
CONSTRUCTION AND MATERIALS SPECIFICATIONS MANUAL

REVISION # 12 – January 17, 2020

NOTICE OF REVISION

Email Contact Information:

The City will only send notification of Manual revisions by email. If you would like to receive notifications of future revisions, send your email address to claudio.leon@hamilton.ca

Access to Hamilton Standards:

Each manual holder is responsible for determining implementation dates and directions for use of these revisions. It is recommended that you retain superseded versions of specifications for future reference.

All specifications and drawings are available free of charge online at the City of Hamilton website at:

<https://www.hamilton.ca/develop-property/policies-guidelines/construction-and-material-specifications>

Here you will find the latest versions of the published standards, archives of the previously published standards and Revision Information Sheets for currently published standards.

Hard-copy paper versions of the standards are available for a fee at our office located at:

Public Works Department – Reception
77 James Street North, Suite 320
Hamilton, Ontario, L8K 6E9
Call 905 546-2424, Ext. 4170.

Method of payment: Cash or company cheque payable to the City of Hamilton. Personal cheques must be certified.

Revisions to the Construction and Materials Specifications Manual:

Superseded / Cancelled (Remove)		Revised / New (Insert)		Comments
Document	Dated	Document	Dated	
Construction and Material Specification Manual Index	June 2019	Construction and Material Specification Manual Index	January 2020	Specification Dates Updated
Form 200, General Conditions	June 2019	Form 200, General Conditions	January 2020	Specification Revised
Form 400, Specification for the Installation of Watermains	June 2019	Form 400, Specification for the Installation of Watermains	January 2020	Specification Revised
Form 400 – Appendix A Procedure for the Disinfection, Testing and Connection of Watermains	October 2019	Form 400 – Appendix A Procedure for the Disinfection, Testing and Connection of Watermains	January 2020	Procedure Revised
Form 800, Specification for Hot-Mix Asphalt	November 2018	Form 800, Specification for Hot-Mix Asphalt	January 2020	Specification Revised
Standard Road Drawing Index	June 2019	Standard Road Drawing Index	January 2020	Updated
RD-102.02	June 2017	RD-102.02	January 2020	Drawing Revised
DT:0111-01	September 2015	-	-	Drawing Deleted
DT:0111-02	September 2015	-	-	Drawing Deleted
-	-	DT:0119-02	March 2019	New Drawing
Standard Watermain Drawing Index	June 2019	Standard Watermain Drawing Index	January 2020	Updated
WM-202	June 2017	WM-202	January 2020	Drawing Revised
WM-207.04	November 2005	WM-207.04	January 2020	Drawing Revised
WM-207.05	November 2005	WM-207.05	January 2020	Drawing Revised
-	-	WM-207.06	January 2020	New Drawing
WM-209.01	June 2019	WM-209.01	January 2020	Drawing Revised
WM-209.02	June 2019	WM-209.02	January 2020	Drawing Revised
WM-209.03	June 2019	WM-209.03	January 2020	Drawing Revised

Revision Summaries:

These summaries are for information purposes and will highlight major or substantial changes only. Each revision and specification should be reviewed in its entirety.

Construction and Materials Specification Manual Index:

- References and specification dates updated.

Summary of Changes to Form 200 – General Conditions

200.03.08 - Section 200.03.08 Wrap Up Liability Insurance added. Subsequent sections renumbered.

Summary of Changes to Form 400 - Specification for the Installation of Watermains

400.10 - Revised – Effective immediately, all watermain valves are to open left (counter clock-wise), with the City's 50mm operating nut.

Summary of Changes to Form 400 Appendix A- Procedure for the Disinfection, Testing and Connection of Watermains

Section 2.7 - Revised

Section 2.8 - Deleted

Summary of Changes to Form 800 – Specification for Hot-Mix Asphalt

800.02.01.05 - Second to last paragraph revised.

800.02.02.03 - New section 800.02.02.03 Reclaimed Asphalt Pavement (RAP) added.

800.02.03.12 - New section 800.02.03.12 Referee Testing added. Subsequent sections renumbered.

Standard Road Drawings:

- **RD-102.02** - Detail for Control Joints at Hydrants added.
- **DT:0111-01** - Removed
- **DT:0111-02** - Removed
- **DT:0119-02** - New Drawing for Speed Cushions - added

Standard Watermain Drawings:

- **WM-207.04** – Bubble 3 revised to delete reference to gate valves direction of operation. All watermain valves are to open left (counter clock-wise), with the City's 50mm operating nut.
 - Note 5. FOR VALVE LOCATION (WM-204.01) - Deleted
- **WM-207.05** – Gate valve and valve box (WM-202) added at the property line
 - Bubble 2 revised to delete reference to gate valves direction of operation. All watermain valves are to open left (counter clock-wise), with the City's 50mm operating nut.
 - Bubble 3 deleted and subsequent bubbles renumbered
 - Note 2 revised to correct the bedding and backfill standard drawing references
- **WM-207.06** – New drawing
- **WM-209.01** – Reference to Valve Box WM-202 removed and replaced with generic note 'Service Valve'.
- **WM-209.02** – Reference to Valve Box WM-202 removed and replaced with generic note 'Service Valve'.
- **WM-209.03** – Reference to Valve Box WM-202 removed and replaced with generic note 'Service Valve'.

CONSTRUCTION AND MATERIALS SPECIFICATIONS MANUAL INDEX

<u>DATE</u>	<u>DESCRIPTION / TITLE</u>
<u>General Conditions</u>	
January 2020	Form 200 - General Conditions
November 2018	Form 300 - General Construction Requirements
<u>Standard Specifications</u>	
January 2020	Form 400 - Specification for the Installation of Watermains
November 2018	Form 500 - Specification for Sewer Pipe Materials and CCTV Inspection
October 2019	Form 600- Specification for Granular Fill Materials
June 2017	Form 700 - Specification for Portland Cement Concrete
January 2020	Form 800 - Specification for Hot Mix Asphalt
March 2018	Form 900 - Specification for Standard Compaction Requirements
June 2017	Form 1000 - Amendments to Ontario Provincial Standards

Approved Products List

The City's Approved Products List can be accessed by visiting the following link to "The Road Authority" website:

<http://www.roadauthority.com/Redirect/Mpl/Hamilton%20MPL>

Standard Drawings

January 2020	RD	Standard Road Drawings
January 2020	WM	Standard Watermain Drawings
November 2018	SEW	Standard Sewer Drawings
June 2006	PK	Standard Park Drawings

INDEX

200	.01	DEFINITIONS
	.02	SCOPE OF THE WORK
	.01	Notice to Proceed
	.02	Successful Bidder Responsibilities
	.03	Conformity of Work with Plans and Specifications
	.04	Supply of Materials
	.05	Contractor's Investigations
	.06	Estimated Quantities
	.07	Changes and Alterations
	.08	Extra Work
	.09	Claims
	.10	Cleaning up before Acceptance
	.11	Acceptance of the Work
	.12	Schedule Item of Work
	.03	CONTRACTOR'S RESPONSIBILITIES TO THIRD PARTIES
	.01	Performance and Other Security
	.02	Security and Deposit
	.03	Insurance Requirements
	.04	Commercial General Liability Insurance
	.05	Standard Form Automobile Liability Insurance
	.06	Non-Owned Automobile Liability Insurance
	.07	Builders Risk
	.08	Wrap Up Liability
	.09	Property Installation Floater All Risk Insurance
	.10	Motor Truck Cargo or Transportation Insurance
	.11	Pollution Liability Insurance
	.12	Property Insurance
	.13	Proof of Insurance and Claims Protocol
	.14	Indemnification
	.15	Notices by the Contractor and Observance of Laws, Statutes and Regulations
	.16	Assignment and Sub-Letting
	.17	Patents and Copyrights
	.18	Contractor's Responsibility for Losses and Damages
	.19	Obstructions and Utilities
	.20	Labour Disputes
	.21	Plans and Working Drawings
	.22	Explosives and Blasting
	.23	Claims - Follow Up Procedure
	.24	Construction Liaison Committee

INDEX...Cont'd.

.04	CONTROL OF THE WORK
.01	Project Manager's Authority
.02	Inspector's Authority
.03	Inspection
.04	Superintendence
.05	Methods and Sequence of Work
.06	Quality of Materials
.07	Modifications of Methods & Equipment
.08	Defective Work and Materials
.09	Deviation from Plans
.10	Conflicts and Omissions
.11	Lines, Levels and Grades
.12	Right of Entry
.13	Notices to Contractor and City
.14	Intentionally Deleted
.15	Hindrances and Delays
.16	Character and Conduct of Employees
.17	City Office Closures
.05	PROSECUTION AND PROGRESS
.01	Time the Essence of the Contract
.02	Commencement and Completion
.03	Non-Fulfilment of the Contract
.04	Extension of Time
.06	PAYMENT
.01	Price For Work
.02	Prices and Payments
.03	Contractor's Discharge of Liabilities
.04	Construction Claims Holdback Provision
.05	Workplace Safety and Insurance Board Certificate of Clearance
.06	Certificate of Status
.07	Inspection of Books, Payrolls, Accounts and Records
.07	MAINTENANCE
.01	Maintenance Review

ALPHABETICAL INDEX

200	.02.10 Acceptance, Cleaning up before
	.02.11 Acceptance of the Work
	.02.07 Alterations, Changes and
	.01.01 Approved Product Listing
	.03.16 Assignment, Sub-letting
	.04.01 Authority, Project Manager's
	.06.06 Certificate of Status
	.02.07 Changes and Alterations
	.02.09 Claims
	.03.23 Claims, Follow up Procedures
	.04.16 Character and Conduct of Employees
	.04.17 City Office Closures
	.02.10 Cleaning up before Acceptance
	.05.02 Commencement and Completion
	.04.10 Conflicts and Omissions
	.02.03 Conformity of Work with Plans and Specifications
	.01.02 Contract
	.01.03 Contract Documents
	.03.24 Construction Liaison Committee
	.05.03 Contract, Non-Fulfilment of
	.05.01 Contract, Time the Essence of
	.01.04 Contractor
	.06.03 Contractor's Discharge of Liabilities
	.02.05 Contractor's Investigations
	.04.13 Contractor and City Notices to the
	.03.18 Contractor's Responsibility for Losses and Damages
	.03.17 Copyrights, Patents and
	.03.18 Damages, Contractor's Responsibility for Losses and Damages
	.04.08 Defective Work and Materials
	.04.15 Delays, Hindrances and
	.03.02 Deposit, Security and
	.04.09 Deviation from Plans
	.06.03 Discharge of Liabilities, Contractor's
	.03.20 Disputes, Labour
	.01.10 Project Manager
	.04.01 Project Manager's Authority
	.04.12 Entry, Right of
	.02.06 Estimated Quantities
	.03.22 Explosives and Blasting
	.02.08 Extra Work
	.05.04 Extension of Time
	.01.06 General Manager
	.04.11 Grades, Lines, Levels and
	.04.15 Hindrances and Delays
	.04.03 Inspection
	.04.02 Inspector's Authority

ALPHABETICAL INDEX – Cont'd...

- 200 .01.07 Inspector
.06.07 Inspection of Books, Payrolls, Accounts and Records
.03.03 Insurance
.02.05 Investigations, Contractor's
.03.20 Labour Disputes
.06.03 Liabilities, Contractor's Discharge of
.04.11 Lines, Levels and Grades
.03.18 Losses and Damage, Contractor's Responsibility for
.07 Maintenance
.07.01 Maintenance Review
.01.08 Major Item
.04.08 Materials, Defective Work and
.04.06 Materials, Quality of
.04.07 Methods and Equipment, Modifications of
.04.05 Methods and Sequence of Work
.05.03 Non-fulfilment of the Contract
.02.01 Notice to Proceed
.03.15 Notices by the Contractor and Observance of Laws, Statutes and Regulations
.04.13 Notices to the Contractor and City
.03.19 Obstructions, Utilities and
.04.10 Omissions, Conflicts and
.03.17 Patents and Copyrights
.06.02 Payments, Prices and
.03.01 Performance and Other Security
.01.09 Plans
.03.21 Plans and Working Drawings
.04.09 Plans, Deviation from
.02.03 Plans, Specifications, Conformity of Work with
.06.01 Price for Work
.04.01 Project Manager's Authority
.04.06 Quality of Materials
.02.06 Quantities, Estimated
.04.12 Right of Entry
.02.12 Scheduled Items of Work
.04.05 Sequence of Work, Methods and
.01.11 Site
.01.12 Specification
.02.03 Specifications, Plans, Conformity of Work with
.01.13 Sub-Contractor
.03.16 Sub-Letting, Assignment and
.02.02 Successful Bidder Responsibilities
.04.04 Superintendence
.02.04 Supply of Materials
.03.02 Security and Deposit
.05.04 Time, Extension of
.05.01 Time of the Essence (time – Essence of the Contract)
.01.16 Work
.02.11 Work, Acceptance of

ALPHABETICAL INDEX – Cont'd...

- 200 .02.03 Work Conformity of, with Plans and Specifications
.02.08 Work, Extra
.04.05 Work, Methods and Sequence of
.06.01 Work, Price for
.02.12 Work Scheduled Item of
.04.08 Work and Materials, Defective
.03.21 Working Drawings, Plans and
.06.05 Workplace Safety and Insurance Board Certificate of Clearance

.01 DEFINITIONS AND INTERPRETATION

The following definitions shall apply:

- .01.01** **"Approved Product List"** means the list of acceptable products and/or material approved for use within the City of Hamilton. Lists are issued on an ongoing basis and all references to approved products and materials lists shall be deemed to be to the most recent version.
- .01.02** **"Contract"** means the agreement covering the performance of Work, including the supply of all Work, labour, services, materials, implements and equipment reasonably necessary for the proper and satisfactory execution and completion of the Work, and includes the Form of Tender, Plans, drawings, Specifications, bonds and any written supplementary agreements or written change orders issued by the General Manager.
- .01.03** **"Contract Documents"** means all Tenders, Specifications, performance security, insurance, instructions to bidders, construction requirements, Contract For Works, special provisions, drawings and any and all Addenda and amendments related thereto and connected with the Work or project to be performed under the Contract.
- .01.04** **"Contractor"** means the person, firm or company undertaking the execution of the Work under the terms of the Contract. Contractor shall be synonymous with Successful Bidder.
- .01.05** **"City"** means the City of Hamilton, and where an authority or discretion is conferred upon the City under the Request for Tenders, means the appropriate official of the City as designated or appointed under its governing by-laws, resolutions or policies from time to time.
- .01.06** **"General Manager"** means the General Manager of Public Works for the City of Hamilton or approved designate.
- .01.07** **"Inspector"** means any person, partnership or corporation that the City or Project Manager may appoint for the purpose of assisting in the supervision and inspection of the Work and the materials to be used in the Work.
- .01.08** **"Major Item"** means any individually bid item that has an actual cost, calculated on the basis of its actual or estimated tender quantity, whichever is the larger, and the unit price bid, equal to or greater than 5% of the total tender cost, calculated on the basis of the total of all the estimated quantities and the unit prices bid.

.01.09 "Plans" means any drawings or reproduction of drawings pertaining to the Work.

.01.10 "Project Manager" means the person designated by the City to administer and oversee the Work.

.01.11 "Site" means the area at which the Work is to be carried out.

.01.12 "Specification" means all written or printed descriptions or instructions pertaining to the method and manner of performing the Work or to the quantities and qualities of the materials to be furnished under the Contract, and includes the Special Provisions, Supplemental Specifications, Standard Specifications, Approved Products, Form of Tender and General Conditions together with all written agreements, made or to be made pertaining to the method or manner of performing the Work, or to the quantities or qualities of materials to be furnished under the Contract. Ontario Provincial Standard Specifications and Ontario Provincial Standard Drawings in effect on the date that the Request For Tenders is issued.

.01.13 "Sub-Contractor" means a person, partnership, firm, syndicate, joint venture, or corporation undertaking the execution of a part of the Work by virtue of an agreement between himself and the Contractor, and who has independent control over the Work to be done under such agreement.

.01.14 "Successful Bidder" "Successful Bidder" means the bidder to whom the City has awarded the Contract.

.01.15 "Tender" means the Request For Tenders (RFT) for which these general conditions relate.

.01.16 "Work" means (unless the context requires a different meaning), the whole of the Work, materials, matters and things, required to be done or supplied, mentioned or referred to in the Contract Documents and Plans, or including all extra or additional requirements which may be ordered by the Project Manager.

Any Work or materials not herein specified, but which may be fairly implied as included in this Contract, and of which the Project Manager shall be the sole judge, shall be done or furnished by the Contractor as if such Work or material has been specified.

.01.17 Clarifications

01.17.01 In the Contract Documents, a word importing the masculine, feminine or neuter gender only includes members of the other genders;

- a) a word defined in or importing the singular number has the same meaning when used in the plural number, and vice versa;
- b) the provisions shall be read with such changes of number or corporate status as the context may require;

- c) a reference to any Act, by-law, rule or regulation or to a provision thereof shall be deemed to include a reference to any Act, by-law, rule or regulation or provision enacted in substitution therefore or amendment thereof;
- d) the headings to each section are inserted for convenience of reference only and do not form part of the Contract;
- e) any reference to time shall be deemed to be a reference to Hamilton time;
- f) all technical terms having a recognized meaning as a term of art in a relevant industry or trade shall be deemed to have that meaning in this Contract; and
- g) all accounting terms have the same meaning as are applied to those terms by the Canadian Institute of Chartered Accountants;
- h) any reference to an officer of the City shall be construed to mean the person holding that office from time to time, and also the designate or deputy of that person, and shall be deemed to include a reference to any person holding a successor office or the designate or deputy of that person.

01.17.02 The words 'approval', 'directed', 'required', 'considered necessary', 'authorized', 'acceptable', or 'satisfactory' or words of like import, means approval or directed, required, considered necessary, or authorized by and acceptable or satisfactory to the City or its consultant.

01.17.03 Except where otherwise defined, all terms that are defined in the Construction Act shall have the same meaning in the Contract Documents as in that Act.

01.17.04 Except where to do so would lead to an absurdity or a manifestly unfair result, the Contract Documents shall be deemed to be intended to be complementary, so that

- (a) effect shall be given to each of them (i.e. provisions shall be considered to be repugnant only to the extent that they are inconsistent with each other); and
- (b) what is required by any one shall be as binding as if required by all,

but in the event of inconsistency or conflict between two or more Contract Documents, they shall each have the priority as specified in 200.04.10.

.02 SCOPE OF THE WORK

.02.01 Notice to Proceed

The City may issue a written notice to proceed to the Successful Bidder prior to the execution of the Contract for Works.

Work under the Contract shall commence on the commencement date specified in the notice to proceed, unless otherwise agreed.

.02.02 Successful Bidder Responsibilities

It shall be the Successful Bidder's responsibility to co-ordinate, control and check work of its own forces and of all its Subcontractors and to ascertain that all work is done in accordance with all Contract Documents, governing regulations and good construction practice, is of first class workmanship, and that only proper materials and methods are suitable for the function or performance intended have been used.

The Successful Bidder shall be responsible for faithful and proper performance of all aspects of the Contract.

Without limiting the generality of any other provision of these conditions, unless otherwise provided in the Specifications or the special provisions, the Contractor shall be required to provide and pay for:

- (a) all material, labour and service costs, charges for use of tools and equipment whether owned or rented, and where any work is to be carried out or services are to be rendered on property owned or occupied by the City, all protective and safety provisions, site signs and site conveniences, together with all cranes, scaffolding and shoring, freight costs, and material-handling and storing, and all services and incidentals whether shown or specified or required by good practice;
- (b) all bonds or other accepted forms of bid, performance, and labour and material payment security, insurance, permits and inspections; all applicable taxes, worker's compensation and all other applicable labour-compensation charges necessary to carry out the project, make the supply and complete all Work in accordance with the Contract Documents;
- (c) all services and materials required to carry out the Project, do all of the work and make all necessary or incidental supplies of goods, services, fixtures, construction components, landscaping and other finishing items, in each case fully in accordance with all Contract Documents and all instructions given by the City thereunder, and also in accordance with governing regulations and codes and in compliance with good industrial and commercial practice for first class workmanship, which in all instances, unless otherwise stipulated, shall be deemed to require work that has a finished appearance, is ready for use or occupancy and use for the purpose intended and is fully functional.

.02.03 Conformity of Work with Plans and Specifications

The Contractor shall perform all Work and shall supply all materials save and except those specified in the Contract Documents to be otherwise supplied and shall complete the whole of the Work all in strict conformance with the Plans and Specifications. Dimensions shall not be scaled from the Plans.

02.04 Supply of Materials

The Contractor shall supply all materials for this Contract unless specifically noted otherwise in the Contract Documents. All materials shall meet the Specifications as laid out in the Contract Documents and the appropriate Approved Product List, latest edition.

.02.05 Contractor's Investigations

The Contractor declares and represents that in tendering for the Work, and in entering into this Contract, they have either investigated for themselves the character of the Work to be done and all local conditions, including the location of any Public Utility which can be determined from the records or other information available at the offices of any person, partnership, corporation, including a municipal corporation and any board or commission thereof having jurisdiction or control over such Utility, that might affect their Bid or acceptance of the Work, or that, not having so investigated, they are willing to assume and does hereby assume, all risk of conditions now existing or arising in the course of the Work which might or could make the Work, or any items thereof more expensive in character, or more onerous to fulfil, than was contemplated or known when the Bid was made.

The Contractor also declares that in tendering for the Work and in entering into this Contract they did not and do not rely upon information furnished by the City or any of its servants or agents respecting the nature or conformation of the ground at the site of the Work, or the location, character, quality or quantity of the materials to be removed, or to be employed in the construction of the Work, or the character of the equipment or facilities needed to perform the Work, or the general and local performance of the Work, under the Contract.

.02.06 Estimated Quantities

The estimated quantities set forth in the Tender documents are approximate only, and the basis of payment under this Contract, will be the actual amount of the Work done and material furnished, provided, that if the quantities of the Work to be done or material to be furnished under any item vary from such estimated quantities, the Contractor shall proceed with the Work but if such variation for a Major Item exceeds plus or minus 20% of the estimated quantity and if such variation materially increases or decreases the cost of the Work or material than either party to the Contract, upon the written request of the other shall as soon as reasonably possible, negotiate upward or downwards the compensation for the portion of the Work to be done or material to be furnished which is in excess of or less than such estimated quantity plus or minus the 20% variation as the case may be.

The Contractor's written request that the City negotiate the compensation shall be made as prescribed by Section 200.02.08, for a notice of claim.

.02.07 Changes and Alterations

The Project Manager shall have the right, at any time before or during the prosecution of the Work, or before or after the execution of the Contract, to make or order in writing, any alterations or changes deleting, extending, increasing, decreasing, varying or otherwise altering any lines, grades, forms, dimensions, methods, Plans, materials, or the omission of any portion or portions of the Work, variations in any other way the Works Contracted for, or to order any additional or extra Work to be done or extra material to be furnished and the Contractor shall proceed with and carry out the Work as directed and shall supply such materials as directed, and shall do so without being entitled to any additional payment on account of any changes in Work or materials except as otherwise provided. The Contractor shall proceed with Work without delay and if they are of the opinion that they are entitled to additional compensation, they shall make a written claim for additional compensation as prescribed by Section 200.02.08 herein. If, in the sole opinion of the Project Manager, such order or change materially increases or decreases the cost of the Work or materials from that on which the Contractor based their bid, other than estimated quantities, the Project Manager in his/her sole discretion may increase or decrease the Contract price by an amount or amounts they consider appropriate, and his/her decision shall be final. Nothing herein contained shall preclude City or the Project Manager from having extra, additional, or other Work done by the City Workers or other parties in the event of satisfactory arrangement therefore not having been concluded between the Project Manager and the Contractor or for any other sufficient reason in the sole opinion of the Project Manager.

.02.08 Extra Work

No Work or materials shall be regarded as extra to the Contract Work or materials unless approved in writing as an extra to the Contractor by the Project Manager with the method of payment for it by means of a mutually agreed unit price or a specified in "Section 300.39 Method of Payment of Extra Works by Force Account", provided that the price for the said extra to the Contract is not specified in the Contract.

Where the Contractor considers Work to be extra Work, they shall so notify the Project Manager in writing before proceeding with the Work. However, they shall proceed with the Work without delay on the direction of the Project Manager.

The Project Manager shall be the sole judge of whether any Work or materials are extra Work or materials, and his/her decision shall be final.

Should circumstances arise at any time which, in the Contractor's opinion, would entitle it to additional compensation, and which are not fully provided for herein, the Contractor shall at once, on discovery of such circumstances, notify the Project Manager in writing and shall state clearly and fully what the circumstances are. The claim for the additional sum or compensation shall be submitted within 30 days of completing the Work related to the claim.

.02.09 Claims

In case of the Contractor's neglect or failure to observe fully the conditions set out in this paragraph, they shall forfeit all right to payment therefore which it otherwise would have been entitled to and shall not make any claim in respect thereof, and if made, the Project Manager may reject the same as invalid, and the Contractor shall not have any right to recovery in respect thereof, at law or otherwise and such decision of the Project Manager shall be final.

.02.10 Cleaning Up Before Acceptance

Before any Work will be finally accepted by the City, the Contractor shall do such trimming and disposal of rubbish and surplus materials as to leave the Work neat and presentable throughout, in the opinion of the Project Manager.

