



PROVIDING MORE

Commissioning Plan Guidelines

Prepared by: EPCOR Water Services (EWS)
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Introduction

This document reviews the specific technical requirements to support the development of commissioning plans. This will detail requirements for flushing, hydrostatic and disinfection plans in conjunction with submission of a project overall plan. Other items that should be captured in the commissioning procedure include, foam pigging, temporary infrastructure, and variance requests. Requirements outlined within this document are used to determine acceptance of commissioning plans by EWS.

Note to Contractors

Please be aware of the contractor quick guide (2-pages) located in Appendix A. This quick guide includes process flow diagrams, table of minor/major changes, and additional notes from EWS. It is highly recommended that these two pages be printed off and stored onsite with the commissioning plan for ease of reference.



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Revision Table

Revision History			
Date	Content Providers	Revisions to Document	Content Approvers
Jan. 25, 2024	Alexander Wright, Joshua Frye	For review	Amanda McEachern, Jeff Hunter, Steven Tran

References:

AWWA C651-14 Disinfecting Water Mains. (2015). American Water Works Association.

City of Edmonton Design and Construction Standards Volume 4 Water: Section 8 Acceptance Testing

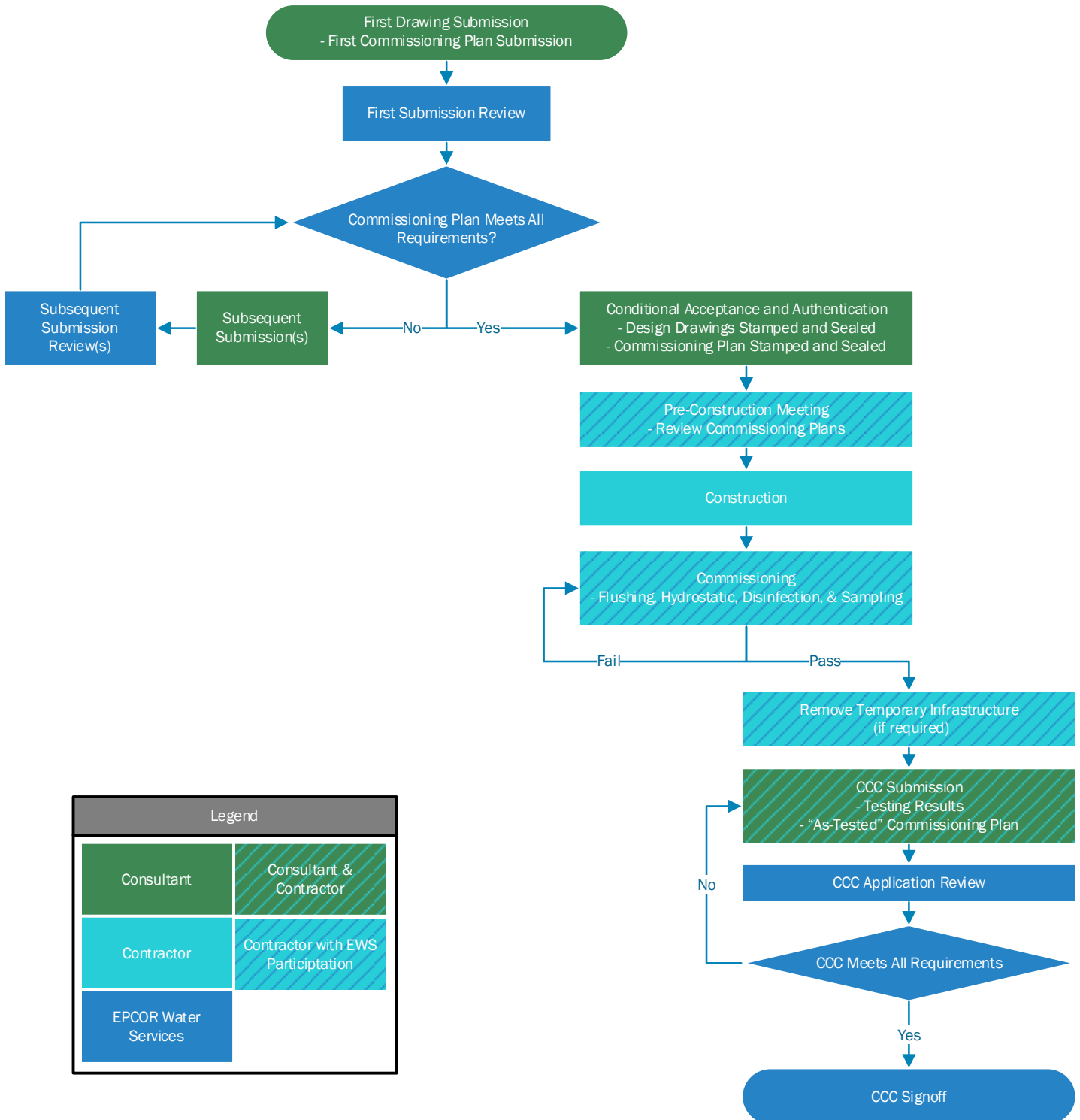
Process Overview

Development of a commissioning plan during the project planning and design phases ensures that the proposed infrastructure can be effectively commissioned after construction. Benefits of early planning range from ensuring that the required appurtenances for commissioning are present in the design to optimizing the configuration of the system to maximize water quality while minimizing ongoing maintenance costs.

