chambers dry 48hrs prior to inspection. All visible leaks shall be repaired by the Vendor though methods approved by the Region and re-inspected. Vendor shall provide confined space access and rescue plans as required for inspections.

Prior to commencing testing, the Vendor shall prepare and provide the testing methodology for review and acceptance by the Region.

References

- OPSS.MUNI 407
- Peel Linear Wastewater Standards

Submittals

- Wastewater Structure Leakage Test Form (Appendix M)

4.4.4. Hydrostatic pressure test

Newly installed pressure designed maintenance holes (Peel Standard Drawing 2-7 series) shall be hydrostatically pressure tested for a duration of 2hrs at a minimum pressure of 345kPa (50psi). Maintenance hole structures shall be tested in conjunction with the pressure design gravity pipe system per the hydrostatic testing guidelines for C30X gravity pipe outlined in Section 4.2.6. and as noted in Peel Standard Drawing 2-7 series.

References

- AWWA M9
- Peel Linear Wastewater Standards

Submittals

- Test Report for Pressure Designed Sanitary Sewer (Appendix J)
- Wastewater Structure Leakage Test Form (Appendix M)

5. Rehabilitation (under development)

This section is under development and will be incorporated into a future version of this document.

6. Asset condition baselines (under development)

This section is under development and will be incorporated into a future version of this document.

Appendices

Refer to links provided on the Peel Region Design, standards specification and procedures webpage.

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