.02.11 Acceptance of the Work

The Contractor shall notify the Project Manager in writing when, in the opinion of the Contractor, the Work has been satisfactorily completed in accordance with the Contract, and the Project Manager will then cause the Work to be inspected. When it is found by the Project Manager to be completed to their satisfaction, they will give Notice of Completion in writing to the Contractor and until then no partial or entire use or occupancy of the Work by the City shall be construed as acceptance of any or all of the Work.

.02.12 Scheduled Items of Work

Quantities quoted for the items in the "Schedule of Prices" are estimates only, and are for the purpose of indicating to Bidder's the magnitude of the Work. For Work done on a unit price basis, the Contractor will be paid for the actual measured quantities at the respective unit prices bid.

Description of the items of the Work to be performed under the Contract, as set out in the "Schedule of Prices", are general in nature for the sake of brevity. It shall be the Contractor's understanding that all required Work shall be undertaken and performed by the Contractor as fully detailed in the Contract Documents.

.03 CONTRACTOR'S RESPONSIBILITY TO THIRD PARTIES

.03.01 Performance and Other Security

The Successful Bidder shall furnish a performance security and labour and material payment security to the City in the prescribed forms set out in the Construction Act, prior to the execution of the Contract for Work and within 10 Business Days of being notified that its Bid has been accepted in accordance with the following:

- (a) the performance of the contract (a performance bond), **in an amount equal to 50% of the Base Bid Price excluding any contingency amount and all Value Added Taxes;** and
- (b) the payment of all necessary services and materials required to complete the Contract in a satisfactory manner (a labour and material payment bond), **in an amount equal to 50% of the Base Bid Price excluding any contingency amount and all Value Added Taxes.**

A failure to provide any security described in subsection .03.01 shall:

- (c) constitute a breach of the requirements of the Tender; and
- (d) entitle the City to claim under any bid security described in the Instructions to Bidders Section 5; and
- (e) allow Procurement to present a report to the Administration and Audit Committee recommending Council not accept any further bids from the Bidder for a specified period of time.

.03.02 Security and Deposit

The performance bond, maintenance bond, payment bond, or other bonds or cash or securities, deposited with the City, shall be held by the City to secure the due performance of all provisions of the Contract, including, without limiting the generality of the foregoing, the payment of all Sub-Contractors and materials suppliers with respect to this Contract.

.03.03 Insurance Requirements

At the time of execution of a Contract for the work, the Successful Bidder will be required to deposit with the City certificates of insurance or certified copies of policies of Commercial General Liability Insurance, Automobile Insurance and Property Insurance, together with such other coverages as may be applicable to the contract for the work. Such insurance coverages shall be obtained, maintained throughout the term of the contract (including any renewal thereof) and paid for by the Successful Bidder, including all costs for any applicable deductible. Coverages shall be in the amounts specified and otherwise in accordance with all other requirements set out in these General Conditions of the Contract and be in a form approved by the City.

.03.04 Commercial General Liability Insurance

Commercial General Liability Insurance, written on IBC Form 2100 or its equivalent, including but not limited to bodily and personal injury liability, property damage, products liability, completed operations liability, owners & contractors protective liability, blanket contractual liability, premises liability, and contingent employer's liability coverage, having an inclusive limit of not less than \$2,000,000 per occurrence and in the aggregate and subject to the following;

- (i) Where the work provides for or contemplates the handling of asbestos, coverage shall not contain an asbestos exclusion and same shall be noted on the certificate of insurance.
- (ii) Where the Description of the Project, Supply or Work provides for or contemplates:
 - (I) the use of explosives for blasting or;
 - (II) vibration from pile driving or caisson work or
 - (III) the removal or weakening of support of any property, building or land whether such support be natural or otherwise.

Explosion, Collapse and Underground (XCU) coverages shall be added by endorsement and same shall be noted on the certificate of insurance.

- (iii) Coverage shall be included for pollution from "hostile fires".

.03.05 Standard Form Automobile Liability Insurance

Standard Form Automobile Liability Insurance that complies with all requirements of the current legislation of the Province of Ontario, having an inclusive limit of not less than:

- (i) Subject to paragraph (ii), \$2,000,000 per occurrence;
- (ii) where the Contract relates to the transportation of an explosive substance, snow removal or road construction, or will involve the use of one or more automobiles or any combination of automobiles and towed vehicles having in any case a combined aggregate weight of 10 tonnes or more before loading, \$5,000,000 per occurrence,

for Third Party Liability, in respect of the use or operation of vehicles owned, operated or leased by the Contractor for the provision of services;

.03.06 Non-Owned Automobile Liability Insurance

Non-Owned Automobile Liability Insurance in standard form having an inclusive limit of not less than \$1,000,000 per occurrence, in respect of vehicles not owned by the Contractor, that are used or operated on its behalf for the provision of services under the Contract;

.03.07 Builders Risk

Where the Description of Project, Work or Supply provides for or contemplates the construction of a building or structure, Contractor will provide Builders Risk insurance to cover the subject property;

- (i) coverage shall be for the full amount of the Total Contract Price plus the full value of any optional features or other options that the City elects to order (but the City may require insurance up to the amount of the replacement cost of any building in structure in, on, or upon which any Work is to be done under the Contract, where in the reasonable opinion of the City's Manager of Risk Management there is a sufficient risk of damage to the same),
- (ii) coverage shall;
 - (I) apply to all risks of direct loss or damage (including theft and sinkhole) but subject to any exclusions and limitations in the Special Conditions and the actual policy form;
 - (II) apply to all products, labour, equipment and supplies of every nature, the property of the City or Contractor or for which the City or Contractor may have assumed responsibility (whether on site or in transit), that is to be used in or pertaining to site preparation, and the erection, fabrication, construction, reconstruction, re-modelling or repair of any building, structure, other fixture or thing;
 - (III) include the installation, testing and any subsequent use of machinery and equipment, including boilers, pressure vessels or vessels under vacuum;
 - (IV) include damage to the Work caused by an accident to or the explosion of any boiler or other pressure vessel or equipment forming part of the Work;
 - (V) include off-site storage, transit and installation risks as indicated in the Installation Floater and Motor Truck Cargo insurance described hereafter, if such coverages are not separately provided
 - (VI) include flood and earthquake insurance if such risks exist.

include coverage for loss of income, extra expense and/or expediting expense is such exposures exist

- (VII) be subject to a waiver of coinsurance
- (VIII) be endorsed to grant permission to occupy.
- (IX) be endorsed to cover the interests of all parties, including the City and all contractors and subcontractors

.03.08 Wrap Up Liability Insurance

If applicable, and where required by the City, the Contractor will provide Wrap-up Liability Insurance acceptable to the City for limits as may be determined by the City for Third Party Bodily Injury, Personal Injury and Property Damage. Such insurance shall be in the name of the Contractor and shall name the Contractor's subcontractors, agent, architects, landscape architects, engineers, consultants, planners, project managers and the City of Hamilton as additional insureds thereunder and also include other persons which the City may reasonably require to be added as additional insured parties. This policy may be required to be Project Specific.

The Policy must include the following as and when required by the City:

- (i) personal injury liability, bodily injury and property damage
- (ii) premises and operations liability;
- (iii) owner's and contractor's protective liability;
- (iv) broad form products and completed operations liability;
- (v) cross liability;
- (vi) severability of interest
- (vii) contingent employers' liability
- (viii) blanket written and oral contractual liability;
- (ix) all risks tenant's legal liability;
- (x) hoist and crane liability;
- (xi) fire fighting and forest fire fighting expense liability;
- (xii) employers liability and voluntary compensation;
- (xiii) non-owned automobile liability;
- (xiv) directors, officers, employees, shareholders, legislators, and officials involved in the project added as insureds and/or additional insureds;
- (xv) shoring, blasting, excavating, under-pinning, demolition, pile driving and caisson work, work below and above ground surface, work below and above water, tunnelling and grading, and similar operations associated with the construction work, as applicable;
- (xvi) sudden and accidental pollution liability with a discovery provision of not less than one hundred and twenty (120) hours and a subsequent reporting provision of not less than one hundred and twenty (120) hours; and
- (xvii) 30 day written notice of cancellation.
- (xviii) include coverage as unnamed insured for all contractors, subcontractors, consultants and employees of the Successful Proponents provided that the City reserves the right to require the Successful Proponent to add further parties as additional unnamed insured persons.

Wrap Up Liability Insurance may replace coverage requirements for .03.04 Commercial General Liability Insurance and .03.06 Non-Owned Automobile Liability Insurance.

.03.09 Property Installation Floater All Risks Insurance.

Where the Description of Project, Work or Supply provides for or contemplates the supply and installation of fixtures, equipment, machinery, apparatus, etc., or other

work such as minor renovations amounting to an improvement within the meaning of the *Construction Act* only, the Contractor shall provide a Property Installation Floater All Risks Insurance. The amount of coverage should be adequate to provide full replacement value of the property, repairs, additions or equipment being installed, otherwise being handled or stored on or off premises.

.03.10 Motor Truck Cargo or Transportation Insurance

If the Installation Floater insurance does not provide transportation coverage, separate Motor Truck Cargo or Transportation insurance All Risks is to be provided for materials or equipment transported in the Contractor's vehicles from place of receipt to building sites or other storage sites.

.03.11 Pollution Liability Insurance

Where requested by the City, Contractor to provide Contractors Pollution Liability Insurance covering the contractor's liability for bodily injury, property damage and environmental damage resulting from pollution and related cleanup costs incurred, all arising out of the work or services to be performed under this contract by or on behalf of the Contractor in an amount of not less than \$2,000,000 per claim or per occurrence, which coverage shall be maintained in force for 12 months following the termination of this contract. Coverage shall be provided for both work performed on site, as well as during the transport of any hazardous materials if applicable. City of Hamilton shall be named as an additional insured.

.03.12 Property Insurance

The Contractor shall maintain Property Insurance, as may be applicable, with respect to loss or damage (including fire, theft, burglary, etc.) of its own property and property in its care, custody and control, including its equipment, tools, stock, used in connection with the Contract.

All policies of insurance policies shall:

- (a) be recorded as being a primary policy and shall be in a form and issued by an insurance company satisfactory to the City, that is licensed to carry on business in Ontario;
- (b) be maintained continuously during the course of carrying out the Project, Work or Supply; or for such period of time as may be required after completion of the Project, Work or Supply, as deemed necessary by the City,
- (c) provide for a deductible amount of no greater than \$10,000; or such other amount as the City, at its sole discretion, may deem appropriate.
- (d) (except in the case of automobile liability insurance, non-owned automobile liability insurance, professional errors & omissions liability insurance, and medical malpractice liability insurance) include the City named as an additional insured, to the extent of the Contractor's obligations to the City under the Contract Documents;

- (e) contain cross liability and severability of interest provisions, as may be applicable;
- (f) preclude subrogation claims against the City and any other person insured under the policy; and
- (g) provide that at least 30 days prior written notice (15 days, in the case of automobile liability insurance, and 10 days in the event of non-payment of premiums) shall be given to the City by the Insurer before the Insurer or Contractor takes any steps to cancel, terminate, fail to renew, amend or otherwise change or modify the insurance or any part thereof.

The City reserves the right to require the Contractor to purchase such additional insurance coverage as the City's Risk Management Services Office may reasonably require. The City reserves the right to request such higher limits of insurance or otherwise alter the types of coverage requirements (taking into consideration such matters as the nature of the work, contract value, industry standards, and availability of insurance) as the City may reasonably require from time to time.

Any insurance coverage acquired under the Contract shall in no manner discharge, restrict or limit the liabilities assumed by the Contractor under the Contract. The dollar limit of insurance coverage shall not be limited by the dollar amount of the Contract.

The Contractor shall pay all premiums on the policies as they become due provided that the City may pay premiums as they become due and deduct the amount thereof from moneys due from the City to the Contractor should the Contractor fail to do so.

.03.13 Proof of Insurance and Claims Protocol

The Contractor shall deposit with the City such evidence of its insurance as provided in or required under the provisions of these Instructions, an Addendum or the Special Provisions,

- a) at the time of execution of the Contract for Work (if any), or
- b) in any event prior to commencing the Project, Work or Supply; and

and thereafter during the term of the Contract, no later than 20 Business Days prior to the renewal date of each applicable policy, the Contractor shall deposit with the City's Procurement Manager an original Certificate of Insurance originally signed by an authorized insurance representative, confirming thereon relevant coverage information including but not limited to name/description of City contract, name of Insurer, name of Broker, name of Insured, name of Additional Insureds as may be applicable, commencement and expiry dates of coverage, dollar limits of coverage, deductible levels as may be applicable, cancellation/termination provisions; or (at the City's election) a certified copy of the insurance policy or policies required under section .03.23. Certificate Holder will be addressed as the City Of Hamilton, City Hall, 71 Main Street West, Hamilton, Ontario L8P 4Y5. All certificates, cancellation, nonrenewal or adverse change notices should be mailed to this address.

The Contractor shall not do or omit to do anything that would impair or invalidate the insurance policies. Delivery to and examination or approval by the City of any certificates of insurance or policies of insurance or other evidence of insurance shall not relieve the Contractor of any of its indemnification or insurance obligations under the Contract. The City shall be under no duty either to ascertain the existence of or to examine such certificates of insurance or policies of insurance or to advise the Contractor in the event such insurance coverage is not in compliance with the requirements set out in the Contract.

Claims reported to the Contractor by a third party or by the City shall be promptly investigated by the Contractor. The Contractor shall make contact with the Claimant within 48 hours of receipt of notice of a claim. The Contractor shall initiate an investigation of the claim immediately upon notice, and advise the Claimant by letter of its position regarding resolution of the claim within 20 Business Days of the notice. The Contractor shall include in its letter of resolution the reasons for its position. Failing acceptance of the resolution by the Claimant of the proposed resolution, the Contractor agrees to report the claim to its Insurer for further review and response to the Claimant. Failure to follow this procedure shall permit the City to investigate and resolve any claims and offset the resultant costs against any monies due, from time to time, under the Contract.

Upon the receipt of a third party claim notice from the City's Risk Management Services Section, the Contractor shall:

- a) Acknowledge receipt of the notice by way of a facsimile or e-mail back to Risk Management Services within 5 business days. The acknowledgment will indicate that the Contractor has received the claim and will include all pertinent contact information for the company individual responsible for the claim.
- b) Provide Risk Management Services with an initial status update within the first 30 days of receipt of the claim notice.
- c) Provide Risk Management Services with a status update upon request at any time as Risk Management Services deems necessary. This update should be provided within 10 business days of receipt of the request.
- d) Provide a closing report to Risk Management Services promptly at the conclusion of a claim

Template's for initial/interim/closing reports will be provided by the City prior to the start of any work.

.03.14 Indemnification

- .03.14.01** The Contractor shall indemnify, defend, and hold the City, including its elected officials, officers, employees, agents, affiliates and representatives (collectively referred to as the "Indemnified Party") harmless against any and all claims, demands, costs (including legal costs on a substantial indemnity basis), penalties, fines, fees, royalties, damages (including indirect, special, remote, and/or consequential damages) and causes of action, including, without limitation, proprietary or personal injury (including death) that arise from, either directly or

indirectly, or relate to,

(a) the Contractor, its officials, directors, officers, employees, agents, affiliates, partners (general or limited), joint venturers, contractors, Subcontractors, and other representatives (collectively referred to as the "Indemnifying Party"), under this Contract,

- (i) negligently carrying out any obligation to which it is subject,
- (ii) failing to carry out any obligation to which it is subject,
- (iii) negligently exercising any right to which it is entitled, or,
- (iv) exercising any right to which it is entitled in a manner which is inconsistent with the terms and conditions of this Contract,

or any combination thereof, except to the extent that the same are caused by the negligence or deliberate wrong-doing of the Indemnified Party, or

(b) any patent, trademark, copyright infringement or other breach of any intellectual property right of any person, for which the Indemnifying Party is responsible.

.03.14.02 The City shall notify the Contractor upon receipt of any such claim or demand that it receives. No settlement shall be made nor consent to judgment given without prior written approval of Contractor and its insurers, which approval shall not be unreasonably withheld.

.03.14.03 The rights to indemnity contained herein shall survive the early termination or expiry of this Contract.

.03.14.04 The City may enforce the rights of indemnity conferred on any Indemnified Party under section 03.14.01 on their behalf and to the same extent as if they were parties to this Contract.

.03.14.05 The rights to indemnity provided for in this section shall be deemed to be in addition to any rights with respect to insurance in favour of the Indemnified Party provided in this Contract.

.03.15 Notices by the Contractor and Observance of Laws, Statutes and Regulations

The Contractor shall give notice of the date of commencement of the Work to any department or Agency of the Provincial or Federal government and to any person, partnership or corporation, including a municipal corporation and any board or commission thereof who may be affected by the Work at least two (2) weeks in advance of such date. The Contractor shall obtain their own expense, all licenses or permits required by all by-laws or Statutes, and Regulations made thereunder.

The Contractor shall give reasonable notice to any department or agency of the Provincial or Federal government and to any person, partnership or corporation, including a municipal corporation and any board or commission thereof, who may be affected by the Work, before any blasting operations are carried out.

In the event of accidental damage to, or interference with any utilities, pole lines, pipe lines, farm tile or other public or other privately owned Works, the Contractor shall immediately notify the owner of the location and details of such damage or interference.

The Contractor shall post prominently and maintain on the site of the Work and wherever else the Project Manager may require, legible copies of any notice schedule or other information that it is required to post under this Contract or any Statute, Regulation, by-law or agreement.

.03.16 Assignment and Sub-Letting

The Contractor shall not assign, transfer or sub-let the whole or any portion of this Contract, or the whole or any portion of the Work to be performed under this Contract, without the consent in writing of the Project Manager and the Contractor shall not transfer or assign any monies which may be due or which may become payable under this Contract without the consent in writing of the Project Manager, provided that any consent so given, shall not under any circumstances, relieve the Contractor of any of the liabilities or obligations assumed by them under this Contract.

.03.17 Patents and Copyrights

The Contractor shall indemnify and save harmless the City from all and every claim for damages, royalties, or fees for the infringement of any patented invention or copyright occasioned by the Contractor in connection with Work done or material furnished by the Contractor under this Contract.

.03.18 Contractor's Responsibility for Losses and Damages

The Contractor, its agents and all Workers and persons employed by it, or under its control, or employed by or under the control of Sub-Contractors, shall use due care that no person or property is injured, and the Contractor shall be solely responsible for all damages by whomsoever claimed in respect of any such injury. The Contractor shall at its own expense make such temporary arrangements as may be necessary to ensure the avoidance of any such damages or injury and to prevent the interruption of or danger to vehicular or pedestrian traffic on any railway or any public or private road allowance.

The Contractor will indemnify and save harmless the City from and against all actions, suits, claims and demands whatsoever of all persons whomsoever, which may be brought against or made upon the City, and for all loss, expense, costs, charges, damages, indemnities and/or liability which may be sustained, paid or incurred by the City by reason of or in consequence of this Contract, however caused.

All loss or damage occasioned to the Work or arising out of the nature of the Work to be done, or from the normal action of the elements or from any reasonably foreseeable circumstance in the prosecution of the same, or from any normal obstruction or difficulties which may be encountered in the prosecution of the Work, having regard to the nature thereof, shall be sustained and borne by the Contractor at their own expense, and all material required to replace any defective or rejected Work, or to restore any failure shall be at the expense of the Contractor.

Notwithstanding the indemnity provision contained in this section, where in the opinion of the Project Manager, the Contractor has failed to rectify any damage, or injury or infringement or has failed to adequately compensate any person for any damage, injury or infringement for which the Contractor is responsible to the Contractor of its intention so to do, may withhold payment of monies due to the Contractor under this or any other Contract with the Contractor until the Contractor has rectified such damage, injury or infringement or has paid satisfactory compensation for such damage, injury or infringement.

.03.19 Obstructions and Utilities

Except as otherwise provided in this section, the Contractor assumes all the risks and responsibilities arising out of any obstruction on or under the road allowance and any traffic conditions caused by such obstruction including traffic conditions on any highway or road giving access to the Contract area and they shall not make any claim against the City for any loss, damage or expense occasioned thereby.

Before commencing Work the Contractor shall notify all owners of utilities, pipes, structures or other obstructions, sewers and watermains excepted, either under, on or above the surface within or adjacent to the Work area and request their accurate field location.

It is the Contractor's responsibility to co-ordinate it's proposed Works with any Work required by utilities. The Contractor shall make all reasonable efforts to schedule and co-ordinate it's Work to avoid delays.

.03.20 Labour Disputes

The Contractor shall bear the risk and responsibility of any loss, damage or expense to the Work or to themselves of any nature and kind whatsoever, arising from strikes or labour disputes.

.03.21 Plans and Working Drawings

The Contractor shall submit to the Project Manager for approval any shop Plans and working drawings which are not furnished by the City and which may be required for any part of the finished Work and the Contractor may be required to submit for the Project Manager's approval, working drawings for any falsework, forms or other incidental details of construction required in the construction, but not required as part of the finished Work.

It is expressly agreed that neither the provisions of Plans, shop drawings and/or working drawings by the Project Manager or the City nor the approval by the Project Manager of any Plans, shop drawings and/or working drawings submitted by the Contractor, shall relieve the Contractor from any responsibility for the adequacy or soundness of such Plans, shop or working drawings or such Work, or for any deviation from such Plans, shop drawings, working drawings or Specifications.

.03.22 Explosives and Blasting

The Contractor shall comply with all laws respecting the handling, storage and use of explosives.

In addition to any other precaution that may be necessary, the Contractor shall, immediately prior to a blast, clear the blasting area of all residents, vehicular and pedestrian traffic, and shall post flagmen on each road entering the blasting area, who shall stop all traffic and shall prevent such traffic from entering the area until the blasting has finished. The Contractor shall provide and use a siren or whistle to warn the public and the workers that a blast is to be set off and to indicate the "all clear" after the blast has taken place. Four short soundings of the siren or whistle, two minutes before detonation of a blast shall be used for warning and for protection, and one long ten to fifteen second sounding of the siren or whistle shall be used to give the "all clear".

Notwithstanding any direction of the Project Manager in regard to explosives, drilling or methods of blasting used, the Contractor shall take all precautions necessary to ensure that persons are not injured and that property and the structures, including public utilities are not damaged. Without limiting the generality of Section 200.03.18, the Contractor shall be responsible for all claims whatsoever arising from the hauling, handling, use of or storing of explosives and all effects direct or indirect of the blasting operation.

No payment shall be made by the City for protective measures or for damages to persons or for damages or repairs to property, structures, or public utilities, or for any claim whatsoever arising from blasting operations.

The Contractor shall employ, at its own expense, the services of a specialist experienced in seismic investigations to determine and control the permissible intensity of vibrations which will result from blasting operations. Investigations shall be carried out by the Contractor and the specialist before any rock excavation is started in order to determine the maximum explosive charges that can be used at different locations throughout the area of rock excavation. The Contractor shall submit a report to the Project Manager outlining the results of the investigations and tests made and detailing the control required during blasting throughout the area of rock excavation.

Further seismic reading shall be taken by the specialist during blasting operations. Such readings shall be continuous and shall be taken where buildings and structures are located within 60 metres of the blasting area.

Within the area of the above buildings and structures the monitoring equipment shall be placed to obtain representative readings. As construction proceeds, the monitoring equipment shall be repositioned on an on-going basis.

In addition to the above, vibrations generated shall not exceed a vibrational peak particle velocity of 50 mm per second when monitored at the nearest building or structure.

If the monitoring station is not at the nearest structure, then the allowable particle

velocity shall be reduced in accordance with the increased distance from the blast and shall be determined by the blasting specialist.

Additional monitoring and readings shall be obtained in other sensitive areas where the pre-blast survey indicates the need.

The Contractor and specialist shall visit the Owners of properties and buildings where tests and/or investigations are required and shall describe blasting and seismic investigations to them and obtain their permission to carry out the necessary investigations and notify them of the blasting schedule.

The Specialist will be an advisor to the Contractor and the acceptance of their reports and recommendations by the Project Manager will in no way relieve the Contractor of any responsibility for damage or injury by blasting.

All costs incurred by the Contractor in the employment of the specialist in seismic investigations shall be deemed to be included in the items in the Contract under which any rock excavation is required.

.03.23 Claims - Follow Up Procedure

The Contractor shall retain an independent adjuster who will determine the Contractor's liability for all third party claims and advise the claimants in writing of the determination of liability within thirty (30) days of service of the claim on the Contractor.

If the Contractor's independent adjuster fails to determine the liability for any of the third-party claims as noted above, the City reserves the right to have an independent adjuster review the claim and determine liability therefore. Any monies paid by the City in satisfaction of any third-party claim determined to be the Contractor's liability plus all associated costs will be deducted from monies owing to the Contractor by the City.

.03.24 Construction Liaison Committee

Upon the request of the Project Manager, the Contractor shall participate in a Community Construction Liaison Committee.

This committee may consist of local residents, the Contractor and City representative(s) and shall meet on a regular basis to discuss issues related to the Work being performed by the Contractor. In these cases, the City, and the Contractor will aid the local residents in establishing a Community Construction Liaison Committee.

.04 CONTROL OF WORK

.04.01 Project Manager's Authority

The Project Manager may supervise all Work included herein and shall determine the quantities, quality, acceptability and fitness of the several kinds of Work and materials which are to be paid for under this Contract, and determine all questions relating to the said Work and materials and the construction thereof. The Project Manager shall in all cases be the sole judge of all questions of fact which may arise in respect to the Contract, including, but not so as to limit the generality of the foregoing, all claims by the Contractor and all questions relating to the execution and progress of the Work, the supplying of materials and the interpretation of the documents comprising the Contract. The Project Manager's decision shall in all cases be final.