All commissioning plans are required to be submitted to and reviewed by EWS prior to any commissioning activities occurring. Note, any activity not accepted by EWS is at the Developer's own risk and may be subject to additional (re)testing. EWS is committed to working with the designers to provide relevant feedback and for each commissioning plan, with the intent to minimize the number of submissions before granting conditional acceptance.

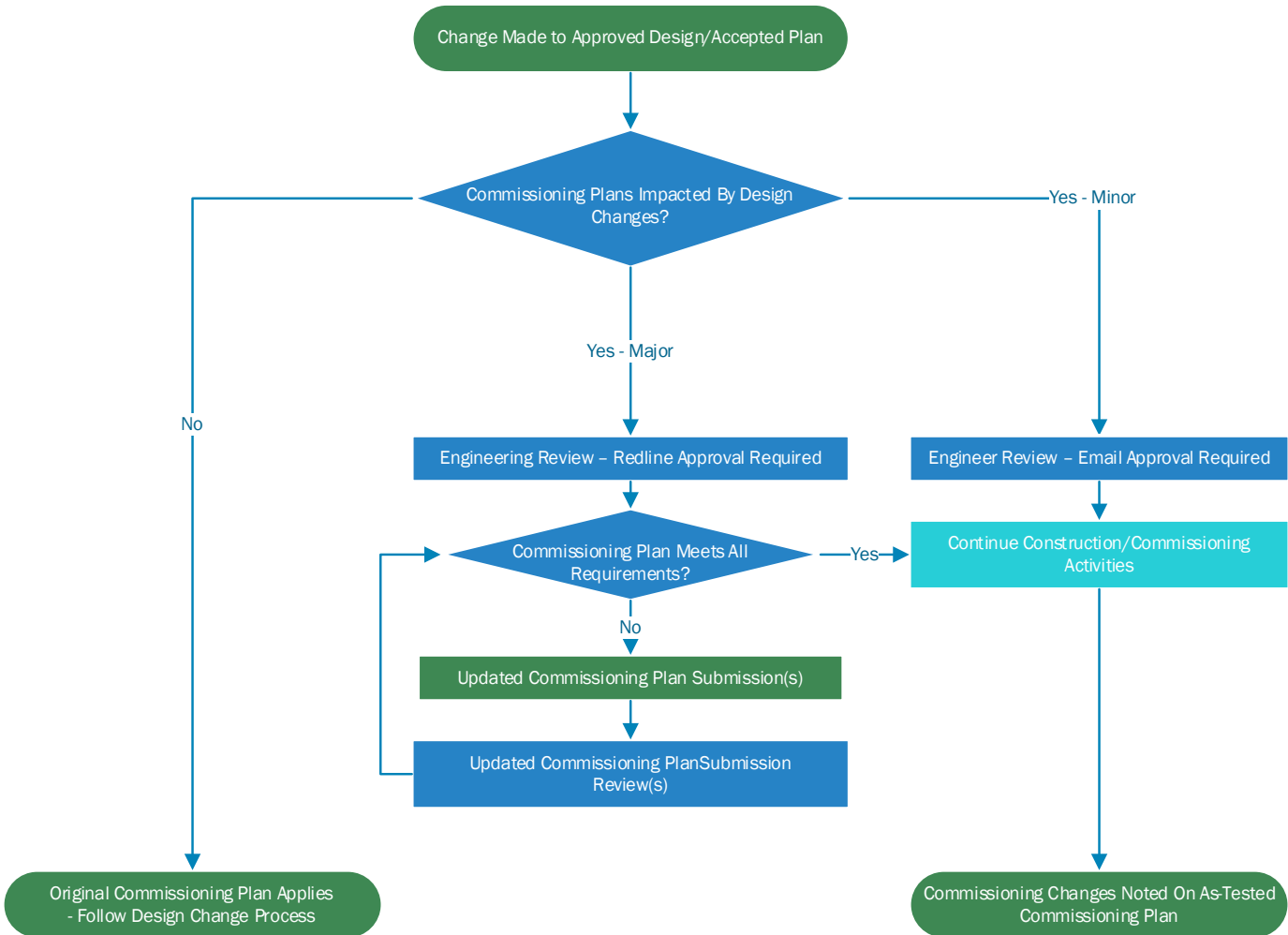
Diagrams on the following pages outline the process for the development, review, and changes to the commissioning plans. Note, these diagrams only present the steps required with respect to the development of the commissioning plans. Additional steps and deliverables are required for design drawing approval, CCC issuance, etc...