The Project Manager has authority to stop the progress of the Work or any part or parts thereof in an emergency or whenever in it's opinion such stoppage may be necessary to ensure the safety of life, or the structure, or neighbouring property, or whenever in his/her opinion the Work or any parts thereof is being carried out in an unsatisfactory manner, and the City shall not be responsible for any loss, expense, costs, charges, damages, indemnities and/or liability which may be sustained, paid or incurred by the Contractor, any other Contractor or Contractors, any Sub-Contractor or Sub-Contractors or any other person or persons by reason of such order to stop by the Project Manager.

If the Contractor should neglect to prosecute the Work properly or fail to perform any provision of this Contract, the City after five (5) days written notice by the Project Manager to the Contractor, may without prejudice to any other right or remedy the City may have, make good such deficiencies and may deduct the cost thereof from any monies then or thereafter due the Contractor.

Notwithstanding any other provisions in the Contract, in case of immediate danger to public safety, the City may take such emergency measures or may cause such immediate corrective repair Work to be done as the Project Manager deems necessary under the circumstances and shall notify the Contractor of the City's action, in writing, as soon as possible.

The cost of such emergency Work shall be borne by the Contractor, and the cost shall be deducted, collected or recovered by the City as provided in the Contract and in the Performance of Contract Security.

.04.02 Inspector's Authority

Inspectors of the City shall see that the provisions of the specifications are faithfully adhered to, especially with regard to the quality of workmanship and materials. Work done in the absence of an Inspector may be ordered to be opened-up for thorough examination, and if unacceptable, must be rebuilt or replaced as directed, at the Contractor's sole expense. Approval by an Inspector shall not be taken as, or construed into, an acceptance of defective or improper Work or materials, which must be removed and properly replaced whenever discovered at any stage of the Work. Directions given by Inspectors relating to the quality of material and workmanship, shall be obeyed at once by the Contractor. Inspectors do not have the power to set

out Work or give any stakes, lines gauges, levels, or grades. Any orders or directions given by the Inspector, other than as herein provided for, shall not be binding upon the City.

The Inspector is responsible for public relations on the project site. The Contractor must restrain its employees from giving unauthorized information and shall refer all inquiries from whatever source, relating to the Works to be undertaken within the scope of the Contract, to the Inspector.

.04.03 Inspection

The Contractor shall at all times and at its own expense furnish all reasonable aid and assistance required by the Project Manager or Inspector for the proper inspection and examination of the Work or any part thereof. The Contractor shall, at its own expense, furnish samples for testing when required and shall furnish all reasonable facilities for the inspection of material and workmanship. The Contractor shall obey the directions and/or instructions of the Project Manager or his/her authorized representatives such directions and/or instructions and they shall be made in writing at the request of the Contractor.

Notwithstanding any inspection that the City might carry out, the failure of the Project Manager or the Inspector to condemn or object to any defective Work or material shall not constitute a waiver of any Specification or approval or acceptance of such defective Work or material and except as otherwise expressly provided herein the Contractor shall be and remain liable within the terms of the Contract for such defective Work or materials, any losses, damages, costs, charges or expenses in connection therewith.

.04.04 Superintendence

The Contractor shall at all times have on the Work as its agent a competent superintendent or foreman capable of reading and thoroughly understanding the Plans and Specifications and of adequately communicating with the Project Manager and their representatives, and thoroughly experienced in the type of Work being performed who shall receive instructions from the Project Manager or his/her authorized representatives. The superintendent or foreman shall have full authority to execute the orders or directions of the Project Manager without delay, and to promptly supply such materials, equipment, tools, labour and incidentals as may be required. Such superintendence shall be furnished irrespective of the amount of Work sub-let.

The Project Manager shall be provided, to his/her satisfaction, with the address and telephone number of the Contractor's representative who may be contacted and available within reasonable notice 24 hours a day, 7 days a week, on matters relating to this Contract.

.04.05 Methods and Sequence of Work

Before starting the Work the Contractor shall submit in writing to the Project Manager, their proposed methods and sequence of Work and shall obtain approval thereof and such approval shall not relieve the Contractor of any of their duties and obligations

under this Contract.

The Contractor must notify the City at least one full week prior to the scheduled start of the Contract in order that the necessary inspection forces and traffic control procedures can be established.

Within seven (7) days of the award of this Contract, the Successful Bidder shall submit Three (3) copies of a construction schedule bar chart for approval by the Project Manager. This chart shall show clearly the proposed dates of commencement and completion of each major phase of the Work.

The Contractor will be required to employ a sufficient number of working crews to complete the Work within the working time specified in the Contract Documents.

.04.06 Quality of Materials

All materials supplied by the Contractor shall be new, shall conform to the requirements of the Specifications and be approved by the Project Manager prior to use in the Work.

Where required by the Project Manager, the Contractor shall furnish a complete written statement of the origin, composition and manufacture of all materials to be supplied by it and shall furnish samples thereof for testing purposes. The Contractor shall not change the source of supply of materials without the prior written authorization of the Project Manager.

Approval of any materials by the Project Manager shall not be considered as waiver of objection to the Work or materials at any subsequent time, due to their failure to conform with the Specifications.

.04.07 Modifications of Methods and Equipment

The Contractor shall furnish for the Project Manager's approval, such materials tests, mix designs and tests of items manufactured or fabricated off the job site as the Project Manager may require.

The Contractor shall make such alterations in its method, equipment and working forces as the Project Manager in writing directs if at any time the method or equipment or working forces are found by the Project Manager to be unsafe or inadequate to ensure the protection, safety, or quality of the Work or to ensure a rate of progress sufficient in the opinion of the Project Manager to complete the Work within the time limit specified under the Contract, but notwithstanding the foregoing, the onus is on the Contractor to ensure that such required safety protection, progress and quality of the Work is maintained.

.04.08 Defective Work and Materials

The Contractor shall correct or replace any defective Work or material supplied by them, at its own expense, upon the direction of the Project Manager.

If the Contractor should refuse or neglect to remove any defective Work or material

supplied by it in accordance with a written notice from the Project Manager, such Work or material may be removed by order of the Project Manager, at the Contractor's expense, and in addition to any other remedies available to the City, to recover the cost and expense of such removal, the City may deduct the cost and expense of such removal from any monies due to or to become due to the Contractor on any account.

.04.09 Deviation from Plans

The Contractor shall not deviate from the approved Plans, Specifications, or working drawings without the prior written consent of the Project Manager.

.04.10 Conflicts and Omissions

The documents comprising the Contract are complementary and what is required by any one of them shall be as binding as if required by all of them. The Contractor shall do all Work and furnish all materials in accordance with the best Construction and Engineering practices. In the event of a conflict between them, each shall enjoy priority against the others (subject to any express term or condition to the contrary) in accordance with the following successive order:

- (1) Contract For Work
- (2) Addenda
- (3) Special Provisions
- (4) Plans
- (5) Specifications
- (6) standard drawings and standard specifications
- (7) Form of Tender
- (8) General Conditions – Form 200
- (9) General Construction Requirements – Form 300
- (10) Supplementary Instructions to Bidders
- (11) Instructions to Bidders

Neither party to the Contract shall take advantage of any apparent error or omission in the Plans or Specifications, but the Project Manager shall be permitted to make such corrections and interpretations as may be necessary for fulfilment of the intent of the Plans and Specifications. Any Work material not herein specified but which may be fairly implied as included in this Contract, of which the Project Manager shall be the sole judge, shall be done or furnished by the Contractor as if such Work or material had been specified and the Project Manager's decision shall be final.

.04.11 Lines, Levels and Grades

The City will provide the locations of published vertical bench marks and horizontal control points to the Contractor. The Contractor shall employ at it's own expense a qualified person who shall establish all other necessary lines, elevations and grades, and shall erect required batter boards and sight lines necessary to construct all proposed Works under the Contract. All monuments and reference stakes shall be placed so as to be undisturbed during excavation operations, and subsequent construction. The name of the person who is going to do this Work, their qualifications and experience must be submitted to the Project Manager for approval.

From time to time, the above mentioned person shall verify by an instrument, base lines, bench marks and all other reference marks and the Contractor shall be responsible for the accuracy of all lines and levels and of the Work as built in accordance therewith.

The Project Manager may, at any time, check the lines, elevations, grades, batter boards and any other reference marks, set by the person employed by the Contractor, and the Contractor shall correct any errors disclosed by such check.

Such check shall not be construed to be approval of the Contractor's Work and shall not relieve the Contractor of the responsibility for the accurate construction of the entire Work.

In the event that the Contractor elects to use laser equipment to establish reference marks for any portion of the work, the Contractor shall provide the Inspector with the means of checking grades and/or reference marks including but not limited to batter boards or other means as may be approved by the Project Manager.

.04.12 Right of Entry

At any time during the currency of this Contract, the City, its Contractors, employees or agents, may enter the property or location for the purpose of constructing or installing such collateral Works as the City may desire, and the Contractor shall not interfere with or prevent the construction of such collateral Works.

.04.13 Notices to Contractor and City

All notices and demands provided with respect to the Contract shall be in writing and shall be served (i) personally, (ii) by registered mail, return receipt requested, or (iii) by facsimile or, in the case of the notices specified below, other form of electronic communication during the transmission of which no indication of failure of receipt is communicated to the sender, as follows:

to the Contractor at the address set out on the Form of Tender

to the City at the address given by the City at the commencement of the Contract.

The only notices which will be served by electronic communication are applications for progress payment, completion invoice, and notices of non-payment. All other notices and demands will be served personally, by registered mail, return receipt requested, or by facsimile.

If notice is sent by registered mail as stated above, it shall be deemed to have been received by the recipient five business days after date of posting. If the notice is delivered by hand to the recipient it shall be deemed to have been received by the recipient on the date of delivery. If the notice is delivered by fax or email, it shall be deemed to have been received by the recipient on the day it was sent if sent on a business day during regular business hours (Monday to Friday, 8:30 a.m. to 4:30 p.m.), and if not, then on the first business day thereafter. "Business day" means a day when the administrative offices of the City are open.

Each party may change any such address by giving five days' prior written notice of such change to the other party in the manner prescribed above.

.04.14 INTENTIONALLY DELETED

.04.15 Hindrances and Delays

The Contractor shall upon written notice from the Project Manager, discontinue or delay any or all of the Work when in the opinion of the Project Manager it is unwise to proceed for any reason whatsoever, and the Work shall not be resumed until the Project Manager shall in writing so direct.

When the Work under this Contract is for any reason discontinued, and will not be resumed until the following working season, or for any extended period, the Contractor shall, when directed by the Project Manager, open and place the roadway in a passable, safe and satisfactory condition for public travel, and the roadway shall not again be closed to pedestrian or vehicular traffic thereon or be obstructed without written authority of the Project Manager.

.04.16 Character and Conduct of Employees

The Contractor shall employ only orderly, experienced and competent persons to do the Work and should the Project Manager inform them in writing that any person or persons on the Work, are in the opinion of the Project Manager, inexperienced, incompetent or disorderly such person or persons shall be discharged from the Work and shall not again be employed on the Work without the consent in writing of the Project Manager.

The Contractor shall neither permit, nor allow the introduction or use of alcoholic liquors or beverages upon or about the Works in this Contract, or upon any of the grounds occupied under this Contract by them.

.04.17 City Office Closures

The Contractor shall not carry on it's operations under any Contract on Sundays, holidays or any days on which the City's administrative offices are closed, without the prior written permission of the Project Manager.

.05 PROSECUTION AND PROGRESS

.05.01 Time - The Essence of the Contract

Time shall be of the essence of this Contract.

.05.02 Commencement and Completion

The Work shall be commenced on the commencement date specified in the Notice to Proceed, and shall be continuously and with utmost diligence and dispatch carried on to completion unless otherwise provided in the Contract, and shall be completed and full possession given to the City within the time allowed in the Special Provisions, said time to commence on the commencement date specified in the Notice to Proceed, unless a longer time shall be allowed in writing by the Project Manager, in which case the Contract shall be carried on to completion and possession given to the City within the additional time as allowed.

.05.03 Non-Fulfilment of the Contract

If the Contractor fails or neglects to commence the Work or to prosecute the Work diligently and at a rate of progress that in the opinion of the Project Manager, will ensure the entire completion of the Work within the time limited therefore under this Contract; or should the Contractor become bankrupt or insolvent, or commit any act of insolvency, or bankruptcy, or abandon the Work or fail to observe and perform any of the provisions of this Contract, of which the Project Manager shall be the sole judge, or should the Contractor default in the completion of the Work within the time or extended time limit therefore under this Contract or if the Work or any part thereof, is not progressing continuously and in such a manner as to ensure its entire completion, in the opinion of the Project Manager, within the time stipulated for completion, or if the Contractor fails or refuses to remedy any

defective or unsatisfactory Work or remove any defective material or cease any unsatisfactory Work when so ordered by the Project Manager or to comply with any reasonable order of the Project Manager, or if the Contractor shall persist in any course of action in violation of any of the provisions of this Contract, then in any or all of such cases, the Project Manager may notify the Contractor to discontinue all Work under the Contract, and the City may then employ such means as it may deem necessary to complete the Work, including exercising any right of the City under the Performance of Contract Security, and in such case the Contractor shall remain liable for all losses, damages, expenses, or costs which may be suffered by the City by reason of such delay and/or default by the Contractor. If the said losses, damages, expenses, or costs exceeds the sum which would have been payable under this Contract, if the same has been completed by the said Contractor, the Contractor or their surety, or both, shall pay the amount of such excess to the City or such amount or any portion thereof may be deducted from any monies due or to become due to the Contractor under this Contract.

All property, materials, articles and things whatsoever, including all machinery, tools, plant and equipment, and all rights, proprietary or otherwise, licenses, powers and privileges, whether relating to or affecting real or personal property, acquired, possessed or provided by the Contractor or by the City for the purpose of the Work

shall be the property of the City and may be used, exercised and employed by the City as fully as they might have been used, exercised and employed by the Contractor, and the City may sell or otherwise dispose of at public auction, or private sale or otherwise, the whole or any portion or number of such property, materials, articles and things, at such price or prices, as it may deem fit and retain the proceeds of any sale of disposition and all other amounts then or thereafter due by the City to the Contractor on account of or in part satisfaction of any losses, damages, expenses or costs which the City may sustain or have sustained by reason of any delay or default or defect aforesaid.

.05.04 Extension of Time

An extension of time for completion of the Work or part thereof under this Contract may be granted in writing, by the Project Manager in the event of delay caused by strikes on the part of the workers employed, or by any act of the City, or any combination thereof or from such other cause as is beyond the Contractor's control, or in the event of extra or additional Work being ordered by the Project Manager. Such extension shall be for such time as the Project Manager may prescribe as being fair and reasonable, and the Project Manager shall fix the terms on which the said extension may be granted. An application for an extension of time as herein provided shall be made in writing by the Contractor to the Project Manager at least fifteen (15) days prior to the date of completion fixed by the Contract. Any additional time granted for the completion of the Contract will be conditional upon the Contractor providing the City with evidence that all bonds or other securities, furnished to the City by the Contractor have been increased and extended at least to the limit of the time extension. Any extension of time that may be granted to the Contractor shall be so granted and accepted without prejudice to any rights of the City whatsoever under this Contract, and all of such rights shall continue in full force and effect after the time limited in this Contract for the completion of the Work and whenever in this Contract, power and authority is given to the City or the Project Manager or any person to take any action consequent upon the act, default, breach, neglect, delay, non-observance or non-performance by the Contractor in respect of the Work or Contract, or any portion thereof, such powers and/or authorities may be exercised from time to time and not only in the event of the happening of such contingencies, before the time limited in this Contract for the completion of the Work, but also in the event of the same happening after the time so limited in the case of the Contractor being permitted to proceed with the execution of the Work under an extension of time granted by the Project Manager. In the event of the Project Manager granting an extension of time, time shall continue to be of the essence of this Contract.

.06 PAYMENT

.06.01 Price for Work

Unless otherwise provided in the Contract, the Contractor shall accept the compensation as herein provided in full payment for furnishing all necessary labour, materials, services, taxes, tools, equipment, supplies, light, power, water and other incidentals, and for performing all Work under the Contract.

.06.02 Prices and Payments

Applications for payment shall be made in writing to the City to the email address given by the City for this purpose at the commencement of the Contract.

Each application for payment shall meet the requirements of a “proper invoice” as defined in the Construction Act if the Contractor includes the following:

- a statement of work performed and values, which statement shall include the Contract number, project name and purchase order number;
- breakdown of approved change orders and percentage completed of each;
- any other documents prescribed by the Project Manager at the commencement of the Contract; and
- any other requirement that the Construction Act prescribes for a proper invoice.

A Progress Payment Certificate will be given by the General Manager of Public Works Department using the Contractor's invoice as a guide only, once a month, as to the estimated amount of Work done and material furnished to the satisfaction of the General Manager of Public Works Department and of the value thereof in the opinion of the General Manager of Public Works Department according to the terms of the Contract. Where such certificate differs from the Contractor's invoice, the City will issue a notice of non-payment to the Contractor as required by the Construction Act. The City will pay to the Contractor 90 percent of the amount shown on such certificates, less previous payments and the amount of any liens (plus 25% for security for costs) of which the City has notice and any amounts that the City deems necessary to retain for its protection against claims or liabilities or for any claim or claims the City may have, or have notice of, against the Contractor under this Contract, other Contracts, or otherwise and such payments shall not in any way be construed as an acceptance of all or any part of the Work or material under this Contract.

The parties agree that the City has the contractual right to set-off against any amounts owing by the City to the Contractor under this Contract, any amount owed to the City by the Contractor, whether such amount arises from this Contract or under any other contract between the City and the Contractor, irrespective of whether or not those contracts are related or arise at equity or law. This right of setoff shall be subject to the Construction Act, as applicable.

Along with the Contractor's notification of completion of the Work as per Section 200.02.11, the Contractor shall submit by email transmission, in quadruplicate, a Completion Invoice addressed to the General Manager of Public Works Department. The Completion Invoice shall meet the requirements of a “proper invoice” as set out above and also include satisfactory evidence that section 32 of

the Construction Act, as amended, has been complied with.

If the Work has been completed to the satisfaction of the Project Manager, subject to and upon such approval, and subject to a current Workplace Safety and Insurance Board Certificate, a Completion Payment Certificate will be issued to the Contractor. Payment shall then be made in an amount equal to the amount of the said certificate less 10 per cent holdback and less all amounts previously paid to the Contractor, provided that the City may retain any proportion or all of such payment that it deems necessary for its protection against claims, liabilities, damages, or costs or for any claims that the City may have or have notice of against the Contractor under this Contract or other Contracts or otherwise. Within one calendar month after the issuance of the Completion Payment Certificate, the Contractor shall notify the Project Manager of any errors or omissions herein.

The Contractor shall not submit an invoice between the period of December 14 to January 4, inclusive, in any year. The Contractor shall not submit an invoice during any other reasonable period which the City advises the Contractor in writing due to downtime for payment system upgrades.

Notice of non-payment by the City shall be made to the Contractor by email transmission.

The determination of a matter by an adjudicator under the Construction Act may be submitted to the courts at any time.

Hold Back Monies Will Be Released On The Following Basis:

Substantial Performance

Holdback monies will be released no earlier than sixty (60) days after the date the Contractor publishes the Certificate of Substantial Performance in accordance with the Construction Act, as amended from time to time, and satisfactory evidence thereof has been submitted to the City.

Substantial Performance and Certificate of Substantial Performance shall have the same meaning as set out in the Construction Act, as amended from time to time.

Contract Completion

A Final Payment Certificate for any balance of holdback monies due, less any liens (plus 25% of any such liens for costs) which the City has notice and less any amounts that the City deems necessary to retain for its protection against claims, liabilities, damages or costs for any other claims the City may have against the Contractor otherwise, and such payment shall not in any way be construed as an acceptance of all or any part of the Work or material required under this Contract.

The final Payment Certificate will become due and payable on or before the deadline prescribed by the Construction Act.

The Contract shall be deemed to be completed and services or materials shall be deemed to be last supplied to the improvement when the price of completion,

correction of a known defect or last supply is not more than the lessor of,

a) 1% of the Contract Price; or

b) \$5,000.00

Contingency Allowance

Where a contingency allowance is provided for in any of the Contract Documents, the Contractor shall not be entitled to payment of the whole or any part of that amount, except to the extent that it can be shown that extra or additional work has been carried out by the Contractor beyond that contemplated within the Contract Documents, and that a Change Order has been issued by the Project Manager entitling the Contractor to receive such payment.

.06.03 Contractor's Discharge of Liabilities

The Contractor shall discharge all liabilities incurred by it for labour, materials or services, used or reasonably required for use in the performance of this Contract on the date upon which each become due.

The Contractor shall cause each Sub-Contractor engaged in the performance of this Contract to discharge all liabilities incurred by such Sub-Contractor for labour, materials, or services used or required for use in the performance of this Contract. Workers employed by a Sub-Contractor shall be paid in full at intervals not less frequently than semi-monthly and other liabilities of the Sub-Contractor, as aforesaid, shall be discharged on the date upon which each becomes due. At the request of the City, the Contractor shall furnish the City with evidence satisfactory to the City that the Contractor's liabilities and those of its Sub-Contractors as aforesaid have been discharged and this shall include a Certificate of Clearance or statement of status from the Workplace Safety and Insurance Board (WSIB) that the Contractor has complied with the requirements of the Workplace Safety and Insurance Board and is in good standing before the Board. Further, the Contractor shall immediately advise the City if there is any change in the Contractor's status with the WSIB and provide the City with the necessary certificate or statement associated therewith.

No payment to which the Contractor is otherwise entitled under this Contract shall, in the discretion of the Project Manager, be due and payable to it so long as it or any of such Sub-Contractors are in default under this Section. Upon such default occurring, the Project Manager may notify the Contractor to discontinue all Work under the Contract and the City shall have the same rights and privileges as are provided in Section 200.05.03 of these General Conditions. The City, after notice in writing to the Contractor and/or its Surety, may pay any such liability of the Contractor and of the Sub-Contractors, as aforesaid, and deduct the amount so paid from any monies due or that may become due to the Contractor on any account, and, if there are insufficient monies due or to become due to the Contractor to permit of such deduction, the Contractor shall pay to the City upon demand, an amount sufficient to make up the deficiency. In making payments under this Section the City may act upon any evidence that it deems sufficient and may compromise any disputed liability and such payment should not be open to dispute or question by the Contractor or the surety, if any, but are final and binding upon them.

.06.04 Construction Claims Holdback Provision

The City reserves the right to withhold funds from payment to the Contractor in the event the Contractor fails to satisfy the claims handling requirements as specified in 200.03.12 and/or if it is evident that the Contractor is not responding to the claim in a legitimate manner.

The amount of the holdback will be based on an assessment by Risk Management Services of damages claimed in addition to potential investigation and administration costs.

.06.05 Workplace Safety and Insurance Board Certificate of Clearance (WSIB)

The Contractor shall supply the following to the City prior to the execution of the Contract for Works or before commencing the Project, Work or Supply of any materials:

- (a) shall submit to the City an original Clearance Certificate from the Ontario Workplace Safety and Insurance Board and shall provide additional certificates with respect to such coverage as often as the City deems necessary during the term of the Contract to ensure continued good standing with the Workplace Safety and Insurance Board; or
- (b) furnish proof in a form satisfactory to the City from the Workplace Safety and Insurance Board that the Contractor does not require Workplace Safety and Insurance Board insurance, but in such a case if the Contractor changes its status during the term of the Contract so that such coverage is required, the Contractor shall immediately provide the City with the certificate required under clause (a).
- (c) during the term of the Contract, when submitting each payment invoice, a copy of the Contractor's current certificate of clearance from the WSIB for itself as well as all major Sub-Contractors as determined by the City's Project Manager must be provided. Where a substantial portion of the work to be done under the Contract is to be carried out by a subcontractor, the City may require the Contractor to furnish the same evidence as provided under subsection (1).

The Contractor will not be paid any amount until or unless all required certificates of clearance have been provided by the Contractor to the City or alternately the City will withhold funds in an amount satisfactory to the Project Manager to protect the City's potential liability of WSIB arrears.

If the City suspects that a certificate presented is not authentic or accurate, payment will be withheld until an original copy of the certificate has been received.

The City reserves the right to contact the Workplace Safety Insurance Board directly to confirm that the Contractor or Sub-Contractor is in good standing with the Board. In such cases that the City is advised that there are outstanding Workplace Safety Insurance Board payments, the provisions specified in 200.06.03 shall apply. The

City will advise the Contractor when monies are withheld or deducted due to non compliance with the requirements of the Workplace Safety and Insurance Board by the Contractor or Sub-Contractor.

.06.06 Certificate of Status

All successful Bidders which are corporations shall submit to the City a Certificate of Status from the Ministry of Consumer and Commercial Relations indicating that the successful Bidder is in good standing and has not been dissolved. The Certificate of Status shall be submitted to the City once per calendar year together with the executed Contract for the first Contract awarded by the City to the successful Bidder in each calendar year.

.06.07 Inspection of Books, Payrolls, Accounts and Records

The Contractor shall maintain and keep sufficient complete and accurate books, payroll, accounts and records relating to the Work or any extension or additions thereto or claims arising therefrom to permit the verification and audit thereof and shall have no claim for payment of any nature and kind whatsoever, therefore, unless such books, payrolls, accounts and records have been so maintained and kept.

The City may inspect and audit the books, payrolls, accounts and records of the Contract at any time during the period of the Contract and at any time thereafter as

deemed necessary by the City and the Contractor shall supply certified copies of payrolls and any other records required, whenever requested, by the City.

The Contractor shall preserve all original records pertaining in any way to the Work of the Contract, or any extensions or additions thereto or claims arising therefrom, for a period of twelve (12) calendar months after the expiration of the maintenance period and the Contractor shall require that all Sub-Contractors employed by it preserve all original records pertaining in any way to the Work of the Contract, or any extensions or additions thereto or claims arising therefrom for a similar period of time.

The Contractor shall file with the City forthwith upon the appointment of each Sub-Contractor a consent and covenant of each Sub-Contractor under seal by which the Sub-Contractor agrees to the provisions in the same Section in the same way as if the Section read, "Sub-Contractor" for "Contractor".

.07 MAINTENANCE

The Contractor shall maintain the Works and every part thereof, in perfect order and in complete repair during the period of twenty-four (24) calendar months from the date of the established completion thereof, as herein provided, and make good in a permanent manner, satisfactory to the Project Manager, any and all damage or injury to the Works, both during their construction and during the period of maintenance, as aforesaid, and should the Contractor from any cause fail to do so, then the City through the Project Manager, may do so, and the whole costs, charges and expenses so incurred, may be deducted, or collected by the City as provided for herein. The decision of the Project Manager is to be final as to the necessity of repairs or of any Work done or required to be done under the provisions of this or any clause in the Contract Documents and for any amount of monies expended thereunder.

.07.01 Maintenance Review

The City will notify the Contractor prior to the expiry of the twenty-four (24) calendar month maintenance period to permit the Contractor to coordinate a final deficiency review. The Contractor will walk and review the entire physical limits of the Contract with the Project Manager or designate to review Work completed. The review will consist of all above and below ground components covered by the scope of Work of the Contract.

The Contractor will be responsible for providing all equipment required to conduct any necessary testing for the review. All deficiencies identified by the review will be corrected at the cost of the Contractor to the satisfaction of the Project Manager prior to the expiry of the maintenance period.

TABLE OF CONTENTS

.01	SCOPE
.01.01	General
.01.02	Work Included
.02	RESPONSIBILITY FOR MATERIAL
.02.01	Material Furnished by the Contractor
.02.02	Material Furnished by the City
.02.03	Safe Storage
.02.04	Replacement of Damaged Material
.02.05	Disposition of Defective Material
.03	HANDLING OF MATERIAL
.03.01	Loading and Unloading
.03.02	Transporting, Unloading, Storing and Handling Pipe
.04	APPROVED WATERMAIN MATERIALS
.05	DUCTILE IRON PIPE WATERMAIN
.05.01	Ductile Iron Pipe Watermain – 100mm to 300mm
.05.01.01	Polyethylene Encasement of Ductile Iron Watermain
.05.02	Ductile Iron Pipe Watermain – 400mm and larger
.05.02.01	Submissions
.06	CONCRETE PRESSURE PIPE WATERMAIN (500mm and Larger)
.06.01	Submissions
.07	POLYVINYL CHLORIDE (PVC) PIPE WATERMAIN
.07.01	Polyvinyl Chloride (PVC) Pipe Watermain – 100mm to 300mm
.07.01.01	Service Connection Fittings and Appurtenances – PVC Pipe
.07.02	Polyvinyl Chloride (PVC) Pipe Watermain – 400mm to 750mm
.07.02.01	Submissions
.07.03	Installation of Pipes
.07.04	Jointing Polyvinyl Chloride (PVC) Pressure Pipe
.07.05	Changes in Line and Grade
.07.06	Polyvinyl Chloride (PVC) Pipe - Cathodic Protection
.08	TRUNK WATERMAIN DESIGN AND OPERATING PARAMETERS – 400mm AND LARGER
.09	VALVE CHAMBERS
.09.01	Chambers
.09.02	Valve Chamber Piping
.09.03	Ductile Iron
.09.04	Concrete Pressure Pipe
.09.05	Stainless Steel Pipe (750mm and larger)
.09.06	Chamber Fittings
.09.07	Bolts
.09.08	Design
.09.09	Submissions

- .10 VALVES**
 - .10.01 Gate Valves
 - .10.02 Butterfly Valves
 - .10.03 Air Release and Vacuum Valves

- .11 TRACER WIRE AND CONDUCTIVITY TESTING**
 - .11.01 Tracer Wire
 - .11.02 Conductivity Testing

- .12 TEMPORARY WATER SERVICE BY-PASS FOR CONSUMERS**
 - .12.01 Submissions
 - .12.02 General Description
 - .12.03 By-Pass Pipe and Materials
 - .12.04 Service of Water to Feed By-Pass
 - .12.05 Temporary Connection to Customer
 - .12.06 Disinfection of Temporary Service Connections

- .13 EXCAVATION AND PREPARATION OF TRENCH**
 - .13.01 General
 - .13.02 Alignment and Grade
 - .13.03 Excavation to Grade
 - .13.04 Excavation in Poor Soil
 - .13.05 Excavation in Rock
 - .13.06 Preparation of Trench Bottom
 - .13.07 Preparation of Trench Bottom Below Grade
 - .13.08 Care of Surface and Excavated Material for Reuse
 - .13.09 Piling Excavated Material
 - .13.10 Interruption of Service, Shutting Down or Charging of Mains

- .14 BEDDING AND BACKFILL OF WATERMAINS**
 - .14.01 General
 - .14.02 Bedding
 - .14.03 Backfill
 - .14.04 Summary of Bedding and Backfill Materials
 - .14.04.01 Ductile Iron and Polyvinyl Chloride (PVC) Pipe Watermain
 - .14.04.02 Concrete Pressure Pipe Watermain
 - .14.04.03 Water Services
 - .14.04.04 Hydrants

- .15 LAYING**
 - .15.01 Laying Pipe
 - .15.02 Cutting Iron Pipe

- .16 JOINTING MECHANICAL-JOINT PIPE**
 - .16.01 Assembling Joint
 - .16.02 Bolting of Joint
 - .16.03 Permissible Deflection in Mechanical-Joint Pipe

- .17 JOINTING STEEL CYLINDER REINFORCED CONCRETE PIPE**

- .18 JOINTING TYTON-JOINT PIPE**
 - .18.01 Cleaning and Assembling Joint
 - .18.02 Preparation of Spigot on Site
 - .18.03 Electrical Conductors
 - .18.04 Permissible Deflection in Tyton-Joint Pipe
 - .18.05 Jointing Flange Pipe

- .19 SETTING VALVES AND FITTINGS**
 - .19.01 Valve Boxes
 - .19.02 Drainage of Mains
 - .19.03 Dead Ends

- .20 HYDRANTS**

- .21 BACKFLOW PREVENTERS**

- .22 ANCHORAGE**
 - .22.01 Anchorage for Fittings
 - .22.02 Metal Harness

- .23 WATER SERVICES**
 - .23.01 Services -19mm and 50mm Diameter
 - .23.02 Services - 100mm Diameter and Larger
 - .23.03 Curb Boxes
 - .23.04 Trench for Water Service
 - .23.05 Laying Water Service Pipe
 - .23.06 Leaks in Services

- .24 CONCRETE AND MORTAR**
 - .24.01 Materials
 - .24.02 Proportioning and Mixing of Mortars
 - .24.03 Jointing Old and New Work
 - .24.04 Placing in Water
 - .24.05 Forms
 - .24.06 Form Removal
 - .24.07 Curing of Concrete
 - .24.08 Finish
 - .24.09 Defects
 - .24.10 Reinforcing Steel

- .25 DISINFECTION, TESTING AND CONNECTION OF WATERMAINS**

APPENDICES

- 400 A PROCEDURE FOR THE DISINFECTION, TESTING AND CONNECTION OF WATERMAINS**

.01 SCOPE**.01.01 General**

This Specification covers the requirements for the installation of ductile iron, polyvinyl chloride, concrete and steel watermains. All watermains and water services shall be supplied and installed in accordance with OPSS.MUNI 441 – Construction Specification for Watermain Installation in Open Cut, as amended by this specification.

.01.02 Work Included

The Contractor shall, unless specified otherwise, furnish all equipment, tools and labour necessary to do the Work required under this Contract and unload, haul and distribute all pipe, fittings, valves, hydrants and accessories. The Contractor shall also remove the pavement as stipulated; excavate the trenches and pits to the required dimensions; excavate the bell holes; construct and maintain all bridges for traffic control; sheet, brace and support the adjoining ground structure where necessary; handle all drainage or ground water; provide barricades, guards and warning lights; lay and test the pipe, fittings, valves, hydrants and accessories; backfill and consolidate trenches and pits; restore roadway surface, unless otherwise stipulated; remove and dispose of surplus excavated materials as directed; clean the site of the Work; and maintain the street or other surface over trenches as specified.

.02 RESPONSIBILITY FOR MATERIAL**.02.01 Material Furnished by the Contractor**

All watermain materials furnished by the Contractor shall be new. Reuse of watermain pipe, components and appurtenances is not permitted.

Unless otherwise noted in the Contract Documents, the Contractor shall supply all materials required to complete the Works. This will include but not be limited to:

- a) The proposed watermain pipe(s) complete with all valves, connections, fittings, special appurtenances, thrust blocks, anchor blocks, tee's, bends, sleeves, and all lowerings in accordance with the elevations and grades shown on the Contract Drawings.
- b) Water for testing and disinfection shall be supplied by the Contractor from a location corresponding to the appropriate Drinking Water System. Hydrant usage will require the necessary permit and meterage charges. The Contractor shall be responsible for the transportation of this water from source of supply to point of use.
- c) The Contractor shall be responsible for all material furnished by them and shall replace all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labour required for the replacement of installed material discovered defective prior to the final acceptance of the Work.

d) In addition to Form 200.04.06, all materials supplied by the Contractor shall be in accordance with the applicable current Approved Products List or Contract specification. Any material used that is not approved or not appropriate shall be removed and replaced by the Contractor at no cost to the City.

.02.02 Material Furnished by the City

Where the Contract Documents or Drawings indicate that the City will supply materials, the Contractor shall pick-up the required materials at the designated location and haul such materials to the site as required.

The Contractor's responsibility for material furnished by the City shall begin F.O.B. at the point of delivery to the Contractor. Materials already on the site shall become the Contractor's responsibility on the day of the execution of the Contract. The Contractor shall examine all material furnished by the City at the time and place of delivery to and shall reject all defective material.

.02.03 Safe Storage

The Contractor shall be responsible for the safe storage of material supplied by or to them and accepted by them and intended for the Work, until it has been incorporated in the completed project. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.

.02.04 Replacement of Damaged Material

Any material furnished by the City that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor.

.02.05 Disposition of Defective Material

Prior to acceptance of responsibility for safe storage by the Contractor under Form 400.02.03, any material furnished by the City found to be defective shall be set aside and removed from the site or the Work by the City. All defective materials furnished by the Contractor shall be promptly removed by from the site.

.03 HANDLING OF MATERIAL

.03.01 Loading and Unloading

All pipe fittings, pipe, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

.03.02 Transporting, Unloading, Storing and Handling Pipe

All pipe up to and including 600mm shall be delivered to the site with end covers and tamper evident seals in accordance with OPSS.MUNI 441.07.07.

.04 APPROVED WATERMAIN MATERIALS

All watermain pipe, fittings and other materials shall be as listed on the Approved Products List, as amended. Materials shall meet the current version of the applicable standards, including but not limited to CSA, ASTM, ANSI/AWWA, NSF Standard 61 and OPSS.

Acceptable pipe materials are ductile iron, polyvinyl chloride and concrete pressure pipe. Steel Pipe is acceptable in project specific applications only.

OPSS.MUNI 441.05.02	Ductile Iron Pipe – acceptable. Refer to Form 400.05.
OPSS.MUNI 441.05.03	Concrete Pressure Pipe – acceptable. Refer to Form 400.06.
OPSS.MUNI 441.05.04	Polyvinyl Chloride Pipe – acceptable. Refer to Form 400.07.
OPSS.MUNI 441.05.04.03	Molecularly Oriented Polyvinyl Chloride Pipe (PVCO) – acceptable. Refer to Form 400.07.01.
OPSS.MUNI 441.05.05	Polyethylene Pipe - not acceptable.
OPSS.MUNI 441.05.06	Steel Pipe – acceptable for special projects only per the Contract Documents.
OPSS.MUNI 441.05.07	Copper Pipe – acceptable. Refer to Form 400.23.
OPSS.MUNI 441.05.08	Composite Pipe - not acceptable.

.05 DUCTILE IRON PIPE WATERMAIN

All watermain materials shall be in accordance with AWWA C104, C105, C110, OPSS.MUNI 441, this specification and be selected from the Approved Products List, latest version.

Watermain gaskets shall be EPDM (Ethylene Propylene Diene Monomer), Nitrile NBR (Acrylonitrile Butadiene), or Fluorocarbon (Viton, Fluorel or approved equivalent). Selection of gasket material shall be suitable for the existing soil geo-environmental conditions.

.05.01 Ductile Iron Pipe Watermain – 100mm, 150mm, 200mm and 300mm

Ductile iron pipe shall be Pressure Class 350, cement lined, Tyton joint and/or restrained Joints, for 300mm and smaller pipe as per OPSS.MUNI 441.05.02 with cement lined fittings.

All pipe, mechanical joints of pipe and restraints shall be protected by Polyethylene Encasement in accordance with this specification and the

manufacturer's recommendation. Field cut pipe shall be kept to a minimum.

An approved corrosion protection tape system (primer, mastic and tape) shall be applied to all restraints prior to the installation of the Polyethylene Encasement.

Unless otherwise noted in the Contract Documents, anchor blocks and joint restraint shall be used at all fittings. Anchor blocks shall be constructed in accordance with the Contract Drawings and standard watermain drawings. Joint restraint shall be selected from the Approved Products List and installed in accordance with the following:

All fittings and valves shall be restrained for a minimum of 18m in each direction.

All fittings at dead ends shall be restrained for a minimum of 18m.

All watermain joints and fittings within areas of engineered fill shall be restrained.

All fittings on all water services 100mm or greater shall be restrained from the main to the service valve at the property line.

Joint restraints shall be installed in strict accordance with the manufacturer's specifications and recommendations.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

All proposed or replacement water services, 100mm or larger, shall be constructed using a pipe material that is the same as the watermain material.

.05.01.01 Polyethylene Encasement of Ductile Iron Watermain

Polyethylene encasement shall be in accordance with ANSI/AWWA C105/A21.5 and the following:

- (i) Material to be Low Density, polyethylene film having a nominal thickness of 8 mil (.008 inch) in accordance with ANSI/AWWA C105/A21.5, Section 4.1.2.3
- (ii) Installation Method "A" only to be used. (Poly-Tube with overlap - No sheets)
- (iii) Direct service connection tapping through triple polyethylene adhesive tape & the polyethylene film is to be used for all service taps.
- (iv) Junctions between wrapped & existing unwrapped pipe - polyethylene wrap is to cover the adjacent pipe for a distance of at least 0.9m. Secure the end with sufficient circumferential turns of tape.
- (v) Attached service lines of dissimilar metals shall be wrapped with polyethylene or suitable dielectric tape for a minimum clear distance of 0.9m away from the ductile iron pipe.

.05.02 Ductile Iron Pipe Watermain – 400mm and Larger

All ductile iron watermain shall be designed in accordance with the Trunk Watermain Design and Construction Parameters given in Form 400.08.

Pipe shall be Class 52, ductile iron cement lined, with Tyton and/or restrained Joints as per OPSS.MUNI 441.05.02, with cement lined fittings. All pipe, mechanical joints of pipe and restraints shall be protected with Polyethylene Encasement in accordance with this specification and the manufacturer's recommendation. Field cut pipe shall be kept to a minimum.

An approved corrosion protection tape system (primer, mastic and tape) shall be applied to all restraints prior to the installation of the Polyethylene Encasement to the satisfaction of the Project Manager.

Polyethylene encasement shall be in accordance with ANSI/AWWA C105/A21.5 and as described in subsection .05.01.01.

Unless otherwise noted in the Contract Documents, anchor blocks and joint restraint shall be used at all fittings in accordance with the City's standard drawings and Contract Drawings.

Restrained Mechanical Joint for ductile iron pipe will be required at all fittings and for suitable length as recommended by the Supplier. Restraint shall be selected from the Approved Products List and shall be installed in strict accordance with the manufacturer's specifications and recommendations. Joints alone shall be capable of withstanding thrust up to 150psi test pressure.

All watermain joints and fittings within areas of engineered fill shall be restrained.

The maximum permissible joint deflection shall be less than or equal to 50% of the values recommended by the manufacturer.

Closure pipe shall consist of Restrained Mechanical Joint Fittings and Solid Sleeve.

All dead ends on watermain shall be closed with cast iron plugs/caps or bulkheads that are adequately restrained for pressure testing and provided with a 50mm corporation main stop.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

.05.02.01 Submissions

The Contractor shall supply 2 copies of the following information to the Project Manager prior to installing any pipe:

- a) Letter confirming that the proposed pipe material, fittings and restraint are designed to operate as a complete system that meets all specified watermain design and operating parameters.

- b) Pipe layout drawings and schedules showing the location and type of all pipe, fittings, restrained lengths, valves, method of restraint, location and size of all anchor blocks;
- c) Drawings showing the proposed location of all valve chambers, including detailed dimensions and a listing of all internal components.
- d) All submissions shall be stamped by an Engineer licensed by Professional Engineers Ontario (PEO) to practice in the Province of Ontario.

.06 CONCRETE PRESSURE PIPE WATERMAIN (500mm and Larger)

All concrete watermain shall be in accordance with AWWA C301 and/or C303, OPSS.MUNI 441, this specification and be selected from the Approved Products List, latest version. Non-cylinder pipe is not permitted.

400mm concrete pressure pipe will only be permitted for short repair sections or where specifically approved for use by the City.

All concrete watermain shall be designed in accordance with the Trunk Watermain Design and Construction Parameters given in Form 400.08.

Restrained Joint Concrete Pressure Pipe will be required at all fittings and for suitable length as recommended by the manufacturer. Joints alone shall be capable of withstanding thrust up to 150psi test pressure. Joint restraint shall be in accordance with the manufacturer's recommendations. Welded joints will not be permitted.

All watermain joints and fittings within areas of engineered fill shall be restrained.

Joint restraints shall be installed in strict accordance with the manufacturer's specifications and recommendations.

Anchor blocks and joint restraint shall be used at all fittings in accordance with the City's standard drawings and Contract Documents.

Tracer wire shall be installed on concrete pressure pipe shall be light coloured, plastic coated and strapped to the pipe at 6m intervals and in accordance with Form 400.11.

Closure pipe shall consist of two lengths of pipe with a dresser coupling. The lengths of pipe shall be made to lengths measured in the pipe trench by the Contractor.

The maximum permissible joint deflection shall be less than or equal to 50% of the values recommended by the manufacturer.

.06.01 Submissions

The Contractor shall supply 2 copies of the following information to the Project Manager prior to installing any pipe:

- a) Letter confirming that the proposed pipe material, fittings and restraint are designed to operate as a complete system that meets all specified watermain design and operating parameters.
- b) Pipe layout drawings and schedules showing the location and type of all pipe, fittings, restrained lengths, valves, method of restraint, location and size of all anchor blocks;
- c) Drawings showing the proposed location of all valve chambers, including detailed dimensions and a listing of all internal components.
- d) All submissions shall be stamped by an Engineer licensed by Professional Engineers Ontario (PEO) to practice in the Province of Ontario.

.07 POLYVINYL CHLORIDE (PVC) PIPE WATERMAIN

All PVC watermain shall be in accordance with OPSS.MUNI 441, AWWA C605, C900, C907, C909, this specification and be selected from the Approved Products List, latest version.

.07.01 Polyvinyl Chloride (PVC) Pipe – 100mm, 150mm, 200mm and 300mm

Pipe shall be in accordance with OPSS.MUNI 441.05.04, and the following:

OPSS.MUNI 441.05.04 Polyvinyl Chloride Plastic Pipe Products

PVC pipe in sizes 100mm, 150mm, 200mm and 300mm shall have cast iron outside diameters (CIOD) in all sizes. Pipe shall be joined by means of integral elastomeric-gasket joints conforming to ASTM D3139. Acceptable PVC materials are as follows:

- a) Polyvinyl chloride pipe (PVC) Class 235, DR18 conforming to AWWA C900 and CSA B137.3;
- b) Molecularly oriented polyvinyl chloride (PVCO), Pressure Class 235 (PC235) conforming to AWWA C909.

Fittings for 100mm, 150mm and 200mm PVC pipe shall be injection molded PVC conforming to AWWA C907. Fittings for 300mm shall be manufactured from segments of AWWA C900 PVC pipe, bonded together and over-wrapped with fibreglass-reinforced polyester to meet the requirements of CSA B137.3.

Where metal fittings are used on PVC mains, an approved corrosion protection tape system (primer, mastic and tape) and cathodic protection shall be installed on the fittings to the satisfaction of the Project Manager. The corrosion protection tape system shall cover the entire fitting, including restraints.

Unless otherwise noted in the Contract Documents, anchor blocks and joint restraint shall be used at all fittings. Anchor blocks shall be constructed in accordance with the Contract Drawings and standard watermain drawings (WM series). Joint restraint shall be selected from the Approved Products List and installed in accordance with the following:

All fittings and valves shall be restrained for a minimum of 18m in each direction.

All fittings at dead ends shall be restrained for a minimum of 18m.

All watermain joints and fittings within areas of engineered fill shall be restrained.

Joint restraints shall be installed in strict accordance with the manufacturer's specifications and recommendations.

All restraints shall be protected with an approved corrosion protection tape system (primer, mastic and tape), applied to the satisfaction of the Project Manager.

All fittings on all water services 100mm or greater shall be restrained from the main to the service valve at the property line.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

.07.01.01 Service Connection Fittings and Appurtenances – PVC Pipe

OPSS.MUNI 441.05.12 Service Connection Fittings and Appurtenances

Add the following:

Service connections to 100mm, 150mm and 200mm PVC mains shall be made by using PVC molded tapped couplings, conforming to AWWA C907 and CSA B137.2, or using service saddles selected from the Approved Products List.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

All proposed or replacement water services, 100mm or larger, shall be constructed using a pipe material that is the same as the watermain material.

.07.02 Polyvinyl Chloride (PVC) Pipe – 400mm to 750mm

All PVC watermain 400mm to 750mm shall be designed in accordance with the Trunk Watermain Design and Construction Parameters given in Form 400.08.

OPSS.MUNI 441.05.04 Polyvinyl Chloride Pipe

Revised as follows:

PVC pipe in sizes 400mm to 750mm shall conform to AWWA C900 and shall be designed according to AWWA Manual M23: PVC Pipe-Design and Installation, 2nd Edition. All 400mm pipe shall be DR18. Joints alone shall be capable of withstanding thrust up to 150psi test pressure.

Fittings for 400mm through 750mm PVC pipe shall be manufactured from

segments of AWWA C900 PVC pipe, bonded together and over-wrapped with fibreglass-reinforced polyester to meet the requirements of CSA B137.3.

Where metal fittings are used on PVC mains, an approved corrosion protection tape system (primer, mastic and tape) and cathodic protection shall be installed on the fittings to the satisfaction of the Project Manager. The corrosion protection tape system shall cover the entire fitting, including restraints.

Joint restraint will be required at all fittings and for suitable pipe lengths as recommended by the manufacturer. Joint restraint shall be selected from the Approved Products List and installed in strict accordance with the manufacturer's recommendations.

Anchor blocks and joint restraint shall be used at all fittings in accordance with the City's standard drawings and Contract Documents.

All watermain joints and fittings within areas of engineered fill shall be restrained.

All restraints shall be protected with an approved corrosion protection tape system (primer, mastic and tape), applied to the satisfaction of the Project Manager.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

.07.02.01 Submissions

The Contractor shall supply 2 copies of the following information to the Project Manager prior to installing any pipe:

- a) Letter confirming that the proposed pipe material, fittings and restraint are designed to operate as a complete system that meets all specified watermain design and operating parameters.
- b) Pipe layout drawings and schedules showing the location and type of all pipe, fittings, restrained lengths, valves, method of restraint, location and size of all anchor blocks;
- c) Drawings showing the proposed location of all valve chambers, including detailed dimensions and a listing of all internal components.
- d) All submissions shall be stamped by an Engineer licensed by Professional Engineers Ontario (PEO) to practice in the Province of Ontario.

.07.03 Installation of Pipes

OPSS.MUNI 441.07.14 Installation of Pipe

Add the following:

Excavation and Preparation of Trench shall be completed in accordance with the manufacturers recommendations and AWWA C605.

.07.04 Jointing Polyvinyl Chloride (PVC) Pressure Pipe

OPSS.MUNI 441.07.15.04 Polyvinyl Chloride Pressure Pipe – PVC and PVCO

Add the following:

PVC pipe shall be laid in accordance with AWWA C605. Pipe deflection shall be in accordance with subsection .07.05 Changes in Line and Grade.

Bell and Spigot Joints

The pipe shall be jointed in accordance with AWWA C605 and the manufacturer's specifications. If elastomeric gaskets are supplied separately, they shall be inserted into the groove of the bell end of the pipe.