An overview of the commissioning process is included below from initial design and plan development, through construction/commissioning, to closeout:

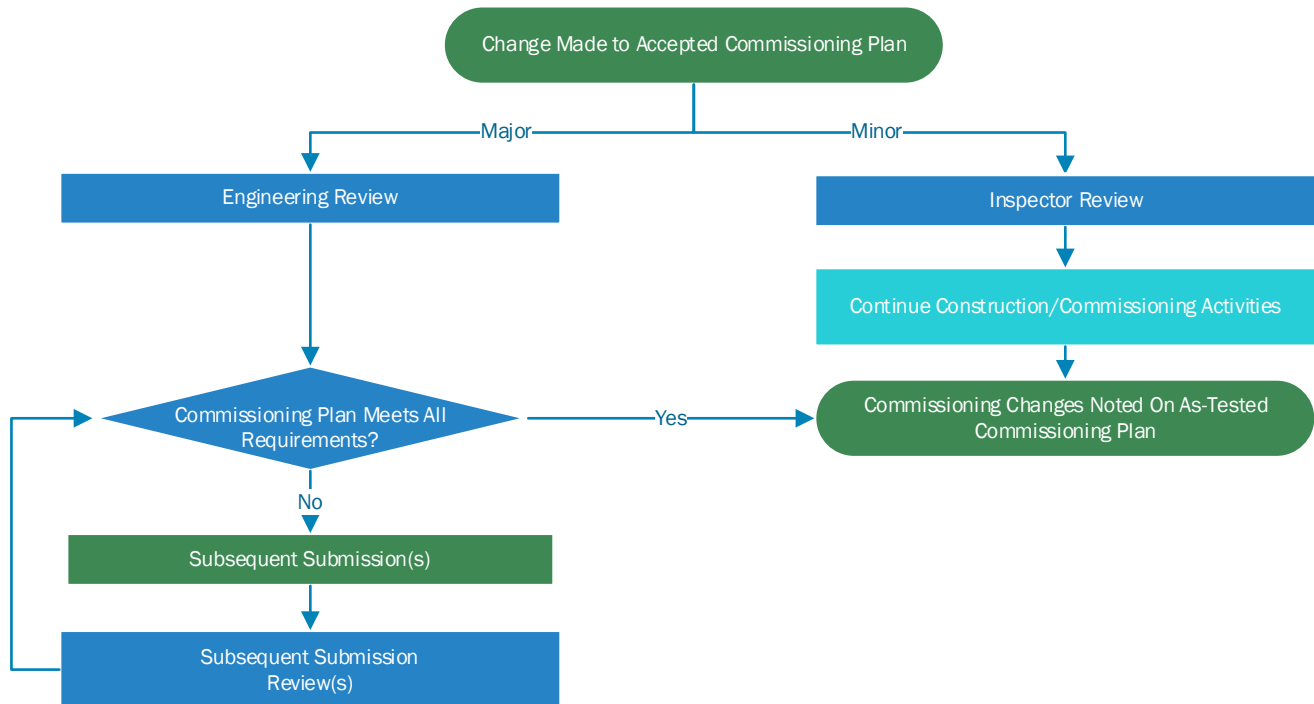


Legend	
Consultant	Consultant & Contractor
Contractor	Contractor with EWS Participation
EPCOR Water Services	

The following diagram depicts the steps if changes occur during the construction/commissioning stage. If changes are made to the proposed design drawings (including redlines), changes to previously accepted commissioning plans may be required. Changes shall be requested in writing for EWS review and acceptance. The impact of redlines on the commissioning plan will be evaluated by EWS in conjunction with the redline review. EWS will advise if revisions to the commissioning plan are required as a condition of redline approval. Definitions of major and minor changes can be found in the following section.



The following diagram depicts the steps if changes occur during the construction/commissioning stage. If changes are made from the approved design and/or commissioning plans (including redlines), changes to previously accepted commissioning plans may be required. Definitions of major and minor changes can be found in the following section. Changes shall be requested in writing for EWS review and acceptance prior to conducting the proposed work. Contractors shall inform Consultants before contacting EWS:





Major vs. Minor Changes

Changes to the design that impact the commissioning plans are separated into minor and major changes:

Minor Changes – Low risk changes, requires email acceptance by EWS Engineering (or EWS inspector if in field), changes to be documented in the “As-Tested” documentation, intended to provide more flexibility to field staff while minimizing review workflows

Major Changes – Medium to high risk changes, requires acceptance by EWS Engineering, changes may require revisions to the accepted plan (additional changes to be documented in the “As-Tested” documentation)

The following table outlines the classification of several changes:

Proposed Change	Severity
Reordering flushing runs	Minor
Combining multiple phases/stages for commissioning (as one plan)	Minor
Change in chlorination run length (increase/decrease)	Minor (up to 400 m between samples)
Change in hydrostatic run length (increase/decrease)	Minor (up to 450 m for DMs and 800 m for TMs)
Addition/removal of temporary infrastructure (temp-bleeder, temp-injection point, temp-hydrant, etc.)	Minor
Change to design plans (addition, removal, relocation)	Minor *If redline required may result in Major Change
Change of flush port type (increasing available flow)	Minor
Change of flush port type (decreasing available flow)	Major
Realignment of services	Case dependent: - If sampling or injection point → Major - Else → Minor
Relocation of injection point	Case dependent: - If within 3m of BV → Minor - Else → Major
Relocation of sample point	Case dependent: - If within 6m of plug/BV → Minor - Else → Major
Splitting multiple phases/stages for commissioning (from one Plan to multiple Plans)	Major
Change in chlorination method	Major (requires EWS acceptance)
Modification of flushing runs (changes to valves, flush points, mains, etc.)	Major
Hydrant outage	Major (requires EWS & Fire Rescue Services acceptance)