Lubricant for gaskets shall conform to pipe manufacturers recommendations and shall be NSF-61 approved. Clean the gasket, the bell, the groove area and the spigot area with a clean rag to remove any dirt or foreign material before assembling. Insert the gasket into the groove and seal it firmly. Apply lubricant, as provided by the manufacturer, to the beveled spigot end. Push the lubricated end past the gasket into the bell until the reference mark is even with the bell.

.07.05 Changes in Line and Grade

OPSS.MUNI 441.07.17 Change in Line and Grade

Add the following:

All pipe joint deflections shall be less than or equal to 50% of the values recommended by the manufacturer. No deflection of the pipe barrel for changes in line or grade are permitted.

.07.06 Polyvinyl Chloride (PVC) Pipe - Cathodic Protection

The following are minimum requirements. Specific soil conditions may require changes to the cathodic protection system. The installation and placement of anodes and tracer wires shall be in accordance with OPSD 1109.011 and the following:

Cathodic protection shall be provided for all tracer wires on PVC watermain pipes. One (1) 5.4kg zinc anode will be provided for every 1000m tracer wire.

One (1) 5.4kg zinc anode is to be installed on all copper service connections, by means of a service ground clamp, coated with T.C. Mastic or wrapped with "Scotchfill" electrical putty or approved equal. The anode is to be placed at least 1.0m away from the water service and as deep as the service and within 1.0m of the curb stop.

One (1) 10.8kg zinc anode is to be installed on each hydrant. If PVC pipe is used between the hydrant tee and the hydrant boot, two (2) 10.8 kg zinc anodes shall be used.

One (1) 5.4kg zinc anode is to be installed on every line valve, and every metallic fitting connected to a PVC watermain. Fittings include bends, tees, crosses, sleeves, reducers, plugs, caps and couplings.

One (1) 14.5kg magnesium anode is to be connected to the first length of an existing metallic watermain pipe when connected to a new PVC watermain.

All sacrificial zinc anodes shall conform to ASTM B-418 Type II and shall be made of high grade electrolytic zinc, 99.99 % pure. Magnesium anodes shall conform to ASTM B-107-Type M1.

For all anodes connected to new pipe, fittings or to existing metallic watermains, a Cadwelder and CA-15 or equivalent cartridge shall be used. All thermite weld connections to be coated with T.C. Mastic (Tapecoat of Canada), Roybond 747 Primer and Royston "Handy Cap" or approved equal.

Contractors are advised that there is no specific pay item for Cathodic Protection; all costs shall be included in all other appropriate items.

.08 TRUNK WATERMAIN DESIGN AND OPERATING PARAMETERS – 400mm AND LARGER

All trunk watermains shall be in accordance with the following requirements:

The pipe manufacturer shall calculate the joint restraint required based on the trench width, cover over the pipe, bedding and pressures indicated in this specification and on the Contract Drawings.

Watermains, fittings and restraint shall be designed and constructed for operation under the following parameters:

Design / Field Test Pressure	Working Pressure	Surge Pressure (Additional)	Additional External Loads
150psi	100psi	100psi	Hwy. H-20 S16

- a) The factor of safety for pipe and fitting restraint shall be 2 times the design / field test pressure (300psi).
- b) Pipe joints alone shall be capable of withstanding 150psi test pressure.
- c) Trench Type 5 shall be used.
- d) Proposed joint restraint shall be able to accommodate all operating, test and surge pressures independent of anchor blocks.
- e) Anchor blocks will be required in addition to joint restraint.
- f) All restrained joints shall be installed in strict accordance with the manufacturer's specifications and recommendations and shall include

appropriate corrosion protection.

- g) Depth of bury shall be a maximum of 1.6m to top of pipe or less. Where drawings or documents indicate depth of bury less than 1.6m to top of pipe, that value will be used.

.09 VALVE CHAMBERS

.09.01 Chambers

Valve chambers shall be in accordance with OPSS.MUNI 402, OPSS 1351, City standards and Contract Drawings. Chambers shall be capable of withstanding the required thrust forces and be selected from the Approved Products List.

Pre-cast chambers shall be supplied from a plant listed as Prequalified under the Plant Prequalification Program by the Ontario Concrete Pipe Association.

.09.02 Valve Chamber Piping

Chamber piping materials shall be ductile iron pipe, concrete pressure pipe or stainless steel pipe in accordance with the following:

.09.03 Ductile Iron

Ductile Iron Pipe shall be a minimum of Class 54, conform to AWWA C151 and be cement lined as per AWWA C104.

.09.04 Concrete Pressure Pipe

Prestressed Concrete Cylinder Pipe shall conform to AWWA C301.

.09.05 Stainless Steel Pipe (750mm and larger)

The Contractor may consider a stainless steel valve chamber piping option with similar configuration to the City's standard drawings for concrete pressure pipe valve chamber piping. The Contractor shall submit detailed chamber stainless steel piping layout drawings for the City's review prior to the submission of shop drawings.

Stainless Steel pipe shall be Schedule 40, Grade 316L or higher, ASTM A778, shall be straight seam with full penetration butt-weld as per AWWA C220, NSF61 approved. Stainless steel pipe shall be pickled and passivated.

Fabricated fittings shall be according to AWWA C208.

Angle collars with slip-on backing flange ASTM A774 are acceptable.

Connections between dissimilar pipe/flange metals shall be done with flange insulating gaskets kits.

Blow-off valve piping, air valve piping and pitometer piping shall be stainless steel.

All bolts shall be SS type 304 bolts, nuts and washers

.09.06 Chamber Fittings

Ductile Iron Fittings shall conform to AWWA C110.
Prestressed Concrete Cylinder Pipe shall conform to AWWA C301.
Stainless Steel Fabricated fittings shall conform to AWWA C208.

.09.07 Bolts

All nuts, bolts and washers shall be stainless steel. Bolt size, type and diameter shall be in accordance to AWWA C207. Bolt length shall be sufficient to accommodate flanges, gaskets and insulators. Protective coatings (primer, mastic and tape) shall be applied to all nuts and bolts inside chambers.

.09.08 Design

All pipe and fittings shall be designed to the values given in the Trunk Watermain Design and Operating Parameters – 400mm and Larger, subsection 400.08.

.09.09 Submissions

The following shall be in addition to the trunk watermain requirements outlined in Form 400, Sections .05.02.01, .06.01 or .07.02.01. The following information shall be submitted prior to ordering or installing any chamber components:

- a) Shop drawings, specifications and data sheets for all pipe specials;
- b) Valve type, catalogue data, actuator type (with input and output torque ratings), principal dimensions, schedule of parts and materials and expected time of delivery;
- c) Layout drawings showing all chamber pipe and internal components. Itemized listing of chamber components including model names, numbers and all dimensions.

All submissions shall be stamped by an Engineer licensed by Professional Engineers Ontario (PEO) to practice in the Province of Ontario.

.10 VALVES

OPSS.MUNI 441.05.09 Valves

All valves shall be selected from the Approved Products List or as specified in the Contract Documents.

OPSS.MUNI 441.05.09.01 General

Revised as follows:

Valve types shall be in accordance with the following:

- a) All valves shall be selected from the Approved Products List or as specified in the Contract Documents.
- b) All watermain valves are to open left (counter clock-wise), with the City's 50mm operating nut.
- c) Track and roller option required for horizontal position valves.
- d) Bell end valves not acceptable.
- e) Fasteners including nuts, bolts and bolt studs shall be stainless steel.

.10.01 Gate Valves

OPSS.MUNI 441.05.09.03 Gate Valves

Add the following:

Valves 75mm to 400mm shall be ductile iron gate valves.

.10.02 Butterfly Valves

OPSS.MUNI 441.05.09.04 Butterfly Valves

Add the following:

- a) Valves greater than 400mm shall be butterfly valves
- b) Torque ratings shall be as specified by the City. Contractor shall supply detailed actuator information upon request.
- c) Butterfly valves shall be installed so that the valve seat adjustment faces the spool piece side.

.10.03 Air Release and Vacuum Valves

OPSS.MUNI 441.05.09.05 Air Release and Air/Vacuum Valve

Revised as follows:

Air release and air/vacuum valves shall be double acting type

.11 TRACER WIRE AND CONDUCTIVITY TESTING

.11.01 Tracer Wire

Tracer wire shall be installed on all new installations of polyvinyl chloride and concrete pressure pipe including mains, branches and services. The wire shall be positioned along the top of the pipe and fastened at 6 metre intervals. Tracer wire shall be as listed on the Approved Products List.

The wire is to be installed between each valve and/or the end of the new watermain. Joints in the wire between valves shall be avoided. At each valve and hydrant secondary valve, the tracer wire loop shall be brought up the outside of the valve box and inserted into the tracer wire opening in the upper section. Insertion point shall be clear of the lid and use a protective grommet. Tracer wire shall be secured to the outside of the valve box near the top prior to backfilling. The tracer wire shall also be connected to the cathodic protection system as required.

Splices in tracer wire shall be done using a splice kit approved for use in direct bury underground use.

.11.02 Conductivity testing

The Contractor will be required to conduct all tracer wire conductivity testing to ensure that the tracer wire is installed correctly and intact. Testing shall be conducted by authorized personnel using approved testing equipment and shall be supervised by the Contract Inspector or Project Manager. No payments for watermain works shall be processed until tracer wire testing is completed and accepted by the City. All costs for conductivity tests shall be included in the watermain item. If the tracer wire is not electrically continuous from valve to valve, the Contractor shall, at their expense, replace or repair the wire as required.

.12 TEMPORARY WATER SERVICE BY-PASS FOR CONSUMERS

Where called for or where needed, the Contractor shall provide, maintain and remove by-pass piping in accordance with OPSS 493, Form 400 - Appendix A and the following requirements.

12.01 Submissions

In order to evaluate the impact on the water network as a whole and the ability of the by-pass pipe to provide the volumes and flows required, the Contractor shall provide the proposed by-pass system layout proposal to the Project Manager for review and written approval. The Contractor shall not commence the installation of any by-pass materials in the absence of such written approval.

The Contractor will be required to revise the by-pass system and construction staging per the conditions provided in the written approval and shall provide revised drawings.

The Contractor shall have no basis for increased working time due to these requirements, revisions and/or conditions and all associated costs will be deemed to be included in the unit prices bid.

The Contractor shall supply 3 prints of the by-pass proposal a minimum of 3 weeks in advance of installation. Drawings of the system(s) being proposed shall be 1:500 metric scale (hard copy and PDF format) will be submitted to the Project Manager for approval. The Contractor shall provide By-pass Piping Submissions, for all phases of the bypass installation, in accordance with Form 400 and the following requirements.

- a) construction staging
- b) pipe sizes, manufacturer and material
- c) by-pass connection points/details
- d) back flow preventer size, location and manufacturer
- e) temporary hydrants connection points
- f) water services connection points
- g) horizontal location of the by-pass pipe in the road allowance
- h) locations and the materials used to ramp over the by-pass pipe
- i) locations where by-pass pipe is to be buried and the associated temporary restoration.

.12.02 General Description

Temporary by-pass pipe, where required, shall be laid above ground to supply water to consumers connected to a pipeline while that pipeline is out of service. An approved back-flow preventer shall be used by the Contractor whenever connecting to a hydrant.

Temporary by-pass shall include hoses and the necessary outlet/fittings to each house service connection. The Contractor shall maintain the temporary water lines in safe operating condition at all times. The Contractor shall be required to mound over the by-pass wherever it crosses a street, driveway, or sidewalk, in order to prevent injury to vehicular and pedestrian traffic. Lights and barricades shall be furnished and maintained by the Contractor when required by the Project Manager. When a replaced section of watermain is restored to service, the Contractor shall remove any corresponding temporary pipe and house service connection and shall leave the street, sidewalk and adjacent property in a neat and orderly condition.

.12.03 By-Pass Pipe and Materials

The size, pipe, hose and other materials furnished by the Contractor for the temporary service pipe and connections to house services/branches, shall be approved by the Project Manager and be fully adequate to withstand the indicated pressures and all other conditions of use. The pipe and fittings shall provide adequate water tightness and be disinfected prior to being put into service.

.12.04 Service of Water to Feed By-Pass

The Contractor shall furnish all above and below ground connections required to provide the necessary pressurized water to feed the temporary by-pass line. All connections shall be at reasonably close and convenient locations and hydrants will be used whenever available.

.12.05 Temporary Connection to Customer

The Contractor shall make all shut-offs of consumers services and the final connections from the by-pass pipe to the consumer using flexible hose. Special connections requiring excavation, cutting or tapping shall be made by the Contractor. The Contractor shall notify the customer concerning this operation in advance. When the pipeline has been replaced, the Contractor shall clean the service by back-flushing with air or water. Once the pipeline is returned to service, the Contractor shall restore the consumer to service and disconnect the hose from the consumer connection. Where admittance to the customer's premises is denied or impossible, by virtue of absence, the connection cannot be cleared, it may be necessary to excavate and clear the service at the main. This shall be paid for on a unit price basis stated in the Form of Tender - Schedule of Quantities and Prices.

Where 100mm diameter Temporary Connections to the Consumers are called for, the length of the 100mm diameter piping required will be paid at the unit price for 100mm diameter Temporary By-Pass Piping. Cutting-in or tapping shall be provided by the Contractor and is included in the price bid.

All temporary service connection materials shall conform to the NSF 61 Standard. All hose used for individual property connections shall be minimum 20mm I.D., designed for a working pressure of 860kPa and be free from defects in materials and workmanship.

The pipe, hose and all other materials supplied by the Contractor for temporary servicing shall be approved by the Project Manager. Materials shall be fully adequate to withstand the pressures and other conditions of use and shall be of material which does not impart any taste or odour to the water in accordance with NSF 61 Standard. The pipe and fittings shall provide adequate water tightness and care shall be exercised throughout the installation of any temporary pipe and service fittings to avoid the possible pollution of any City main/property services or the contamination of the temporary service pipe. Flushing of the private service connections and chlorination of the by-pass line prior to their use will be required. The temporary service connection shall be valved near the point of connection to the by-pass and also to the private plumbing system so that, except for the final connection, the by-pass line and private services may be chlorinated.

During freezing, stormy or inclement weather, no Work shall be done except that which is directed by the Project Manager. No by-pass service pipe or property service connections shall be installed during freezing or inclement weather and pipes already in use shall be removed or drained and services restored when directed by the Project Manager. Removal and re-installation of such pipes or services shall be done at the Contractor's expense.

Each home shall have its own temporary water service connection to the by-pass pipe and a connection to the private plumbing via a wye at an outside tap. The branching of wyes from a single spigot shall not be permitted; nor will connecting homes in series. An approved hose connection vacuum breaker (HCVB) shall be supplied on the open end of all wyes.

It shall be the responsibility of the Contractor to ensure an adequate water supply at all times. During the construction process, the Contractor is responsible for restoring a customer's water supply within two hours of notification from the Project Manager.

.12.06 Disinfection of Temporary Service Connections

Temporary service connections shall be chlorinated at the commencement of the Contract Works. Disconnection and relocation of service connections from one site to another within the Contract Works will not be subject to re-chlorination, unless otherwise directed by the Project Manager.

Where temporary service connections are disinfected in conjunction with the temporary by-pass watermain no physical connections to hose bibs will be permitted until after successful disinfection.

Where temporary by-pass service connections are disinfected offsite in a controlled environment, one set of samples shall be collected from every 350m of service hose connected in a series. One set of samples shall also be taken from the source and at each end of any hose group connected in series, regardless of the total length. Where temporary by-pass service connections are disinfected in conjunction with the temporary by-pass water main additional samples must be taken at the end of any two (2) temporary by-pass service connections for every 350m of temporary by-pass watermain disinfection.

.13 EXCAVATION AND PREPARATION OF TRENCH

.13.01 General

The trench shall be excavated only so far in advance of pipe laying as permitted. Removals shall be in accordance with Form 300 – General Construction Requirements.

.13.02 Alignment and Grade

Refer to OPSS.MUNI 441.07.14, 441.07.17, Form 200.02.05, 200.02.06 and 200.03.18.

.13.03 Excavation to Grade

Refer to OPSS.MUNI 441.07.08 and 441.07.14.

.13.04 Excavation in Poor Soil

Where the bottom of the trench at the required pipe grade is found to be unstable or to include material which, in the opinion of the Project Manager, should be removed, the Contractor shall excavate and remove such unsuitable material. Poor soil may consist of ashes, cinders, all types of refuse, organic or inorganic material.

Material shall be removed to the width and depth required to provide adequate support to the pipe and allow proper installation. The Contractor shall be allowed

extra compensation for this work provided for in Form 200.

Where the bottom of the trench at subgrade is found to consist of material which, in the opinion of the Project Manager, cannot be removed and replaced with an approved material and thoroughly compacted in place to support the pipe properly, the Contractor shall construct a foundation for the pipe. Pipe foundation shall consist of piling, timbers, concrete or other materials. All plans for pipe foundation shall be approved by the Project Manager. Extra compensation will be allowed for such additional work as per Form 200.

.13.05 Excavation in Rock

Where excavation is made in rock or boulders, the trench shall be excavated to the width and depths that are required to provide for the granular bedding shown on plans.

In areas where the proposed watermain trench bottom varies from rock to earth, the Contractor shall taper the bottom of the earth trench over a two (2) metre length and supply, place and compact Granular "A" in this section to minimize any differential settlement between the two (2) bedding conditions.

.13.06 Preparation of Trench Bottom

The bottom of the trench at pipe grade shall be finished to within 9mm of a straight line between pipe joints or batter boards and all tolerances shall be above the specified grade. It will only be permissible to disturb the finished surface over a distance of 450mm near the middle of each pipe for the withdrawal of slings or other lifting tackle.

.13.07 Preparation of Trench Bottom Below Grade

Where the trench has been excavated below pipe grade the Contractor shall place Granular "A" in 150mm layers to the required grade. Each layer shall be compacted by approved vibratory tampers to obtain 95% of the Standard Proctor Maximum Dry Density. The surface of the compacted granular material shall be finished to provide a continuous uniform support for the pipe at grade to the accuracy specified in subsection .13.06.

Unless otherwise specified, when the trench bottom has been excavated below the required pipe grade, the preparation of the trench bottom to pipe grade will be at the Contractor's expense. When the trench bottom is excavated below the pipe grade at the direction of the Project Manager, the preparation of the bottom of the trench to pipe grade will be allowed as extra compensation as provided for in Form 200.

.13.08 Care of Surface and Excavated Material for Reuse

Refer to Form 300.23.

.13.09 Piling Excavated Material

All excavated material shall be piled in a manner that will not endanger the Work and that will avoid obstructing sidewalks and driveways. Hydrants, valves, utilities

and drainage courses shall be left unobstructed and accessible until the Work is completed.

.13.10 Interruption of Service, Shutting Down or Charging of Mains

OPSS.MUNI 441.07.21 Shutting Down or Charging Mains

Revised by the following:

No valves or other controls on the existing system shall be operated for any purpose by the Contractor. Only City employees will operate such valves, hydrants, blow-offs and curb stops. Refer to Form 300.21 Connecting to Existing Plant and Form 400 - Appendix A.

.14 BEDDING AND BACKFILL OF WATERMAINS

.14.01 General

OPSS.MUNI 401.07.10, 441.07.13 and 441.07.14 are revised by the following:

Bedding and backfill shall be conducted in accordance with the depths and widths specified on the standard drawings and/or on the Contract Drawings. No type of slag including steel slag, blast furnace slag or nickel slag will be permitted for bedding or backfilling of watermains or water service trenches. All granular bedding and cover materials shall meet the requirements of Form 600.

.14.02 Bedding

Bedding shall be Granular material conforming to Form 600, placed in accordance with WM-200.01 and 200.02. Granular material shall extend to a minimum of 300mm above the top of pipe. Bedding materials shall conform to Form 600 and shall be compacted in accordance with Form 900. Bedding shall be shaped and compacted adequately to support pipe barrel and bells as required.

No type of slag including steel slag, blast furnace slag or nickel slag will be permitted for bedding of watermains.

.14.03 Backfill

Unless otherwise specified on the Contract Drawings or documents, trenches may be backfilled with select, approved native excavated earth materials from trenches. Where these materials are unavailable or deemed to be unsuitable, granular backfill will be used. Where granular backfill materials are used, they shall conform to Form 600 and shall be compacted in accordance with Form 900.

No type of slag including steel slag, blast furnace slag or nickel slag will be permitted for backfilling of watermain trenches.

The use of unshrinkable fill shall be employed where normal means cannot produce the required compaction of the material.

.14.04 Summary of Bedding and Backfill Materials

Bedding and backfill of watermains shall be in accordance with the following:

.14.04.01 Ductile Iron and Polyvinyl Chloride (PVC) Pipe Watermain

Bedding and cover - Granular "A"

Backfill - Select approved excavated native materials or Granular "A" or "B" Type II

.14.04.02 Concrete Pressure Pipe Watermain

Bedding and cover - Granular "A"

Backfill - Select approved excavated native materials or Granular "A" or "B" Type II

.14.04.03 Water Services

Bedding and cover – Granular "D" (crushed stone)

Backfill: approved excavated native materials or Granular "A" or "B" Type II

.14.04.04 Hydrants

Bedding and cover - 19mm washed crushed stone

Backfill approved excavated native materials or Granular "A" or "B" Type II

.15 LAYING

.15.01 Laying Pipe

At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a suitable watertight plug. Before filling main with water in freezing weather, exposed pipe and fittings shall be covered with straw, or other approved means shall be taken in order to prevent freezing.

Refer to also OPSS.MUNI 441.07.14 and 441.07.15.

.15.02 Cutting Iron Pipe

Refer to OPSS.MUNI 441.07.16 Cutting of Pipe and the following:

The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe and in accordance with the manufacturer's recommendations.

The flame cutting of pipe by means of an oxyacetylene torch shall not be allowed nor shall the cutting of pipe with hammer and chisel be allowed.

.16 JOINTING MECHANICAL-JOINT PIPE

.16.01 Assembling Joints

Refer to OPSS.MUNI 441.07.15.

.16.02 Bolting of Joint

Refer to OPSS.MUNI 441.07.15 and all nuts shall be tightened with a suitable torque-limiting wrench. The torque for various sizes of bolts shall be as follows:

SIZE mm	RANGE OF TORQUE N·m
16	55-80
19	80-120
25	95-135
32	120-160

Nuts spaced 180° apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland.

.16.03 Permissible Deflection in Mechanical-Joint Pipe

Refer to Table 4.1 in Form 1000 – Amendments to Ontario Provincial Standards Volume 1, Division 4 - Drainage and Tunnels.

.17 JOINTING STEEL CYLINDER REINFORCED CONCRETE PIPE

Refer to OPSS.MUNI 441.07.15 Jointing

.18 JOINTING TYTON-JOINT PIPE

.18.01 Cleaning and Assembling Joint

Refer to OPSS.MUNI 441.07.15 Jointing

.18.02 Preparation of Spigot on Site

Where spigots require preparation on site, the outside of the spigot shall be filed to produce an angle of approximately 30°.

.18.03 Electrical Conductors

"Lockwedges" or strap-type electrical connections supplied by the pipe manufacturer shall be provided at each joint to ensure electrical conductivity. A minimum of two wedges per joint shall be installed in accordance with the manufacturer's directions.

Strap-type electrical connections shall be connected at each joint in accordance with manufacturer's directions.

The wedges shall be installed only after the pipe has been laid to proper line and grade and shall be preferably located at 180° apart.

.18.04 Permissible Deflection in Tyton-Joint Pipe

Refer to Table 4.2 in Form 1000 – Amendments to Ontario Provincial Standards Volume 1, Division 4 - Drainage, Watermains and Utility.

.18.05 Jointing Flange Pipe

Unless otherwise specified, the Contractor shall furnish all bolts, studs, nuts and gaskets required to completely connect up all flanged pipe, fittings, flanges and other appurtenances attached to the pipe.

All bolts and nuts shall have American Standard threads of the Coarse Thread Series, and shall conform to ASA B18.2. For sizes 28mm diameter and below, they shall be of the conventional type and the material shall conform to ASTM A-307 (Grade B). Materials for bolts and studs 31mm diameter and above shall conform to ASTM A-193 (Grade B-7) or to ASTM A-325 (S.A.E. Grade 5). Nuts shall conform to ASTM A-194 Grade 2H. Bolts shall have hexagonal heads and shall be held with hexagonal semi-finished nuts. The length of any bolt shall be such that it will not project beyond the nut more than 13mm or less than 6mm, and no bolt shall be less than the diameter of the hole in which it fits by more than 3mm.

Gaskets shall be red rubber full faced 3mm thick in accordance with dimensions given in the latest edition of ASME B16.21 for Non Metallic Gaskets for Pipe Flanges.

.19 SETTING VALVES AND FITTINGS

.19.01 Valve Boxes

Valve boxes shall be used for secondary valves at hydrants and where indicated on the watermain plans and profiles. Valve boxes shall be centred and plumb over the wrench nut of the valve, with the box cover flush with the surface of the finished pavement or such other level as may be directed. Refer to Standard Drawing WM-202. Installed valve boxes over gate valves shall be staked and the marking on the stake shall read "Gate Valve".

.19.02 Drainage of Mains

Drainage branches, blowoffs, air vents and appurtenances shall be provided with gate valves. Drainage branches or blowoffs shall not be connected to any sewer, submerged in any stream or be installed in any other manner that will permit back siphon into the distribution system.

.19.03 Dead Ends

All dead ends on new mains shall be closed with cast iron plugs or caps and provided with a 19mm corporation main stop.