Commissioning Plan Submissions

Commissioning plans must be submitted to ePlan within the “Documents” folder in conjunction with the design drawing submissions. The commissioning plans will be reviewed at the same time as the design drawings where comments for revisions will be made. Updated revisions to the commissioning plans are to be submitted in the “Documents” folder with subsequent submissions until conditional approval of the plans is provided. Commissioning plans shall be stamped and sealed when the design drawings are approved by the City of Edmonton, Development Coordination. (Note, if the commissioning plans are not stamped and sealed at the time of review, this requirement will be noted as a condition of acceptance.) A stamped and sealed copy of the approved flushing and testing plans must be on site during all flushing and testing activities. A record of all flushing and testing activities for the project must be recorded using the forms provided on EPCOR’s website.

At a minimum, each flushing and testing plan should include the following:

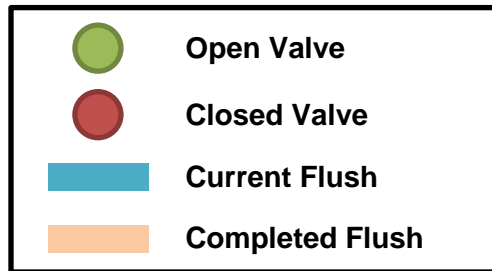
- The sequence of commissioning activities (flushing, hydrostatic, then disinfection and sampling unless variance requested for and approved by the EWS Engineer prior to commissioning);
- A flushing spreadsheet;
- A drawing for each:
 - Flushing run(s);
 - Hydrostatic testing segment(s); and
 - Disinfection and sampling segment(s).

See [Section 1.4](#) of the City of Edmonton Design and Construction Standards, Volume 4 for a detailed description of submissions, reporting and record keeping requirements.

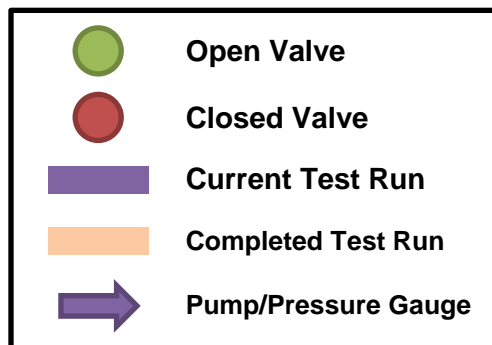
Drawing Requirements

Submitted drawings should be clear, organized and easy to read in the field. The drawings are required to show the following components within the project area in black line work:

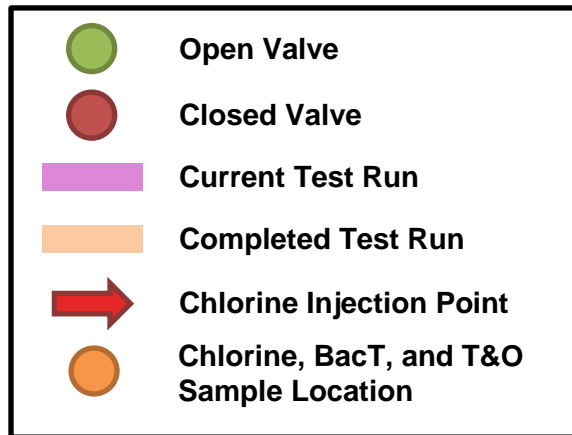
- Drawing title;
- Page number;
- A North arrow;
- Street names;
- Lot/block numbers;
- All water mains and appurtenances;
- Water main sizes and materials;
- All water main reducers and tees;
- Boundary valves;
- All temporary infrastructure required to complete flushing and testing indicated with applicable notes;
- Run/segment number;
- A legend using clear symbology to identify all relevant items.
 - Example legend for flushing plan:



- Example legend for hydrostatic plan:



- Example legend for disinfection plan:



Flushing Spreadsheet

The flushing spreadsheet provides the technical details for each run to ensure plans meet all commissioning requirements. Submitted flushing spreadsheets shall include/identify the following items for each run:

- Run sequence
- Length of flushing run (m)
- Discharge location
- Hydrants to purge (a general note to purge hydrants is also acceptable)
- Pipe diameter (mm)
- Pipe volume (m³)
- Required discharge volume (5x pipe volume for the flushing run – m³)
- Minimum flow rate to achieve required velocity (L/s)
- Type and size of discharge ports required
- Number of ports required to discharge water
- Estimated flow rate achieved (L/s)
- Minimum required flush time (minutes)

Flushing Plan

The objective of a flushing plans are to create an agreed-upon plan for the staging, direction and flow rate of water to scour the water main prior to commissioning. It ensures the water infrastructure is designed in such a way to accommodate appropriate flushing of watermains. Submitted flushing plans should meet the following criteria:

- Legend indicating symbology of flushing runs;
- Segment to be flushed should be clearly shown;
- Completed segments should be clearly shown;
- Flush runs must be < 450 m, ideal length is 200 m;
- Only one source valve for each stage of fill or flushing run to prevent any back siphonage into the existing water network;
- Source water must come from a clean, potable source;
- Valves should be configured to achieve uni-directional flow (water cannot loop back on itself);
- Flush should be from larger pipe to smaller pipe whenever possible;
- Discharge location must be marked with appurteurence symbol included;
- Flushing should be planned to achieve the minimum required velocity as provided in [Table 8.1](#) of the City of Edmonton Design and Construction Standards, Volume 4;
 - If existing infrastructure cannot attain the minimum required velocity, alternatives should be proposed for EWS review.
- Flushing shall be completed for all water mains (up to and including interim stubs) within the subdivision, as outlined by the approved engineering drawings, unless otherwise approved by EWS;
- Temporary hydrants being used for flushing have a note indicating removal after flushing and replaced with a flush point for chlorination, to the satisfaction of the EWS Inspector;
- Temporary bleeders being used for flushing have a note indicating they will be decommissioned after flushing and to the satisfaction of EWS inspector;
- Discharged water must be dechlorinated in accordance with [Section 8.7](#) of the City of Edmonton Design and Construction Standards, Volume 4.

Foam Pigging Requirements

Foam pigging is a watermain pre-flushing cleaning technique during the construction phase. Foam pigging provides frictional drag that removes foreign material, iron tuberculation and other matter as the foam pig is drawn through the water main. Foam pigging is required for all water mains 450 mm and larger. It can also be used on water mains less than 450 mm instead of temporary infrastructure if the permanent infrastructure cannot achieve the minimum required flushing velocity to scour the watermain. Foam pigging requirements are outlined below:

- Plans shall be submitted and approved prior to the start of construction;
- Foam pigging shall be shown on the flushing spreadsheet and clearly indicated on flushing plans;
- The foam pig must be inserted during construction and pigging shall be done by pulling the pig along during construction;
 - Cutting the pipe to insert the pig after construction is not permitted.
- The pipe must have weight on it (i.e. backfilled) so that the pig does not catch on pipe joints;
- A firm pig must be used (not soft);
- Minimize rocks/sand/debris from entering the pipe during construction so the pipe is not scratched during pigging;
- Minimize the amount of pipe lubricant used during construction;
- Flushing is still required to remove dust, tapping drillings, etc. after pigging is complete.

Hydrostatic Testing Plan

The purpose of hydrostatic testing a new water main is to determine if the installation is capable of withstanding ordinary operating transient pressure conditions without failure or excessive leakage at the joints and service connections. The guidelines are intended to provide the performance criteria and testing protocol necessary for hydrostatic testing to ensure that the new water main installation meets the design specifications. The objective of the Hydrostatic Testing Plan is to provide a snapshot of the steady state scenario for the water main during the hydrostatic test. The plans shall indicate the valve statuses and pump location that will be used for the duration of the test.

Submitted hydrostatic plans shall meet the following criteria:

- Legend indicating symbology of hydrostatic testing runs;
- Each segment to be tested should be clearly shown;
- Hydrostatic testing runs must be <450 m in length for water mains 400 mm in diameter and smaller;
- Hydrostatic testing runs must be <800 m in length for water mains 450 mm in diameter and larger;
- Each segment can only be made up of one type of pipe material;
 - Note: fused PVC and jointed PVC can be hydrostatically tested together but there is no allowance for leakage within the fused PVC section.
- Pressure gauge and pump should be located at a service connection, flush point, or manual air vents, wherever possible. If unavailable, a temporary bleeder may be required (see Temporary Infrastructure Requirements);
 - Hydrants are not permitted to be used as a pump location.
- Boundary valves of testing section should be shown as closed;
- All mainline valves within test segment shall be shown as open on the plans.

Disinfection, Bacteriological and Taste and Odour Plan

The objective of the Disinfection, Bacteriological and Taste and Odour Plan is to ensure the water main is adequately disinfected so that it passes the required water quality tests. The plan also ensures the proper number of samples are collected and in the correct locations in order to ensure there is no risk of contamination of the existing potable water system.

Submitted Disinfection, Bacteriological and Taste and Odour Plans shall meet the following criteria:

- Legend indicating symbology of disinfection and testing runs;
- Each segment to be tested shall be clearly shown;
- Chlorine injection shall be through a service connection, flush point, or manual air vent within 3.0 m of the disinfection section boundary valve (beginning of water main), wherever possible. If unavailable, a temporary bleeder may be required (see Temporary Infrastructure Requirements);
 - A maximum of 10 m between the chlorine injection point and the beginning of the water main may be permitted on a case-specific bases for projects that were reviewed and approved by EWS prior to December 31, 2022;
 - Hydrants are not permitted for chemical feed.
- Samples shall be taken through a service connection, flush point, or manual air vent, wherever possible. If unavailable:
 - A temporary bleeder may be required (see Temporary Infrastructure Requirements).
 - The designer may choose a location outside of the run's isolation (but close to a valve used to isolate) that hasn't been chlorinated yet to draw the chlorine solution through the long dead end (see sample Chlorination Plan Run 1). The designer must indicate how much water to turn over in the subsequent run before sampling for chlorine residual to ensure the residual sampled is coming from the injection point and not from the previous run (see sample Chlorination Plan Run 3). This can be done by calculating the volume of water in the pipe between the sample location and the injection point and using the flow rate for a 50mm or 25mm port to calculate the time before sampling.
- Boundary valves of testing section must be shown as closed;
- All mainline valves within test segment shall be shown as open on the plans;
- Hydrant control valves shall be open, all hydrant boot valves shall be closed;
- Chlorine, Bacteriological, and Taste and Odour samples must be collected;
 - In 400 m intervals;
 - At the end of the water main; and
 - At the end of each branch greater than 1 pipe length.
- Existing water mains that are depressurized during construction are required to be disinfected to the same standard as new water mains.