.20 HYDRANTS

Hydrants supplied shall be in accordance with OPSS.MUNI 441.05.10, as amended by City standards and must be selected from the Approved Products List. Hydrants shall be installed in accordance with OPSS.MUNI 441.07.19, as amended and the following:

The Contractor shall supply and install the standard 3-way hydrants complete with secondary valves. Hydrant extensions and connections to the proposed watermains shall be in accordance with drawing WM-203.01 and WM-203.02, in the locations shown on the Contract Drawings. All hydrant extensions shall be done from the bottom, at the boot. No extension from the top will be permitted.

Long-side hydrant leads shall receive an additional gate valve and valve box installed on the lead at the main, close coupled with an anchor tee.

Hydrant leads shall be either ductile iron or polyvinyl chloride in accordance with Form 400.05 or 400.07, and shall include the appropriate corrosion protection.

All proposed or replacement hydrant lead pipe material (DI or PVC) shall match the proposed watermain pipe material. Fittings at the watermain can be either DI or PVC.

All parts of the hydrant above ground shall be primed and painted "Red", including caps, bonnets and Storz nozzles. Paint shall be phenolic alkyd primer conforming to CGSB-1.40 and exterior gloss alkyd type CGSB 1-GP-59 paint. Quick drying alkyd primers in accordance with CGSB-1.210 are not permitted for use.

If hydrant paint coatings are scratched or damaged during the course of the Work, the Contractor shall prime and paint the damaged areas. The Contractor shall use a Phenolic Alkyd primer conforming to CGSB-1.40 and Exterior Gloss Alkyd type CGSB 1-GP-59 paint and shall apply a minimum 2mm thickness in addition to the factory supplied primer and finish coat as required by Annual Supplies Specifications. The surface to be painted shall be clean, dry and free of grease.

For bedding and backfill requirements refer to Form 400.14.

The Contractor shall salvage all existing fire hydrants as directed by the Project Manager and deliver them to the Arvin Yard, where the Contract limits are east of (Upper) Wentworth Street.

Where the Contract limits are west of and including (Upper) Wentworth Street, hydrants shall be delivered to the Dundas Yard.

The City does not accept deliver of gate valves and secondary valves. The

Contractor will be responsible for removal and disposal off site of any of these materials.

Arvin Yard - 911 Arvin Avenue, Stoney Creek

Dundas Yard - 135 King Street East, Dundas

.21 BACKFLOW PREVENTERS

OPSS.MUNI 441.05.11 Double Check Valve Backflow Preventers

All backflow preventers used on hydrants shall be supplied by the City in accordance with Form 400 - Appendix A, Section 2.1.

Where Contract Documents require the Contractor to supply a backflow preventer, the type shall be in accordance with City of Hamilton By-Law 10-103 and CSA B64-11.

.22 ANCHORAGE

.22.01 Anchorage for Fittings

Unless otherwise noted in the Contract Documents, all fittings shall be anchored according to the method shown on the standard drawings, the Contract Drawings, or as otherwise directed. The concrete shall be placed such that the joints will be accessible for repairs.

.22.02 Metal Harness

Metal harness of tie rods or clamps of adequate strength to prevent movement shall be used. Steel rods or clamps shall be galvanized or otherwise rustproof treated, or shall be painted as shown or directed.

All restraints shall be protected with an approved corrosion protection tape system (primer, mastic and tape), applied to the satisfaction of the Project Manager.

.23 WATER SERVICES

Water services shall be installed in accordance with AWWA C800, OPSS.MUNI 441 and be selected from the Approved Products List.

.23.01 Services – 19mm to 50mm Diameter

Refer to OPSS.MUNI 441.07.15.07 Service Connection Pipe and the following:

Water service pipe shall be Type "K" soft copper and include the connection at the main and a curb stop with rod.

19mm and 25mm water services shall be installed in accordance with WM-207.01.

50mm water services shall be installed in accordance with OPSD 1104.02.

Connections to ductile iron watermain pipe shall be in accordance with Form 400.05.

Connections to PVC watermain pipe shall use a service saddle and be in accordance with Form 400.07.

Service connections to 100mm, 150mm and 200mm PVC mains shall be made by using PVC molded tapped couplings, conforming to AWWA C907 and CSA B137.2.

Where a water service is connected to a 50mm copper watermain loop, the connection shall be in accordance with WM-205.01 or WM-205.02.

Insulation of water services, where required, shall be in accordance with WM-207.03.

.23.02 Services - 100mm Diameter and Larger

Service connections shall be in accordance with OPSS.MUNI 441.07.15.07 Service Connection Pipe and the following:

Services shall be installed in accordance with WM-207.04 and WM-207.05, include the connection at the main, a reducer where required, a gate valve and valve box at property line.

Long-side services shall receive an additional gate valve and valve box installed on the service at the main, close coupled with an anchor tee.

Service pipe shall be either ductile iron or polyvinyl chloride in accordance with Form 400.05 or 400.07 and shall be constructed using the same pipe material as the proposed watermain.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

All fittings on all water services 100mm or greater shall be restrained from the main to the service valve at the property line.

.23.03 Curb Boxes

Curb boxes are to be located in accordance with standard watermain drawing WM-207.01 and WM-207.02 or as otherwise directed.

The Contractor shall indicate the positions of all water services installed in the following manner:

At each curb box location, a 1.83m, 50mm x 100mm wooden stake shall be planted and shall have a 1 metre bury. Stakes shall be painted white, and each shall bear, on its broad side, above ground, the words "WATER SERVICE", painted in black.

The Contractor shall be responsible for the preservation of all marker stakes. Where stakes are damaged or displaced in any way, the Contractor shall arrange to

have the stakes replaced and accurately positioned, at their own expense.

.23.04 Trench for Water Service

The Contractor shall excavate and backfill the service trench from the watermain to the street line to a minimum depth of 1.6m below the proposed road grade whichever is the lower elevation unless otherwise directed.

.23.05 Laying Water Service Pipe

The Contractor shall lay the service pipe and install fittings to the street line. Soldered joints will not be permitted.

The service shall be bedded in accordance with Standard Drawing No. WM-200.01 and WM-200.02.

If laid over a sewer service or in a rock trench, the pipe shall be laid on a minimum of 150mm of tamped earth or sand. Service corporation fittings shall be installed into the watermain under pressure.

Valves in service pipe lines shall be properly braced before any pressure test is conducted.

Backfill for water service trenches shall be as specified for the watermain trench.

Service pipe at street line shall be temporarily plugged to prevent entrance of foreign material.

.23.06 Leaks in Services

All leaks that may develop in service lines laid by the Contractor within two years after date of completion of Contract shall be immediately repaired by the Contractor when notified by the Project Manager. Emergency repairs will be made by the City at the Contractor's expense.

.24 CONCRETE AND MORTAR

.24.01 Materials

Refer to OPSS.MUNI 441.05.13, 441.07.23 and OPSS Division 9. Concrete shall be Type HS High Sulfate Resistant in accordance with OPSS 1301 and Form 700.

.24.02 Proportioning and Mixing Mortars

Refer to OPSS.MUNI 441.05.14 and OPSS Division 9.

.24.03 Jointing Old and New Work

All joints between different sections of concrete masonry shall be made in an approved manner after the adjoining surfaces are cleaned, washed, roughened and coated with a neat cement grout, at locations approved of by the Project Manager, suitable provisions being made for the bonding of said joints.

.24.04 Placing in Water

No concrete shall be laid in water, except by permission of the Project Manager, nor shall water be allowed to rise and flow over newly placed concrete for a period of 24 hours.

.24.05 Forms

Forms shall be of such strength and rigidity and so supported that they will not deflect objectionably under the weight of pressure of the wet concrete.

They shall be properly braced and tied together so as to maintain position and shape, and prevent leakage of mortar.

Forms shall be so constructed that the finished concrete will conform to the shapes, lines, grades and dimensions indicated on the plans.

The face adjacent to the exposed concrete face shall consist of dressed lumber, smooth and clean.

.24.06 Form Removal

Shoring and forms shall not be removed before the time determined by the Project Manager.

.24.07 Curing of Concrete

After concrete has sufficiently set, its exposed surfaces shall be kept continuously moist for a period of at least seven (7) days.

Effective means shall be provided for maintaining the temperature of the concrete at not less than 10° C for at least 72 hours after placing. The temperature shall then be reduced at a maximum rate of 5.6° C per day until that of the surrounding atmosphere has been reached.

No concrete shall be deposited on ground that is frozen or which contains frozen materials.

Hydrostatic testing shall not be carried out until concrete anchor or thrust blocks have a minimum of 5 days curing time.

.24.08 Finish

Special care shall be used to secure smooth, uniform finish to the exposed surface of concrete. After form removal, concrete surfaces shall be immediately rubbed smooth to a uniform, satisfactory finish, and all surfaces subject to wear shall be faced with facing mixture where shown on the plans.

.24.09 Defects

Should any voids or other defects be discovered in any part of the Work when the

forms are taken down, or at any other time, the defective Work shall be removed and the space refilled with a suitable concrete mortar in a proper manner at the expense of the Contractor.

.24.10 Reinforcing Steel

The ties for reinforcing shall not show on the exposed face of the concrete. All steel for reinforced concrete shall be supplied by the Contractor.

.25 DISINFECTION, TESTING AND CONNECTION OF WATERMAINS

OPSS MUNI. 441.07.25 - Flushing and Disinfecting Watermains

Revised as follows:

All connections, flushing, hydrostatic testing, swabbing, and bacteriological testing procedures shall be in accordance with Form 400 - Appendix A and the Ministry of the Environment, Conservation and Parks (MECP) Watermain Disinfection Procedure.

TABLE OF CONTENTS

1.0	INTRODUCTION
1.1	Scope: Watermain Testing Procedures
1.2	Definitions
1.3	References
1.4	General Requirements for Watermain Installation
1.5	Connection and Testing Procedures Plan and Meeting
1.6	Forms
1.7	Supervision, Testing and Records
1.8	Valve Operation
2.0	WATERMAIN TESTING PROCEDURE
2.1	Temporary Connection and Backflow Preventer
2.2	Charging of Watermains
2.3	Swabbing
2.4	Hydrostatic Testing
2.5	Disinfection of Watermains
2.6	Removal/Disposal of Super Chlorinated Water
2.7	Bacteriological Sampling
3.0	CONNECTION TO EXISTING WATER DISTRIBUTION SYSTEM
3.1	Connection and Tapping of Watermains
4.0	WATER SERVICES
5.0	WATERMAIN BREAKS
6.0	RELINING OF WATERMAINS

1.0 INTRODUCTION

1.1 Scope: Watermain Testing Procedures

This procedure covers the cleaning, disinfection, hydrostatic testing and sampling of watermains. Unless specified otherwise this procedure applies to new and existing watermains, above ground by-pass watermains and relined watermains.

1.2 Definitions

Appurtenance means an appurtenance within the meaning of O. Reg. 170/03.

Category 1 Classification are watermain breaks with no evident or suspected contamination.

Category 2 Classification are watermain breaks with evident or suspected contamination.

Contaminant means foreign matter that is not intended to enter a watermain.

Contamination means the introduction of a Contaminant into a watermain.

Contractor means the person, partnership or Corporation undertaking the Work as identified in the agreement.

CHEL means the City of Hamilton Environmental Laboratory.

CSR means City of Hamilton Customer Service Representative.

CS&CO means City of Hamilton Customer Service and Community Outreach section.

Disinfectants means calcium or sodium hypochlorite that meets or exceeds ANSI/AWWA B300 or liquid chlorine that meets or exceeds ANSI/AWWA B301.

Flushing means post repair valve operation to restore secondary disinfection and discharge suspended materials by flowing water through the repaired section of watermain and out of the system. This definition does not include recharging the watermain or a requirement to achieve scouring velocity within the watermain.

Inspector means the City of Hamilton, Public Works, Engineering Services Contract Inspector or the City of Hamilton, Planning and Economic Development, Growth Management Inspections/Development Construction Coordinator who hold a minimum MECP, O.Reg. 128/04 Drinking-Water Operator Certificate.

LIMS means the City of Hamilton Environmental Laboratory work order database.

LWO Number means the City of Hamilton Environmental Lab Work Order Number.

MECP means the Ministry of the Environment, Conservation and Parks.

Neutralizing Agent means Sodium Thiosulfate that meets or exceeds Table A of ANSI/AWWA Standard C655

Project Manager means the City of Hamilton, Public Works, Engineering Services Project Manager or the City of Hamilton, Planning and Economic Development, Growth Management Project Manager.

SDWA means the Safe Drinking Water Act of Ontario.

Service Pipe means a service pipe within the meaning of O. Reg. 170/03.

Specialist means a company specializing in regulated water systems or a company approved by the Project Manager.

NSF 61 means the National Sanitation Foundation, Standard 61.

1.3 References

These procedures are based on and shall be used in conjunction with, the following:

- Ontario Provincial Specifications (OPS),
- American Waterworks Association Standards (ANSI/AWWA C651 – Disinfecting Water Mains and Appendices A and B),
- Safe Drinking Water Act of Ontario
- Ministry of the Environment, Conservation and Parks (MECP) – Watermain Disinfection Procedure
- The City of Hamilton Design Criteria
- The Canadian Standard Association - CAN/CSA-B64.10
- Hamilton Water procedure PW-WW-P-013-007 entitled DWQMS Water Quality Testing for New Watermain Connections.

1.4 General Requirements for Watermain Installation

The Contractor shall keep pipes clean and dry and take precautions to protect the interiors of pipes, fittings and valves against contamination. End caps shall be installed when Work is not in progress and removed only when connecting the next pipe or appurtenance or continuing Work. Pipes shall not be laid directly in water. Existing watermains, which are dead ended during construction, shall have a minimum 25mm bleeder installed at the dead end. New watermains which are temporarily dead ended shall have a minimum 50mm blow off installed with a temporary cap if there is no hydrant downstream of the last water service on the watermain.

1.5 Connection and Testing Procedures Plan and Meeting

The Contractor shall provide a plan to the Project Manager and Inspector detailing the connection locations, swabbing locations, hydrostatic testing, chlorination and dechlorinating methods, disposal of water and final connection methods prior to the commencement of such works. If the project is being constructed in phases, this plan shall detail each of these items for each phase.

A watermain connection and testing meeting shall be held by the Project Manager prior to any commissioning procedures.

1.6 Forms

The following forms are attached to this document:

- a) Watermain Commissioning Form – Swabbing and Hydrostatic Testing Record
- b) Watermain Commissioning Form – Disinfection and Chlorine Residual Sample Record
- c) Record of Watermain Break Form

1.7 Supervision, Testing and Records

The Inspector shall witness all cleaning, swabbing, hydrostatic testing, disinfection, and shall conduct sample collection along with the Specialist carrying out the cleaning and disinfection.

The Inspector shall take and record measurements on the appropriate Watermain Commissioning Form.

1.8 Valve Operation

City of Hamilton Water Distribution staff must perform the operation of all existing valves inclusive of hydrant secondary valves. In the event of an emergency, the Inspector may operate or direct the Contractor to operate valves.

The Contractor shall be responsible for dewatering any chambers that are fully or partially submerged for the City operation of the valves related to construction activities.

The opening and closing of any valve should be coordinated with the Inspector. All known affected residences or businesses shall be notified 48 hours prior to a planned disruption of water service.

2. WATERMAIN TESTING PROCEDURE

This document is to be read in conjunction with the forms attached to the end of this document. These procedures are to be used in conjunction with the Ontario Provincial Standard Specifications (OPSS), the American Waterworks Association Standards (AWWA) and the Safe Drinking Water Act of Ontario (SDWA), including the MECP - Watermain Disinfection Procedure.

All Works associated with swabbing, hydrostatic testing, chlorination, dechlorinating and disinfection of the watermain are to be performed by a Specialist and shall be witnessed by the Inspector. The Inspector in charge of monitoring shall take and record measurements as per the Commissioning Forms attached herein.

Temporary by-pass piping shall meet all procedures and requirements of new watermain with the exception of hydrostatic testing. A visual check shall be performed at line pressure on a temporary by-pass to ensure that it is leak free.

2.1 Temporary Connection and Backflow Preventer

The temporary connection is to be used for all water supplies to maintain continuous supply of water unless otherwise noted. The size of the temporary connection shall be 50mm diameter for watermains up to and including 200mm diameter, and 100mm diameter for watermains greater than 200mm and up to 400mm diameter, inclusive. All materials for the temporary

connections are to conform to the City of Hamilton Approved Products List. Watermains larger than 400mm in diameter shall be as per design standards.

For Public Works projects, the hydrant adapter (backflow preventer and meter) shall be a reduced pressure zone device type and shall be supplied by the City of Hamilton upon receipt of request from the Project Manager.

For Planning and Economic Development projects, the hydrant adapter (backflow preventer and meter) shall be a reduced pressure zone device type and shall be supplied by the City of Hamilton upon request from the Inspector on behalf of the Contractor.

The adapter shall be installed on a prescribed hydrant and charged by a City of Hamilton Water Distribution Operator. Hydrant(s) utilized as the source water for temporary by pass will be determined by the Project Manager in consultation with City of Hamilton Water Distribution staff.

The existing distribution system and backflow preventer shall be physically disconnected from the test section during all hydrostatic testing.

2.2 Charging of Watermains

The watermain is to be recharged via a temporary connection equipped with an approved backflow preventer.

2.3 Swabbing

The isolated section of watermain shall be charged or pressurized prior to the commencement of swabbing. The swabs shall be numbered and carefully controlled by the Specialist to ensure that all swabs that are introduced into the watermain are retrieved and accounted for. The Inspector shall witness and record the number of swabs inserted and retrieved. All swabs must be inspected prior to insertion and immediately after they exit the watermain to ensure that they have remained intact and that pieces of the foam do not remain inside the watermain. New swabs shall be used for this procedure and under no circumstances will used swabs be allowed.

All smooth-wall watermain pipes up to 750mm in diameter must be swabbed using a minimum of THREE swabs plus, a minimum of one swab shall be passed through each large diameter water service, stub or blow-off, and where a hydrant lead exceeds two pipe lengths. Additional swabs shall be used as directed by the Project Manager or Inspector should discharge water not run clear within ten seconds of the last swab exiting the discharge point. No additional payment shall be made for subsequent swabbing.

Swabs shall be forced through the watermain using potable water at a minimum velocity of 0.6m to 1m per second. The Project Manager must approve all methods of disposal of the discharged water. The Contractor shall take all necessary precautions to minimize soil erosion and shall reinstate any affected areas upon completion.

The swabs must be new, open cell polyurethane foam, having a density of 1.5 pounds per cubic foot (24 kilograms per cubic metre) and are to be a minimum of 50mm larger than the nominal pipe diameter with a length at least one and a half times its diameter. Watermains 300mm or smaller may be swabbed through hydrants with the approval of the Project Manager. Procedures for swabbing watermains larger than 300mm must also be approved by the Project Manager.

2.4 Hydrostatic Testing

Leakage tests shall be carried out on the test section of watermain after swabbing operations have been successfully completed. The Contractor shall ensure that no air pockets are present in the test section of watermain. The existing distribution systems and the backflow preventer shall be physically disconnected from the test section during all hydrostatic testing. The test section shall be capped and the main filled with potable water under a pressure of 1035 kPa (150 psi). After any visible leaks are stopped, leakage shall then be measured by a calibrated meter with readings taken at fifteen minute intervals for a period of two hours and recorded on the Watermain Commissioning form. The allowable leakage shall not exceed 0.082 litres per millimetre of pipe diameter per kilometre of pipe for the 2-hour test period. If the leakage exceeds this figure, the Contractor shall locate and repair all leaks and the test section shall be retested until a satisfactory result is obtained.

The watermain is to be tested in sections, where a section is a length of watermain between two valves or a valve and a dead end. Should the Contractor wish to test more than one section at a time, the Project Manager/ Inspector will calculate the allowable leakage for all sections within the tested portion and the smallest calculated leakage will become the allowable for the entire tested portion.

2.5 Disinfection of Watermains

Disinfection of watermains shall be done in accordance with ANSI/AWWA C651 – Disinfecting Water Mains, as amended by the MECP Watermain Disinfection Procedure and this Form.

Water distribution watermains shall be disinfected using the continuous-feed method of chlorination.

Trunk/transmission watermains shall be disinfected using the continuous-feed method or the slug method of chlorination.

2.5.1 Continuous-Feed Method of Chlorination

Watermains shall be completely filled to remove air pockets and flushed to remove any particulates. After flushing is completed, the main shall be filled with potable water.

The chlorine solution shall be thoroughly mixed prior to pumping it into the system. Chlorine solution shall be injected into the system through the access point at the temporary connection. The chlorine solution shall be applied so that the initial chlorine concentration is a minimum of 50mg/L throughout the system and does not exceed 120mg/L.

The chlorine solution shall flow through each hydrant and blow-off ports. The high chlorine residual is to be measured and recorded by the Inspector at each sample location in conjunction with the Specialist.

The high chlorine concentration shall be left in the isolated system for a minimum of 24 hours. After the required contact time, the chlorine residual shall be measured and recorded at each sample location by the Inspector in conjunction with the Specialist. Flow required to take the chlorine residuals shall be provided through a temporary connection.

The maximum allowable decrease in chlorine concentration after 24 hours is 40% of the initial chlorine concentration, to a maximum decrease of 50 mg/L.

Table 1: Chlorine Concentration and Contact Time for Continuous-Feed Method of Chlorination		
Minimum Contact Time	Initial Chlorine Concentration	Maximum Allowable Decrease in Chlorine Concentration
24 hours	Minimum 50mg/L not to exceed 120mg/L	40% of the Initial Chlorine Concentration (to a Maximum of 50mg/L)

The following examples are provided to demonstrate the proper use of Table 1:

Example 1

When using the continuous-feed method of chlorination with an initial chlorine concentration of 50mg/L, the maximum allowable decrease in chlorine concentration is 40% of 50mg/L, or 20mg/L. Therefore, at least 30mg/L of chlorine must be present after 24 hours.

Example 2

When using the continuous-feed method of chlorination with an initial chlorine concentration of 150mg/L, the maximum allowable decrease in chlorine concentration is 50mg/L, because 40% of 150mg/L is greater than the maximum allowable decrease of 50mg/L. Therefore, at least 100mg/L of chlorine must be present after 24 hours. However, the initial chlorine concentration should not exceed 120mg/L.

If the chlorine residual meets the above Table 1 criteria after 24 hours, the chlorine is ready to be discharged. In the event that the chlorine residual is less than the allowable levels after 24 hours, the chlorine in the system is to be discharged and the system is to be re-chlorinated.

The Inspector has the authority to require further swabbing if the residual is less than the allowable levels after 24 hours. Once this has been achieved, the watermain shall be flushed and sampled for chlorine residual levels.

Minimum acceptable levels are 40% of the initial chlorine concentration to a maximum decrease of 50mg/L.

Note:

Where copper pipe is used for smaller diameter water mains (less than 100mm), Table 1 does not apply. Copper water mains shall be disinfected using the continuous-feed method, with an initial chlorine concentration of ≥ 50 mg/L. Due to the chlorine demand exerted by the copper, no minimum chlorine concentration is required following the 24 hour contact time, and the effectiveness of the disinfection process shall be demonstrated by the bacteriological testing.

2.5.2 Slug Method of Chlorination

Water mains shall be completely filled to remove air pockets and flushed to remove any particulates. After flushing is completed, the main shall be filled with potable water.

The chlorine solution shall be thoroughly mixed prior to pumping it into the system.

Through the access point at the temporary connection, the system shall receive a dose of chlorine, fed at a constant rate such that the water will have not less than 100mg/L chlorine concentration, not to exceed 200mg/L.

The chlorine shall be applied continuously and for a sufficient period of time to develop a solid column, or slug, of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration no less than 25mg/L of the initial chlorine concentration for at least 3 hours.

The chlorine residual shall be measured in the slug as it moves through the main. The duration of disinfection as well as the initial and residual chlorine concentration, at the end of the contact time, shall be measured and recorded by the Inspector at each sample location in conjunction with the Specialist.

If at any time the chlorine residual drops more than 25 mg/L, the flow shall be stopped; chlorination equipment shall be relocated at the head of the slug; and, as flow resumes, chlorine shall be applied to restore the chlorine in the slug to not less than 100 mg/L.

As chlorinated water flows past fittings and valves, related valves and hydrants in the isolated system shall be operated so as to disinfect appurtenances and pipe branches.

Table 2: Chlorine Concentration and Contact Time Slug Method of Chlorination		
Minimum Contact Time	Initial Chlorine Concentration	Maximum Allowable Decrease in Chlorine Concentration
3 hours	Minimum 100mg/L not to exceed 200mg/L	25mg/L

The following example is provided to demonstrate the proper use of Table 2:

Example:

When using the slug method of chlorination, with a minimum contact time of 3 hours, the chlorine concentration shall be measured in the slug at the beginning of the disinfection process, as the slug moves through the watermain, and at the point of discharge. If at any point the chlorine concentration has decreased by more than 25 mg/L, the flow shall be stopped and additional chlorine shall be added to restore the chlorine concentration in the slug to not less than 100 mg/L, not to exceed 200mg/L. For example, if the initial chlorine concentration in the slug is 150 mg/L, then the chlorine concentration must not decrease below 125 mg/L.