Temporary Infrastructure Requirements

It is best practice to avoid temporary infrastructure and find a solution with required permanent infrastructure during engineering design (such as tactical placement of lot services).

Temporary infrastructure may be required if there are no other available solutions for flushing and testing and requires EWS acceptance prior to installation. Temporary infrastructure may include temporary bleeders, flush points or hydrants. The following requirements must be clearly shown on the drawings using a call out note if the temporary infrastructure is planned within the project area:

- Temporary flushing hydrants must be removed and replaced with a flush point upon the completion of high velocity flushing (prior to hydrostatic testing and disinfection), unless otherwise directed by EWS.
- All temporary bleeders to be decommissioned and removed at the mainstop to the satisfaction of the EWSI Inspector after the receipt of passing test results has been obtained.

If temporary infrastructure is location within roadways or utility easements, information must be detailed within the commissioning plans.

Coordinated Commissioning Requirements

Certain subdivision phases may benefit by being entirely or partially flushed and tested in conjunction with another phase. It is recommended to discuss these situations with EWS prior to plan submission. If supported by EWS, the following may be required:

- A letter of coordinated construction from the Developer(s) acknowledging that the stages will be commissioned concurrently and any delays or costs resulting from the concurrent commissioning of the stages is at the Developer's own risk.
- A meeting to coordinate plans if different Consultants are working on concurrently submitted flushing plans.
- Call out notes added to the drawings to clearly identify the sections that will be commissioned with a later stage.
- Other requirements as determined by EWS.

Variance Request Process

It is recommended that variances are discussed at a Consultant/EWS meeting prior to submission. All variances to the standard flushing and testing process should be requested in writing as part of the flushing and testing plan submission. Appropriate justification and any risk mitigation proposals for the variance shall be submitted to support EWS's decision. Variances may be approved by EWS on a case by case basis. Additional mitigation measures or plan adjustments may be requested by EWS.

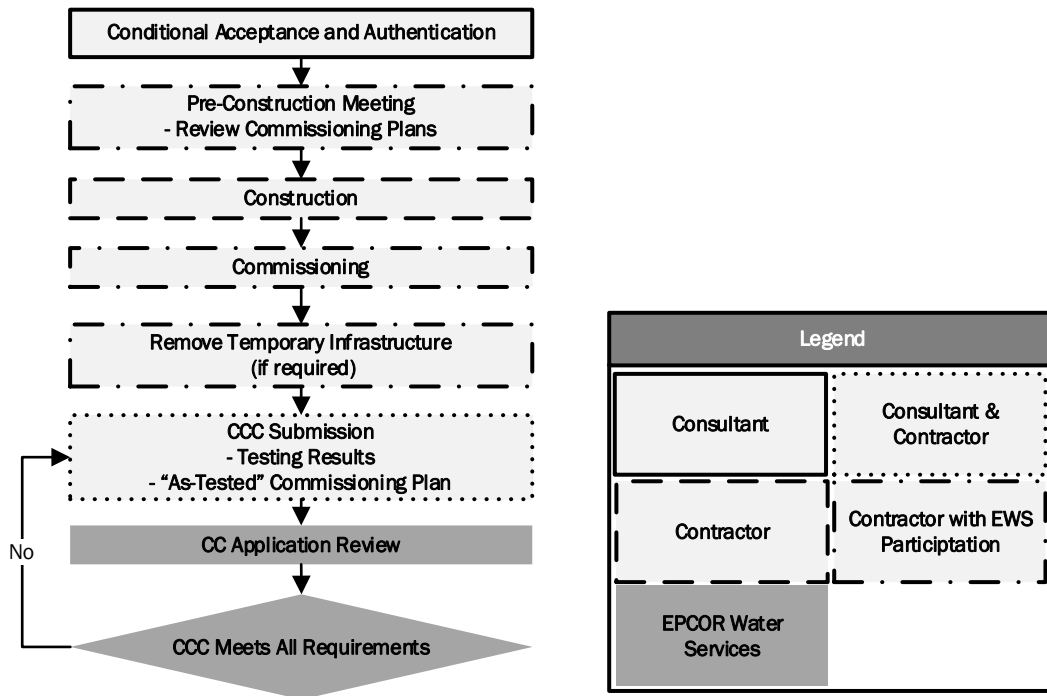
As-Tested Commissioning Plan

Upon completion of project commissioning and passing test results, the Consultant shall compile all deviations from the latest accepted plan. This includes both the Consultant and Contractor requested deviations. This should be documented and the plans updated to accurately reflect the commissioning activities undertaken during the project for future reference. The as-tested commissioning plan shall be submitted to EWS for review and acceptance as part of the CCC application. Note, the as-tested commissioning plan to be authenticated as per the requirements of APEGA's Authenticating Professional Work Products – Practice Standard.