2.6 Removal/Disposal of Super Chlorinated Water

The Contractor shall dechlorinate the discharge water to protect receiving streams and other bodies of water, via catch basins or other points of entry, as per the MECP regulations and ANSI/AWWA C651 as amended. If in near proximity to the sewer treatment plant, the plant is to be notified and must approve receiving the water. The Contractor shall be required to supply all labour, equipment and materials to dechlorinate the water including, but not limited to, de-chlorination mats, diffusers and dechlorinating chemicals.

2.7 Bacteriological Sampling

Bacteriological sampling shall be done in accordance with ANSI/AWWA C651, the MECP - Watermain Disinfection Procedure – Section 1.1.2, and the following:

Prior to chlorine residual and bacteriological sampling, all other testing and disinfection shall be completed, and any super chlorinated water be removed from all portions of the watermain system under consideration including hydrant leads, stubs, branches, services, etc.

After the discharge of super-chlorinated water, the Inspector shall field test for residual chlorine at each testing point of the new watermain to be no less than 0.25mg/L and to be no greater than 3.0mg/L.

Once chlorine residuals are confirmed, the Inspector shall take the bacteriological samples at each sample location and deliver them to the City of Hamilton Environmental Laboratory. Hoses and hydrants shall not be used for the collection of bacteriological samples.

Before any watermain, or temporary above ground by-pass system can be approved for connection to the existing water distribution system, all samples shall pass the appropriate chlorine residual tests (respective to the drinking water system – Woodward, Fifty Road and communal wells) and bacteriological testing requirements as per the City of Hamilton Laboratory testing procedures.

The watermain must remain connected to the approved backflow preventer from the start of the bacteriological testing until the connection to the existing system is undertaken.

If all sample results are successful, the system will then be ready to be placed into service. Contrary to this, a single failed bacteriological parameter will constitute a failure of the entire sampling round. If sample results do not meet requirements, the failed section must then be flushed or re-disinfected as directed by the Project Manager/Inspector and re-sampled at the sample locations.

3. CONNECTION TO EXISTING WATER DISTRIBUTION SYSTEM

Connections to the existing water distribution system shall be done in accordance with ANSI/AWWA C651 and the following:

Once the bacteriological tests have passed and the approval has been given by the Project Manager, the connection to the existing watermain shall be performed, which shall be witnessed and documented by the Inspector.

A sump, minimum 300mm depth, shall be excavated in the trench bottom and be filled with clear stone to provide a location to collect and pump water.

Watermains shall be cut back to remove any temporary taps. The Contractor shall disinfect the connection watermain pipe as outlined in section 3.1 and shall dewater the watermain and trench in a controlled manner as to not allow backflow of water into the watermain.

If trench water, dirt, or debris has entered the watermain during the final connection, the watermain shall be aggressively flushed and additional bacteriological samples shall be taken as directed by the Inspector. If contamination is evident or suspected, the procedures defined under Section 3 of the MECP - Watermain Disinfection Procedure for Category 2 watermain breaks shall apply.

3.1 Connections and Tapping of Watermains

The new pipe, fittings and valves required for the connection shall be spray-disinfected and

swabbed with a minimum 1 percent free chlorine disinfecting solution immediately prior to being installed. The existing watermain being connected to shall also be cleaned in the immediate area of the connection and spray-disinfected with the same solution.

Where existing watermains are tapped, the drill/cutting/tapping bits and all surfaces of mainstops, service saddles, tapping sleeves and valves which will come into contact with drinking water shall likewise be cleaned and disinfected.

The Contractor shall make every reasonable effort to ensure that the final connection is no more than one pipe length.

4. WATER SERVICES

Service connections shall be tapped and connected under pressure. All connections shall be inspected to ensure they are drip tight prior to backfilling. The pipe shall be left exposed until directed by the Inspector, after which backfilling shall be completed.

Services 100mm in diameter and larger shall be considered mainline and shall meet all mainline procedures and testing requirements of Section 2.5 Disinfection of Watermains, and MECP - Watermain Disinfection Procedure - 1.1 New Watermains.

For new services 38mm in diameter up to but not including 100mm diameter, sanitary conditions must be maintained during installation and shall be thoroughly flushed prior to connecting to the existing service. Required drill / cutting / tapping bits, and all surfaces of mainstops, service saddles, tapping sleeves and valves which will come into contact with the drinking water shall be cleaned and spray-disinfected with a minimum 1 percent free chlorine disinfecting solution immediately prior to the connection.

If any of the disinfected surfaces come into contact with the soil and/or water in the excavation prior to use, the cleaning and disinfection procedure shall be repeated.

All by-pass services hoses to be used shall be of potable water grade and shall meet the requirements of NSF 61 Standard. Service hoses shall be capped on both ends with brass caps until installed. Service hoses shall not be installed on by-pass piping until the day of the change over from the distribution watermain to the above ground by-pass watermain, and shall be thoroughly flushed prior to connection.

5. WATERMAIN BREAKS

Watermain breaks shall be treated in accordance with the MECP – Watermain Disinfection Procedure, Section 3. Watermain Disinfection Procedures for Emergency Repairs.

The watermain break repair process is to be documented by completing a Record of Watermain Break Form attached to this document. A copy of the completed Form shall be sent to Hamilton Water Distribution.

6. RELINING OF WATERMAINS

Relining of existing watermains shall be treated in accordance with the MECP – Watermain Disinfection Procedure, Section 1.2 Relining of Watermains, and Section 2.5 of this document.

WATERMAIN COMMISSIONING FORM
Swabbing and Hydrostatic Testing Record

CONTRACT/SITE NAME:

DATE:	LOCATION:
TIME:	
PERFORMED BY:	WITNESSED BY:
No. SWABS INSERTED:	No. OF SWABS RETRIEVED:

DATE	WATERMAIN SECTION, LENGTHS AND DIAMETERS	TIME	LEAKAGE (litres)

0.082 L/mm of pipe diameter per kilometre of pipe for the 2 hour test period

PRESSURE TEST PASSED: YES NO

RECORD OF WATERMAIN BREAK FORM

Watermain Breaks

Category 1: Where there is **no** evidence or suspected Contamination of the watermain before and/or during the repair process.

Category 2: Adverse Water Quality Incident where there **is** evidence or suspected Contamination of the watermain before and/or during the repair process, or where the watermain pipe repair is greater than 6.0m.

Note: In Special Cases of Sewage or Chemical Contamination contact the Water Distribution O.R.O. or the Manager of Water Distribution.

For Watermain Breaks Categories 1 & 2:

Name of Operator-In-Charge (OIC):	Type of watermain repair:
Date: Time:	Flow maintained until Air-gap created: [] Yes [] No
Location:	Air-gap maintained through repair process: [] Yes [] No
Size of watermain:	Pipe & repair parts disinfected: [] Yes [] No
Watermain pipe material:	Post-repair Flushing undertaken: [] Yes [] No
Type of watermain break:	Microbiological samples taken: [] N/A [] Yes [] No
Observations:	

For Watermain Breaks Category 2 (Records in addition to the above):

Method of Disinfection: [] Spray [] Continuous [] Slug	Microbiological samples taken: [] Yes [] No
Initial Chlorine Concentration (ICC) (ppm):	Chain of custody prepared: [] Yes [] No
Final Chlorine Concentration (FCC) (ppm): FCC % (% of ICC):	Watermain returned to normal service: [] Yes [] No <i>Date:</i> <i>Time:</i>
Contact time (hrs,min):	Water Advisory declared: [] Yes [] No [] N/A <i>Date:</i> <i>Time:</i>
Post-repair Flushing (hrs,min):	Ministry Office - notification: [] Yes [] No [] N/A <i>Date:</i> <i>Time:</i>
Upstream residual reading (mg/L):	Spills Actions - notification: [] Yes [] No [] N/A <i>Date:</i> <i>Time:</i>
Downstream residual reading (mg/L):	Medical Officer of Health notification: [] Yes [] No [] N/A <i>Date:</i> <i>Time:</i>
Describe site specific plan and/or additional steps required by the MECP Watermain Disinfection Procedure, Sections 3.4.1 and 3.4.2:	

*If final downstream disinfectant residual is less than 0.2mg/L free chlorine in a chlorinated system or 1.0 mg/L combined chlorine in a chloraminated system, then provide the location and results of upstream disinfectant residuals(s) or by using documented benchmarks for the area, as per Section 3.2.6 of the Ontario Watermain Disinfection Procedure.

TABLE OF CONTENTS

.01	GENERAL	2
.02	SUPERPAVE MIXES	2
.02.01	Design Requirements	2
.02.01.01	Submission and Design Requirements	2
.02.01.02	Mix Requirements for Design Purposes – Hot Mix and Warm Mix.....	2
.02.01.03	Additional Design Requirements for Warm Mix Asphalt.....	3
.02.01.04	Submission Requirements – Warm Mix Asphalt	3
.02.01.05	Superpave Mix Verification	4
.02.01.06	Asphalt Cement Requirements.....	5
.02.02	Materials	5
.02.02.01	Aggregate	5
.02.02.02	Performance Graded Asphalt Cement (PGAC).....	5
.02.02.03	Reclaimed Asphalt Pavement (RAP).....	7
.02.03	Construction	8
.02.03.01	Pre-pave Meeting	8
.02.03.02	Asphalt Plant Inspection	8
.02.03.03	Tack Coat	8
.02.03.04	Placement of Binder and Surface Course Asphalt	8
.02.03.05	Binder Course Asphalt – Temporary Ramping	9
.02.03.06	Use of Paving Equipment – Paving in Echelon	9
.02.03.07	Asphalt Material Transfer Vehicle.....	9
.02.03.08	Re-Heating and Compaction of Longitudinal Joints	9
.02.03.09	Review of Longitudinal Joint Quality.....	10
.02.03.10	Aggregate Gradation and Asphalt Cement Content Acceptance	10
.02.03.11	Air Voids Acceptance for HMA Production	12
.02.03.12	Referee Testing	12
.02.03.13	Asphalt Layer Segregation	13

.01 GENERAL

This specification covers the requirements for hot mix asphalt designed using the Superpave method, including warm mixes.

Unless otherwise amended herein, the design, materials, production and placement of hot mix asphalt shall conform to the following:

- OPSS.MUNI 310 – Construction Specification for Hot Mix Asphalt, including Appendix C
- OPSS.MUNI 1003 – Material Specification for Aggregates – Hot Mix Asphalt
- OPSS.MUNI 1101 - Material Specification for Performance Graded Asphalt Cement
- OPSS.MUNI 1151- Material Specification for Superpave and Stone Mastic Asphalt Mixtures.

.02 SUPERPAVE MIXES

Superpave types shall be as specified in the contract documents, shall be in accordance with Tables 1 and 2 of OPSS.MUNI 1151, and shall be approved prior to use.

The Performance Graded Asphalt Cement (PGAC) shall be in accordance with OPSS.MUNI.1101, as amended by this specification.

.02.01 Design Requirements

.02.01.01 Submission and Design Requirements

The design of Superpave mixes shall be in accordance with the requirements of OPSS.MUNI 1151 Material Specification for Superpave and Stone Mastic Asphalt Mixtures, as amended by this specification.

.02.01.02 Mix Requirements for Design Purposes – Hot Mix and Warm Mix

1151.04.01 of OPSS.MUNI 1151 is amended by the addition of the following:

Asphalt cement shall be performance graded asphalt cement and shall be as described in section .02.02.02.

The Contractor shall design, produce and place asphalt in accordance with the following:

- All surface and binder course asphalt produced and placed on or after November 1 of any year shall be a Warm Mix;
- Where weather conditions at the time of paving prevent the placement of Hot Mix asphalt in accordance with OPSS temperature requirements, a Warm Mix shall be used.

Warm mix asphalt shall be in accordance with section 02.01.03.

.02.01.03 Additional Design Requirements for Warm Mix Asphalt

OPSS.MUNI 310.04.01 of OPSS.MUNI 310 - Appendix 310-C is hereby deleted and replaced with the following:

The Contractor shall be responsible for the following:

- a) Using an approved WMA additive listed below:
 - i) Advera
 - ii) Evotherm
 - iii) Hyper Therm
 - iv) Sasobit
 - v) SonneWarmix
- b) Preparation of the mix design and reporting of all testing results in accordance with test method LS-318 Practice for the Design of Superpave Warm Mix Asphalt (WMA).
- c) Any WMA technology not listed in a) above shall be subject to review and approval by the City.
- d) The WMA mix design and the job mix formula at the anticipated WMA production temperature, both of which shall be according to the requirements of this specification.
- e) Ensuring that, during the development and verification of the WMA mix design, the WMA technology does not adversely affect the asphalt cement performance grade and the WMA mixture performance.
- f) Moisture content of the aggregate coming from the dryers shall not exceed 0.5%.

.02.01.04 Submission Requirements – Warm Mix Asphalt

OPSS.MUNI 310.04.02 of OPSS.MUNI 310 - Appendix 310-C is deleted and replaced by following:

A minimum of 4 weeks prior to paving with WMA, the following information shall be submitted to the Project Manager, in writing:

- a) The name of the supplier and the approved WMA technology selected.
- b) All test results required under LS-318 and any other details on how the requirements of this specification shall be met.
- c) If applicable, the type and dosage of WMA additives, how the additives are to be incorporated to produce the WMA, and the WMA technology supplier's established recommendations for usage.

- d) Where a proposed technology is not currently approved, the Contractor shall submit the following information a minimum of 4 weeks prior to proposed paving dates for review and approval:
 - i) Name of process, manufacturer, type of process and the technology group;
 - ii) Manufacturer's recommendations including:
 - a) Process description and mix design recommendations;
 - b) Required plant modification and hauling recommendations;
 - c) Mixing and compaction temperatures;
 - d) Construction aspects, if any differences from conventional HMA paving besides temperatures.
 - iii) Projects where the process has been used including:
 - a) Client including contact information (telephone, email);
 - b) Mix designs;
 - c) Date and location of construction;
 - d) To date performance.

Where the proposed technology is not approved, the Contractor shall be required to supply and place an approved technology.

.02.01.05 Superpave Mix Verification

1151.04.02.02.02 of OPSS.MUNI 1151 is amended by the addition of the following:

After receiving the asphalt mix design from the Contractor's own laboratory or from a hired firm's laboratory, the Contractor shall provide asphalt mix verification test results in accordance with the following criteria:

- a) The tests must be performed by a laboratory independent from the firm producing the asphalt mix design.
- b) The laboratory performing verification testing must have a valid "Certificate of Conformance" issued by the Canadian Council of Independent Laboratories (CCIL) Asphalt Laboratory Certification Program and be qualified under the following categories:
 - i) Asphalt Mix Design – Marshall and Superpave Methods (Type A)
 - ii) Asphalt Mix Compliance – Marshall and Superpave Methods (Type B)

All verification testing must be reviewed and accepted by the City of Hamilton prior to the start of any paving operations.

The mix design shall be submitted for acceptance at least 4 weeks before construction. The mix design shall be reviewed and approved by the City.

Prior to construction, at the discretion of the Project Manager, a trial batch may be required for verification and approval.

The submitted mix design shall include the JMF and the documents listed in Section 1151.04.05 of OPS 1151 MUNI. The mix design that does not include the required documents will not be reviewed and accepted.

.02.01.06 Asphalt Cement Requirements

The asphalt cement content of the approved JMF shall be equivalent to or greater than those shown in Table 800-1.

**TABLE 800-1
Superpave Minimum Asphalt Cement Content**

Mix Type	Minimum Asphalt Cement Content for JMF
Superpave 9.5	5.5
Superpave 12.5	5.0
Superpave 19mm	4.8
Superpave 25mm or greater	4.6

.02.02 Materials

.02.02.01 Aggregate

Aggregates used shall be in accordance with OPSS.MUNI 1003 Material Specification for Aggregates – Hot Mix Asphalt.

.02.02.02 Performance Graded Asphalt Cement (PGAC)

Performance Graded Asphalt Cement shall be in accordance with OPSS.MUNI 1101 - Material Specification for Performance Graded Asphalt Cement, as amended by the following:

1101.05 of OPSS.MUNI 1101 is amended by the addition of the following:

The basic grade of asphalt cement shall be PG 58–28.

In accordance with ASTM M332 standard, the dynamic shear, T 315, $G^* \sin \delta$ carried out on the residue from pressurized aging vessel (PAV), shall be maximum 6,000 kPa for 58H,V, E -28.

1101.08.03 of OPSS.MUNI 1101 is amended by the addition of the following:

A sample of asphalt cement shall be taken at the beginning of the asphalt paving project. At the discretion of the Project Manager, more samples may be required, for instance to represent 1,000 tons of a particular asphalt mix.

Table 1 of OPSS.MUNI 1101 is deleted in its entirety and replaced with the following:

**Table 800-2
Additional testing requirements and acceptance criteria for PGAC grades**

Property and Attributes (Unit)	Test Method	Results Reported Rounded to the Nearest	Acceptance Criteria	Rejectable
Ash Content, % by mass of residue (%)	LS-227	0.1	≤ 0.6	>0.6
Non-recoverable creep compliance at 3.2 kPa (Jnr-3.2) (kPa-1) when PGAC 58H-28 is specified	Multiple Stress Creep Recovery (MSCR) testing according to AASHTO T 350 testing conducted at a temperature of 58 °C	0.01	≤ 2.0	> 2.0
Non-recoverable creep compliance at 3.2 kPa (Jnr-3.2) (kPa-1) when PGAC 58V-28 is specified		0.01	≤ 1.0	> 1.0
Non-recoverable creep compliance at 3.2 kPa (Jnr-3.2) (kPa-1) when PGAC 58E-28 is specified		0.01	≤ 0.5	> 0.5
Average percent recovery at 3.2 kPa (R3.2) (%)		0.1	> the lesser of [(29.371) (Jnr-3.2) ^{-0.2633}] or 55	≤ the lesser of [(29.371) (Jnr-3.2) ^{0.2633} -10] or 45
Percent difference in non-recoverable creep compliance between 0.1 kPa and 3.2 kPa, Jnrdiff (%)		0.1	N/A Testing carried out only for information purpose	

For residential street pavements, regular PG58-28 asphalt cement will be used with no polymer modification and no MSCR testing required.

Guidelines for the selection of PGAC graded using Multiple Stress Creep Recovery (MSCR) test is given in Table 800-3 below.

**Table 800-3
Guidelines for Selection of PGAC Graded Using MSCR Test**

Road Type	Recommended PGAC Grade Using MSCR Test	Optional Grade Increase (Note 1)
Urban Freeway	58V-28	N/A
Rural Freeway Urban Arterial	58H-28	58V-28
Rural Arterial Urban Collector	Consider specifying 58H-28 if truck traffic is greater than 20% of AADT	58V-28
Rural Collector Urban/Suburban Collector	58-28	58H-28 or 58V-28
Toll Plaza Port Facility Dedicated Transit ways Truck Marshalling Yards (standing traffic)	58E-28	N/A
<p>Notes:</p> <ul style="list-style-type: none"> A. It is recommended that MSCR graded PGAC is used in both surface and top binder courses, i.e. top 80 mm to 100 mm of hot mix. 1. Consideration should be given to an increase in the high temperature traffic level for roadways which experience a high percentage of Trucks or bus traffic at slow operating speeds, frequent stops and starts, and historical concerns with instability rutting. 		

.02.02.03 Reclaimed Asphalt Pavement (RAP)

1151.04.01.01 of OPSS.MUNI 1101 is amended by the addition of the following:

The amount of RAP allowable by mass in a mix will be calculated by the Binder Replacement method according to the following formula:

$$\% \text{ Binder Replacement} = \frac{\% \text{ Binder Content of RAP} \times \% \text{ RAP in Mix}}{\% \text{ Total Binder Content of Mix}} \times 100\%$$

RAP is not permitted in SMA, 12.5 FC1, and 12.5 FC2 mixes, unless specified in the Contract Documents. Up to 15% of RAP is allowed in other surface course mixes and up to 15% of RAP is allowed in binder course mixes, by Binder Replacement.

.02.03 Construction

The supply and placement of hot mix and warm mix asphalt shall be in accordance with the following:

- a) OPSS.MUNI 310 Construction Specification for Hot Mix Asphalt, as amended;
- b) OPSS.MUNI 310 - Appendix C for the placement of warm mix asphalt, as amended.

.02.03.01 Pre-pave Meeting

At least one (1) week prior to any scheduled milling or paving operation to occur, a mandatory Pre-pave meeting shall be held. The Contractor shall ensure that all required documentation relating to the milling and paving operations has been submitted for review and approved prior to the meeting. The items shall include, but are not limited to, the following:

- a) Approved mix designs and Job Mix Formulas;
- b) Proposed milling and paving dates and paving equipment to be used;
- c) Asphalt placement and compaction rolling patterns;
- d) Roadway, lane closures and vehicle access restrictions;
- e) Tack coat scheduling and application patterns.

.02.03.02 Asphalt Plant Inspection

The Contractor shall permit access to the City's inspector in order to monitor the asphalt mix production, particularly the amount of Reclaimed Asphalt Pavement (RAP) added. The stockpiles of aggregates and RAP shall be clearly labelled / identified.

The asphalt plant's health and safety procedures that may be required shall be provided by the Contractor in advance.

Upon request from the Project Manager, the Contractor shall supply copies of plant records during asphalt production that will allow a demonstration of the proportion of RAP added to the mix.

.02.03.03 Tack Coat

Prior to the application of any of surface or binder coarse asphalt, tack coat shall be applied. Hot-mix and warm-mix asphalt can be placed only after the tack coat is cured (changes the colour from brown to black and becomes sticky).

.02.03.04 Placement of Binder and Surface Course Asphalt

Any type of asphalt having a thickness of 80mm or more shall be placed in a minimum of 2 lifts unless otherwise directed by the Project Manager.

The finished elevation of the surface course asphalt shall be placed so as to be flush with the lower edge of curb at the depressed portion of all wheelchair

ramps. The surface course asphalt shall slope down and away from the curb to form a gutter line in front of the wheelchair ramp.

.02.03.05 Binder Course Asphalt – Temporary Ramping

When the surface course asphalt is to be delayed or placed the following year, temporary asphalt ramps shall be placed at all wheelchair ramps and driveway approaches. The top of the temporary asphalt ramps shall be placed so as to be flush with the lower edge of curb at the depressed portion of all wheelchair ramps and driveway approaches. The temporary asphalt ramps shall be removed at the time of placement of the surface course asphalt at no additional cost.

.02.03.06 Use of Paving Equipment – Paving in Echelon

OPSS.MUNI 310.07.07 is amended with the addition of the following paragraph:

Paving in Echelon is mandatory for the placement of binder and surface course asphalt. The pavers shall be operated at the same time and maintain a distance of not more than 50m from each other so that a hot joint is obtained between the lanes of mixtures being placed. The Contractor shall supply sufficient personnel to adequately control both spreading operations simultaneously.

Where the entire width of the proposed pavement platform cannot be paved in echelon with 2 pavers, one longitudinal construction joint is permitted. Each half of the road shall be paved in echelon resulting in only one longitudinal joint in the binder and surface courses located at the centreline of the road. The joint shall be located to ensure that it does not align with the wheel path of traffic.

.02.03.07 Asphalt Material Transfer Vehicle

OPSS.MUNI 310.07.07 is amended with the addition of the following paragraph:

A Shuttle Buggy® Asphalt Material Transfer Vehicle (AMTV) is required for all paving operations, including paving using only one paver. The use of an AMTV will be paid for by the tonne.

.02.03.08 Re-Heating and Compaction of Longitudinal Joints

OPSS.MUNI 310.07.07 is amended with the addition of the following paragraph:

For surface course, the Contractor shall use an approved method of re-heating, re-working and compacting all centreline longitudinal cold joints. Pricing shall be based on an infra-red heating system capable of maintaining a minimum temperature of 93° C to produce a welded joint, without scorching or burning the mix.

All re-heating methods shall be approved prior to the start of any asphalt placement.

The density of the mix at any longitudinal joint shall be within 1.5 percent of the mainline mat density. Compaction of longitudinal joint shall be measured within 0.3 m from the joint.

.02.03.09 Review of Longitudinal Joint Quality

Prior to the expiry of the 24 month maintenance period, all joints in surface course asphalt shall be reviewed. The review will consider weld quality, proper compaction and separation. All joints showing signs of separation or poor welding shall be re-heated and compacted to achieve a welded joint. All repairs to longitudinal joints shall be at the cost of the Contractor.

.02.03.10 Aggregate Gradation and Asphalt Cement Content Acceptance

OPSS.MUNI 310.08.04 is deleted and replaced by the following:

If the HMA is borderline for aggregate gradation or asphalt cement content specified in Table 800-4, the Contractor shall take immediate corrective action through process control at the HMA plant. A total of three consecutive borderline test results for any attribute representing up to 1,000 tonnes of HMA production shall result in the work being deemed rejectable.

**TABLE 800-4
Production Tolerances on the Job-Mix Formula
Aggregate Gradation and Asphalt Cement Content**

Mix	Attribute	Tolerances on the Job-Mix Formula %		
		(Note 1)		
		Acceptable	Borderline	Rejectable
Surface Course	DLS, 4.75mm sieve size	< 5.0	5.0 to 7.5	>7.5
	600 µm sieve size	< 3.5	3.5 to 5.0	>5.0
	75 µm sieve size	< 2.0	2.0 to 3.0	>3.0
Binder and Levelling Courses	DLS, 4.75mm sieve size	< 7.0	7.0 to 10.0	>10.0
	600 µm sieve size	< 4.5	4.5 to 6.0	>6.0
	75 µm sieve size	< 2.0	2.0 to 3.0	>3.0
All Mixes	Asphalt Cement Content	< 0.20	0.2 to 0.30	>0.30

Note 1: Tolerances on the job-mix formula apply as both plus and minus from the job-mix formula percent.