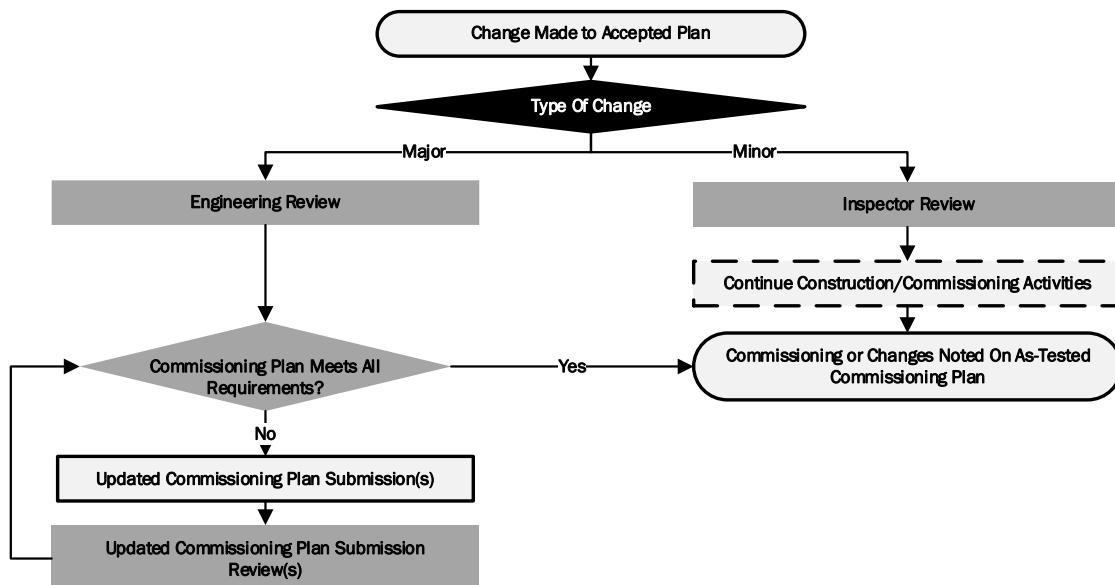
Note, although certain changes to the commissioning plans are permitted, EWS requires that the accepted commissioning plan (and EWS accepted changes) is followed.

Appendix A: Contractor Quick Reference

This quick reference highlights critical information about the commissioning process for contractors. It is recommended that these two pages are printed out and stored on site with the project commissioning plans. The contractor is expected to participate in reviewing the commissioning plan at the pre-construction meeting, construction/commissioning activities, and documentation as outlined in the process flow diagram below:



Contractors must follow the accepted commissioning plan from the design review process. Changes to the accepted commissioning plans are permitted only if the changes are submitted in writing, reviewed by EWS, and written acceptance has been provided by EWS as outlined in the process flow diagram below:



Changes are separated into minor and major changes:

Minor Changes – Low risk changes, requires acceptance by EWS inspector, changes to be documented in the “As-Tested” documentation, intended to provide more flexibility to field staff

Major Changes – Medium to high risk changes, requires acceptance by EWS Engineering, changes may require revisions to the accepted plan (additional changes to be documented in the “As-Tested” documentation)

The following table outlines the classification of several changes, changes should be requested in writing for EWS review and acceptance prior to conducting the proposed work. Contractors shall inform Consultants before contacting EWS:

Proposed Change	Severity
Reordering flushing runs	Minor
Combining multiple phases/stages for commissioning (as one plan)	Minor
Change in chlorination run length (increase/decrease)	Minor (up to 400 m between samples)
Change in hydrostatic run length (increase/decrease)	Minor (up to 450 m for DMs and 800 m for TMs)
Addition/removal of temporary infrastructure (temp-bleeder, temp-injection point, temp-hydrant, etc.)	Minor
Change to design plans (addition, removal, relocation)	Minor *If redline required may result in Major Change
Change of flush port type (increasing available flow)	Minor
Change of flush port type (decreasing available flow)	Major
Realignment of services	Case dependent: - If sampling or injection point → Major - Else → Minor
Relocation of injection point	Case dependent: - If within 3m of BV → Minor - Else → Major
Relocation of sample point	Case dependent: - If within 6m of plug/BV → Minor - Else → Major
Splitting multiple phases/stages for commissioning (from one Plan to multiple Plans)	Major
Change in chlorination method	Major (requires EWS acceptance)
Modification of flushing runs (changes to valves, flush points, mains, etc.)	Major
Hydrant outage	Major (requires EWS & Fire Rescue Services acceptance)

Additional Notes for Contractors:

- Contractor’s primary point of contact is the EWS Inspector
- Careful and proper application of pipe lubricant during construction as outlined by manufacture’s recommended to ensure taste and odor tests pass.
- End of construction activities/day procedures (such as plugging the main) will prevent collection of debris within the water main recommended to help ensure successful flushing and ensure taste and odor tests pass.
- All water discharged must be dechlorinated (see Volume 4 – Section 8.7 Dechlorination) and requires a Large Volume Release Permit

Appendix B: Tips and Tricks for Plan Design

A collection of tips and tricks to optimize the commissioning plans and project design:

1. To minimize additional infrastructure constructed solely for commissioning purposes, consider tactical placement of lot services (and pre-servicing) for current/future injection and sample points within 3 m of BVs.
2. Our experience has shown that to maximize water quality, when flushing a water main from two directions out of the same hydrant (or flushpoint), sequencing the flushing runs to flush from the direction of the strapped/closest valve first, followed by the second direction with the valve farther away yields the best results.
3. To maximize water quality and avoid the use a temporary flushing hydrant, consider dual flushpoints to achieve a scour velocity on a 250mm main. Note, this option does not require foam pigging either.
4. To minimize additional infrastructure installed solely for HEI purposes, consider installing a hydrant with valves strapped to either side of the hydrant tee, such that the hydrant can be used to verify HEI isolations for both portions of the watermain.

Appendix C: FAQ

A collection of frequently asked questions relating to the technical and review process for the commissioning plans:

1. Is winter/cold water commissioning permitted?
 - a. Winter/cold water commissioning is defined as commissioning occurring when the system water temperature is at or below 5 degrees Celsius.
 - b. Winter/cold water commissioning is permitted (as of the 2023 construction season). Note, additional measures or requirements may be required at EWS discretion, may include but is not limited to:
 - i. The Developer/Contractor/Consultant is responsible to ensure that site conditions are safe and there is adequate access to the installed infrastructure for EWS personnel, mitigating the additional impacts of winter conditions.
 - ii. Field samples to be completed in a heated environment.
 - iii. High velocity flushing water needs to be managed as to prevent ice build-up on roadways.
 - iv. Water main commissioning activities may be terminated until spring 2024 if the EWS Inspector deems appropriate due to excessive failed attempts.
 - v. Water sampling and testing equipment and instruments may not function properly under cold weather conditions. Please plan accordingly.
 - vi. Water main commissioning subject to short notice cancellation due to weather limitations. This is at the EWS Inspector's discretion.
2. When is a dual flushpoint/bleeder detail required?
 - a. A dual flushpoint/bleeder detail is required when the dual flushpoint/bleeder is on the end of a public water main, within the roadway, or within an easement.
 - b. A dual flushpoint/bleeder detail is not required when the dual flushpoint/bleeder is on the end of a private water main or private service.
3. Does EWS provide a dual flushpoint/bleeder detail?
 - a. EWS does not have an authenticated standard detail for a dual flushpoint/bleeder at this time.
 - b. If requested, EWS can provide an example detail for reference. Note, the consultant must verify and authenticate this detail if it is included in the design drawings/commissioning plans.
4. Does EWS prefer temporary or permanent infrastructure to meet the commissioning requirements?
 - a. Temporary infrastructure is typically preferred over additional permanent infrastructure, provided the permanent infrastructure is only required for commissioning activities (flushing, hydrostatic testing, or chlorine injection/sampling) and the temporary infrastructure can safely be decommissioned and removed upon completion.
 - b. Note, EWS still requires all permanent infrastructure as required by design standards and hazardous energy isolation confirmation.

- c. Please include the following standard note on both the commissioning plans and design drawings if temporary infrastructure is planned:
 - i. All temporary <<FLUSHPOINTS / BLEEDERS / INFRASTRUCTURE>> to be decommissioned and removed at the mainstop to the satisfaction of the EWSI Inspector after the receipt of passing test results has been obtained.
5. Are flush points still required using EPCOR's standards?
- a. A flush point is required at the end of all water main stubs for hazardous energy isolation confirmation of the water main past the boundary valve. These flush points should be installed in accordance with the standard detail in the Design and Construction Standards.
6. Is flushing permitted between BacT sampling and T&O sampling?
- a. Prior to commencing T&O sampling, two consecutive passing BacT samples are required at each sampling point.
 - b. If the T&O sample is collected within 7 days of BacT sampling, no additional flushing of the watermain is required.
 - c. If passing T&O samples are not achieved within 7 days of the last passing BacT samples, the project may flush the watermain at the EWS Inspector's discretion.
 - i. A minimum hold time of 16 hours is required between any flushing activities and collecting T&O samples.
 - d. If passing T&O samples are not achieved within 14 days of the last passing BacT samples, a single set of refresher BacT samples will be required.
 - i. If any refresher BacT sample fails, two successive passing BacT results are required to put the watermain into service.
7. Can a variance be provided for the distance between the BV and the chlorine injection point (>3 m)?
- a. If a chlorine injection point is not possible within 3 m of the BV, consultants may contact EWS requesting alternatives on a case by case basis.
8. Can a variance be provided for infill projects that only include construction of large diameter services?
- a. At the EWS Engineer's discretion, an alternative can be provided requiring:
 - i. The service is to be swabbed.
 - ii. Granular chlorine is to be used for chlorination.
 - iii. Flushing to occur after chlorination.
 - iv. Hydrostatic test at normal operating pressure for 4 hours.
9. Why are glass bottles required for T&O samples when plastic bottles are acceptable for BacT samples?
- a. Based on lab experience, plastic bottles may leach interferences into the sample water resulting in false exceedances.