Rejected HMA due to aggregate gradation, such as non-compliance on the DLS 4.75mm, 600 µm, or 75 µm sieve sizes, or non-compliance due to the asphalt cement content specified in Table 800-4, shall be subject to review and corrective actions, including but not limited to payment reduction, or material removal and replacement with acceptable HMA at the Contractor's expense.

The asphalt cement content and aggregate gradation shall be determined for each day's mix production for a given plant location on the basis of the sampling frequency criteria in Table 800-5.

Table 6 found in OPSS.MUNI 310 is hereby deleted and replaced by Table 800-5 below.

**TABLE 800-5
Criteria for HMA Sampling and Testing**

MIX TYPE	ASPHALT PLANT DAILY PRODUCTION FOR PROJECT	MINIMUM SET OF TEST SAMPLES
Surface Course	≤ 1000 tonnes	3
	> 1000 tonnes	One additional sample per 250 tonnes or part thereof
Binder Course	≤ 1000 tonnes	3
	> 1000 tonnes	One additional sample per 500 tonnes or part thereof

Note:

1. The Project manager may reduce the sampling/testing frequency for HMA that is consistently being produced to the specification requirements, or for very low volume
2. A set of test samples are to include a QC sample(for the contractor), a QA sample (for The City) and a Hold (for The City)

Field samples for quality assurance and/or quality control testing shall be Quarter Master Samples obtained during asphalt placement and compaction procedures that meet the minimum sample size of 20 kg as given in OPSS.MUNI 310, Table 6. Samples obtained from the spreader hopper or truck box shall not be used for QA/QC testing.

Samples shall be taken and collected by the contractor at locations determined by the Project Manager or the City's representative. These samples shall be representative of the paving operations. At each location, three samples shall be taken and packed in separate cardboard boxes supplied by the paving contractor. The box samples shall be numbered in sequence for a given contract,

and shall be marked to identify each individually. In addition, each sample shall be labelled to include the following minimum identification:

1. Contract Number;
2. Location of Sampling;
3. Date and Time of sampling;
4. Asphalt type;
5. Load number;
6. Load tonnage.

Two of the samples from each sample location shall be the property of The City.

.02.03.11 Air Voids Acceptance for HMA Production

The production of air voids for all HMA mixes shall be evaluated according to Table 800-6.

Table 9 found in OPSS.MUNI 310 is hereby deleted and replaced by Table 800-6 below.

**TABLE 800-6
Laboratory Air Void Criteria for Hot Mix Asphalt Production (LS-265)**

Mix	Air Voids (%)		
	Acceptable	Borderline	Rejectable
All Mixes	3.0 to 5.0	2.0 to 2.9 and 5.1 to 6.0	< 2.0 and > 6.0

If the HMA is borderline for air voids as specified in Table 800-6, the Contractor shall be notified in writing and shall take immediate corrective action through process control at the HMA plant. A total of three consecutive borderline test results representing up to 1,000 tonnes of HMA production shall result in the work being deemed rejectable.

Rejected HMA due to air voids shall be subject to review and corrective actions, including but not limited to payment reduction, or material removal and replacement with acceptable HMA at the Contractor's expense.

.02.03.12 Referee Testing

Where there is a discrepancy between the QC and QA results and the Contractor wishes to request a referee, the QC sample results will be provided within 30 days of receiving the QA results. If the HMA/WMA is deemed rejectable according to Table 800-4 or 800-6, both the City and the Contractor shall review, agree, and identify the limits of rejected HMA/WMA that has been placed. Referee samples within the limits of the affected area shall be delivered by the City to a mutually agreed upon third party referee laboratory to verify

aggregate gradation, asphalt cement, air voids content or a combination of all three. When the results from the referee samples are deemed rejectable according to Table 800-4 or 800-6, the HMA/WMA pavement shall be removed and replaced with acceptable HMA/WMA pavement at the contractor's expense or an appropriate payment reduction may be applied.

Referee testing undertaken to resolve a dispute shall be at no extra cost to the City if the referee test results confirm that the HMA/WMA is deemed borderline or rejectable according Table 800-4 and 800-6 or AC does not meet the requirements of Table 800-2.

.02.03.13 Asphalt Layer Segregation

All hot mix asphalt shall be inspected for segregation in accordance with the following:

.02.03.13.01 Types of Segregation

Segregation consists of areas with comparatively coarser texture than that of the surrounding pavement. All segregation is deemed to be deficient materials and/or workmanship, regardless of the type, location, cause or severity. The Contractor shall provide traffic control, as required, to conduct all segregation assessments.

Two main types of segregation are recognized:

Mid-lane Segregation: consists of any continuous or semi-continuous longitudinal mark or "streak", typically no greater than 300mm in width. Such segregation is often found in the middle of the lane, in the vicinity of a paver's gearbox, but may be located anywhere across the width of the lane.

Other Segregation: consists of discrete areas or patches of regular, irregular or chevron shape.

.02.03.13.02 Severity of Segregation

The severity of segregation is categorized as follows:

Slight Segregation: The pavement matrix is in place between the coarse aggregate particles; however there are slightly more coarse aggregate particles in comparison with the surrounding acceptable mix.

Medium Segregation: The pavement has significantly more coarse aggregate particles than the surrounding acceptable mat and usually exhibits some lack of surface matrix.

Severe Segregation: The pavement appears very coarse, with coarse aggregate particle against coarse aggregate particle and the pavement has little or no matrix.

.02.03.13.03 Paving Segregation

If the Contractor fails to prevent slight segregation in paving, the Project Manager will issue a written warning and request the Contractor to address the problem. The Contractor may be allowed to continue paving at the discretion of the Project Manager. If medium segregation is observed, the paving operation will be stopped. The Contractor shall prove to the satisfaction of the Project Manager that the paving can be continued without any medium segregation.

.02.03.13.04 Correction of Segregation

If the Contractor's actions fail to prevent continued slight to medium segregation from any source, the Project Manager may instruct the Contractor to cease paving until the problem has been corrected and the City shall not be held responsible for any additional costs that the Contractor may incur as a result.

From the time that the Contractor receives notification of mid-lane segregation, the Contractor will be allowed a maximum of 100 tonnes of mix to be placed on the Contract, in order to demonstrate the effectiveness of any repairs and/or adjustments that have been made to a defective paver.

The Contractor shall demonstrate the repairs and/or adjustments to the paver, which is acceptable to the Project Manager. If the Contractor is unable to eliminate segregation to the satisfaction of the Project Manager, by making repairs or adjustments to the paver within the allowable 100 tonnes of hot mix, then the Contractor shall discontinue the use of that machine and/or material.

.02.03.13.05 Mid-Lane Segregation

Medium to severe mid-lane segregation shall be repaired by removal and replacement at no cost to the City. Slight mid-lane segregation will be accepted into the work with no payment reduction.

.02.03.13.06 Other Segregation

The disposition of Other Segregation shall be as follows:

Slight Segregation: Slightly segregated mix will be accepted into the work with no payment reduction.

Medium Segregation: Medium segregation in all HMA lifts shall be repaired at the direction of the Project Manager at no cost to the City.

Severe Segregation: All severely segregated mix shall be repaired by removal and replacement at no cost to the City.

Levelling or padding courses with a total thickness which is less than that is normally placed in a lift of hot mix (i.e., usually 40mm), that is not machine-laid and any areas of "handwork" shall not be assessed on the basis of segregation but on the basis of other workmanship-related problems. However, if they deteriorate prior to being overlaid by another pavement course, the Project

Manager will assess the causes of the deterioration before determining responsibility for the cost of repairs.

.02.03.13.07 Repairs

All repairs shall be subjected to the approval by the Project Manager.

Repairs shall consist of removal and replacement with new hot mix or a hot mix overlay, where permitted.

Repairs for segregated hot mix shall be full lane or shoulder width. However, localized repairs may be permissible for mid-lane segregation in binder courses provided hot joints are used or the mat is still hot.

A paver shall be used for all repairs except those where localized repairs are allowed.

Where localized repairs are allowed for mid-lane segregation in binder courses, these repairs shall be:

- Less than or equal to 300mm in width;
- To the full depth of the subject lift; and
- Entirely tack-coated.

Hot mix used in all repairs shall meet the requirements specified for the tender item in the Contract. All repairs shall be done in a workmanlike manner complying with all requirements for placing hot mix stated in the Contract. All repaired areas must be entirely tack-coated and all transverse joints in surface course repairs must butt up to a vertical face.

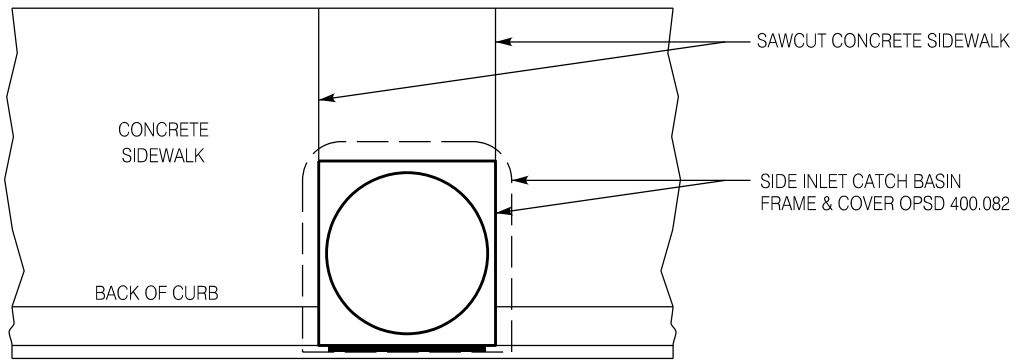
For surface and binder courses, all repairs for remedial work due to visually defective mix, including pavement removal and replacement, overlays where permitted, additional shouldering, traffic control and any other work which has to be redone such as line painting shall be made entirely at the Contractor's expense.

DRAWING No.	DATE	DESCRIPTION
RD-100.01	November 2005	Road Restoration Over Utility Cuts –Sheet 1of 2
RD-100.02	November 2005	Road Restoration Over Utility Cuts - Sheet 2 of 2
RD-101	November 2018	100 mm Dia. Perforated Drain Pipe Detail
RD-102.01	June 2017	Wheelchair Ramp Locations Without Inegrated Accessibility Treatment
RD-102.02	January 2020	Control Joints at Side Inlet Catch Basin Frame and Cover and Hydrants, and Utility Pole Isolation Boxout
RD-103	June 2019	Combined Concrete Walk and Curb and Independent Concrete Walk
RD-104	January 2011	Asphalt Sidewalk
RD-105	November 2005	Interlocking Paving Stone Sidewalk
RD-106	June 2019	Standard Approach
RD-107	June 2019	California Style Approach
RD-108	June 2017	Asphalt Driveway Approach
RD-109	June 2017	Concrete Apron Approach
RD-110.01	June 2017	Offset Curb & Gutter Detail at Single Catchbasin
RD-110.02	June 2017	Offset Curb & Gutter Detail at Double Catchbasin
RD-111	June 2017	Shoulder Paving for Manholes and Chambers in Shoulders
RD-112	November 2005	Concrete Alleyway
RD-113.01	November 2005	Typical Road Cross Section - Local Urban Residential (20.0 m Right-of-Way)
RD-113.02	November 2005	Typical Road Cross Section - Local Urban Residential (18.0 m Right-of-Way)
RD-113.03	November 2005	Typical Road Cross Section Local Urban Residential - Without Sidewalk For Cul De Sacs (18.0 m Right-of-Way)
RD-113.04	November 2005	Standard Road Section For Private Townhouses
RD-113.05	June 2017	Rural Cross Section
RD-114	June 2017	Unsignalized Industrial & Commercial Entrance - Urban Section
RD-115	June 2017	Hammerhead Turning Movement Diagram
RD-116.01	November 2005	Permanent Cul-De-Sac For Local Residential Streets – Symmetrical (18.0 m Right-of-Way)

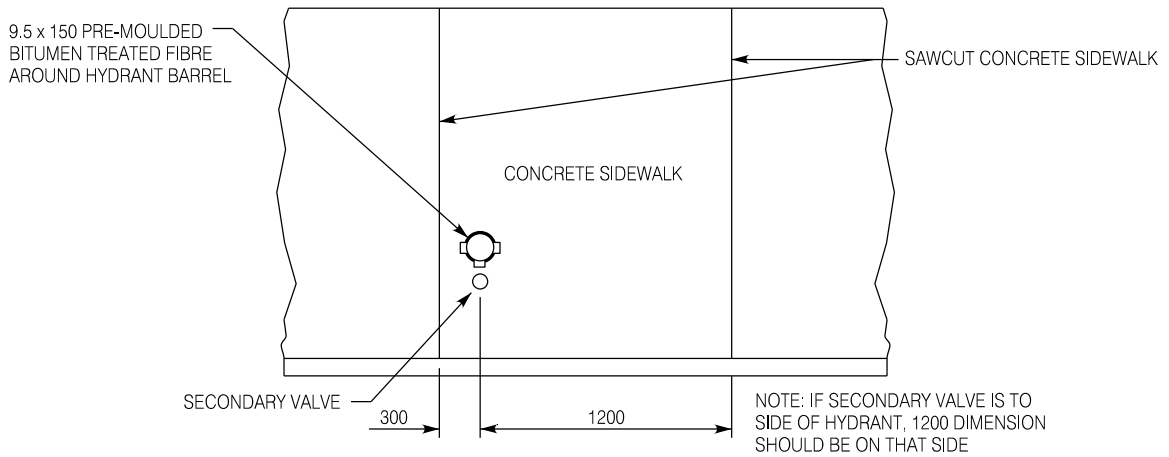
Note: 24" x 36" and 18" x 24" size drawings are not bound in this document

DRAWING No.	DATE	DESCRIPTION
RD-116.02	November 2005	Permanent Cul-De-Sac For Local Residential Streets – Offset Left (18.0 m Right-of-Way)
RD-116.03	November 2005	Cul-De-Sac For Industrial & Commercial Streets
RD-116.04	June 2017	Temporary Turning Circle (20.0 m R.O.W.)
RD-117	June 2017	Rural Residential Entrances
RD-118	June 2017	Rural Industrial & Commercial Entrances
RD-119.01	November 2005	Measurement for Payment Diagram – Road Reconstruction Only
RD-119.02	November 2005	Measurement for Payment Diagram – Road Reconstruction and Combined Walk and Curb Reconstruction
RD-119.03	January 2011	Measurement for Payment Diagram – Widening / Realignment /Narrowing
RD-119.04	November 2005	Measurement for Payment Diagram – Road and Independent Curb and Gutter Reconstruction
RD-120	June 2017	Typical Transit Shelter Pad for 1.2 m by 3.0 m Shelter
RD-121	November 2005	Rear Yard Swale Detail
RD-122	November 2005	Typical Toe of Excavation Swale & Berm Detail
RD-123.01	June 2017	Privacy Fence
RD-123.02	June 2017	Privacy Fence Details
RD-124.01	November 2018	Integrated Accessibility – Sidewalk/Urban Braille Guidelines (Size 24" x 36")
RD-124.02	November 2018	Integrated Accessibility – Sidewalk/Urban Braille Guidelines (Size 24" x 36")
RD-124.03	March 2018	Integrated Accessibility – Sidewalk/Urban Braille Guidelines (Size 24" x 36")
RD-125.01	November 2005	Heritage Poles and Details (Size 24" x 36")
RD-125.02	June 2017	Heritage Poles and Details (Size 24" x 36")
RD-126	November 2005	Irrigation – Typical Details (Size 24" x 36")
RD-127	June 2017	Typical Construction of Flagstone Wall on Slope
DT:0119-01	January 2017	Standard Design for Speed Humps (Size 18" x 24")
DT:0119-02	March 2019	Standard Drawing for Speed Cushions (Size 18" x 24")

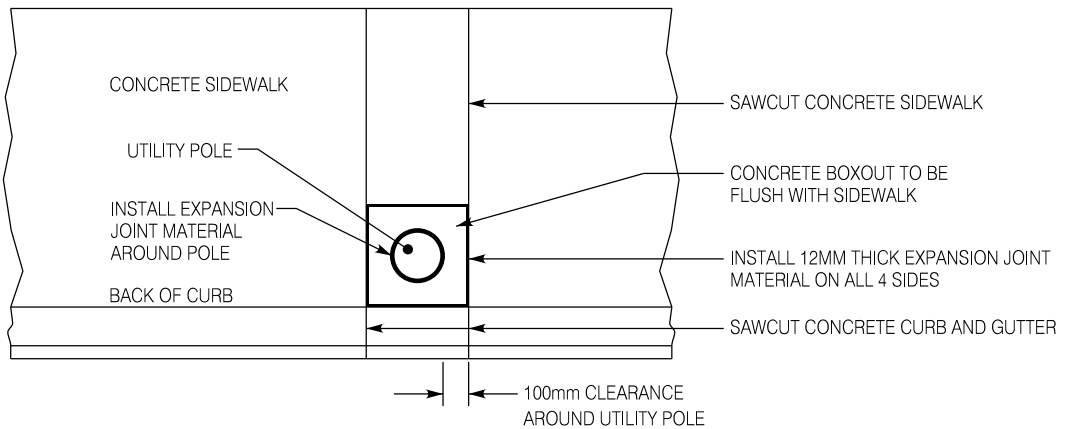
Note: 24" x 36" and 18" x 24" size drawings are not bound in this document



**CONTROL JOINTS
AT SIDE INLET CATCH BASIN
FRAME AND COVER**



CONTROL JOINTS AT HYDRANTS



UTILITY POLE ISOLATION BOXOUT

City of Hamilton
Public Works Department

**CONTROL JOINTS AT SIDE INLET CATCH BASIN FRAME AND COVER AND HYDRANTS,
AND UTILITY POLE ISOLATION BOXOUT**

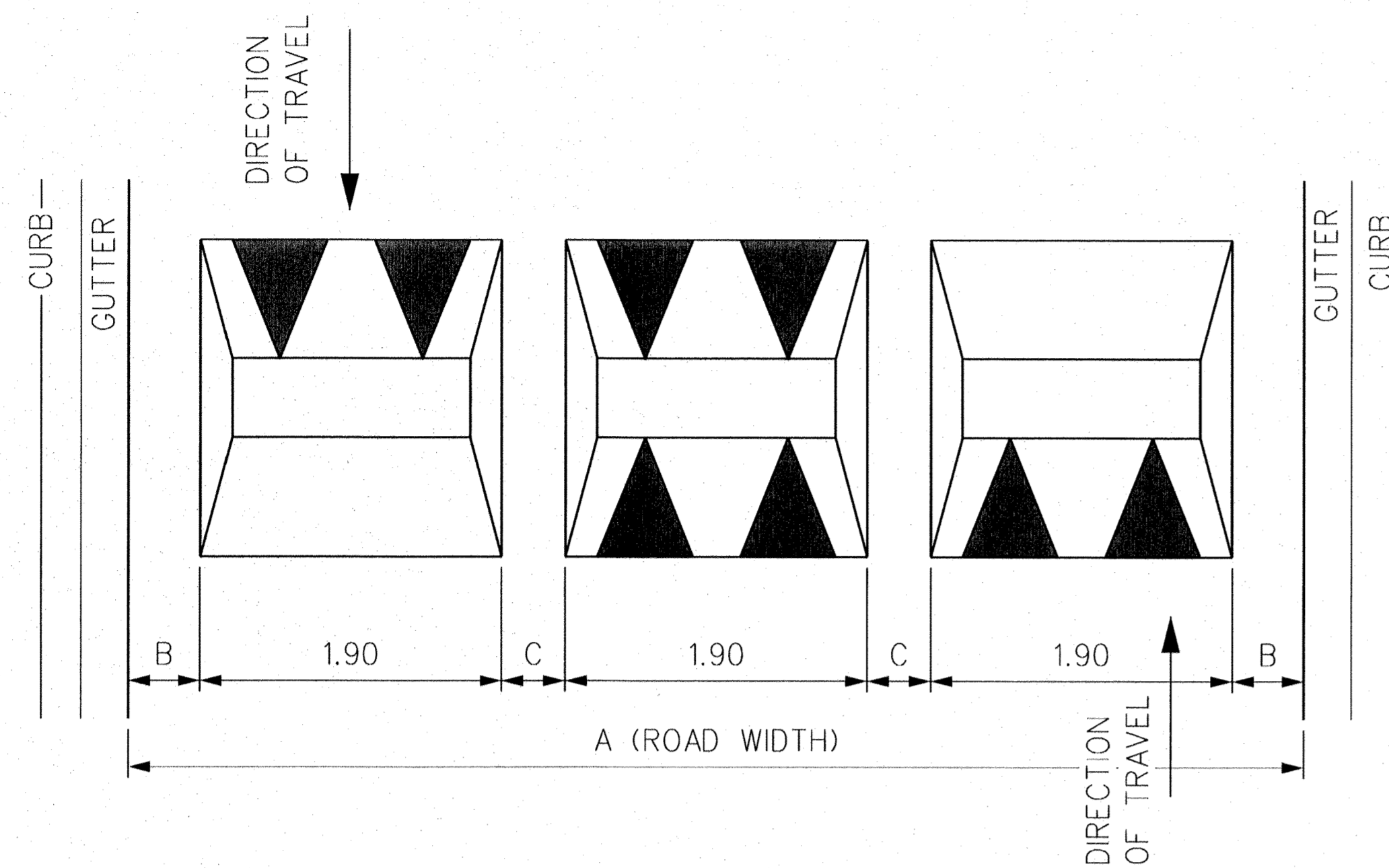
DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

DATE
January 2020

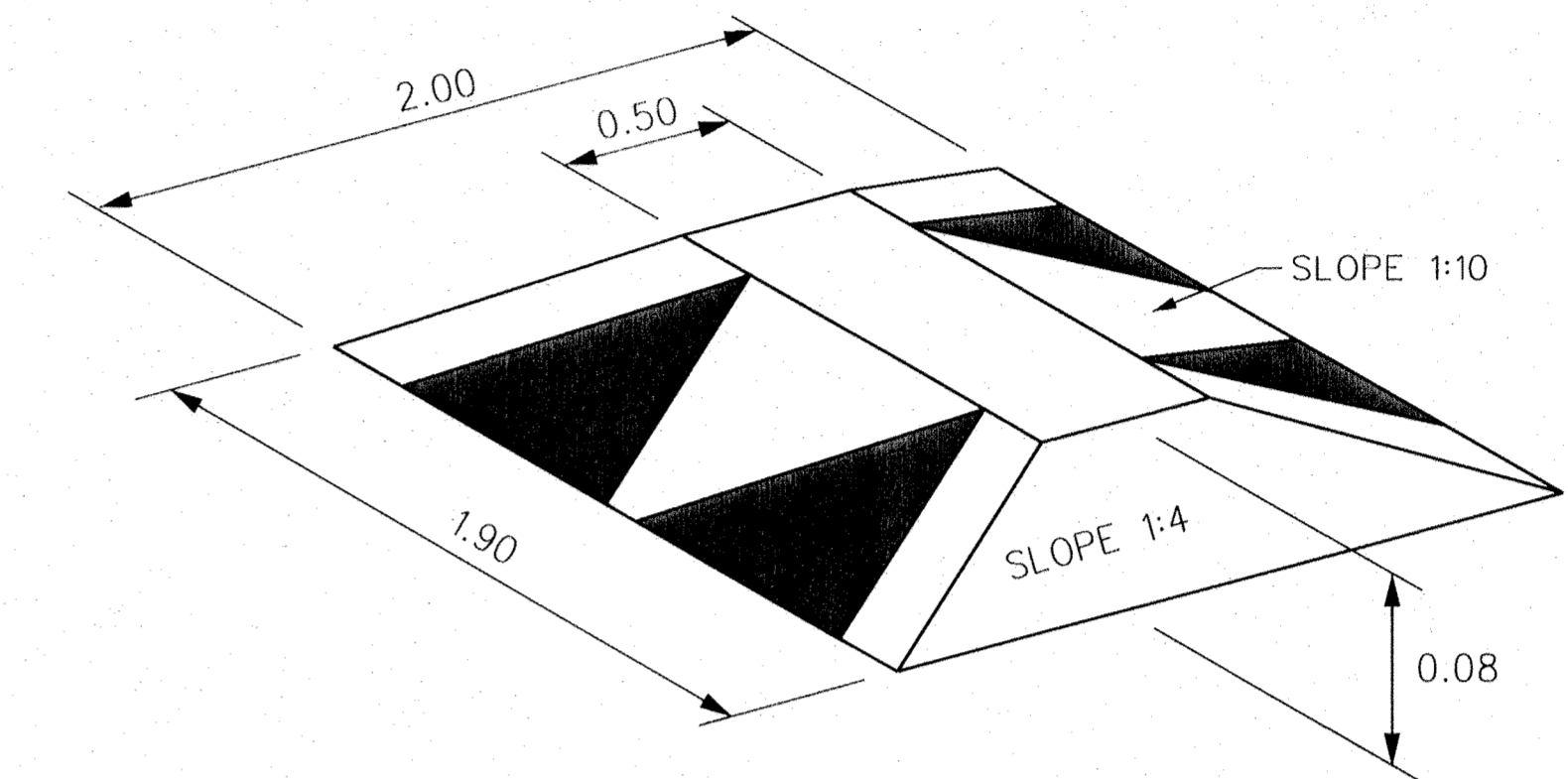
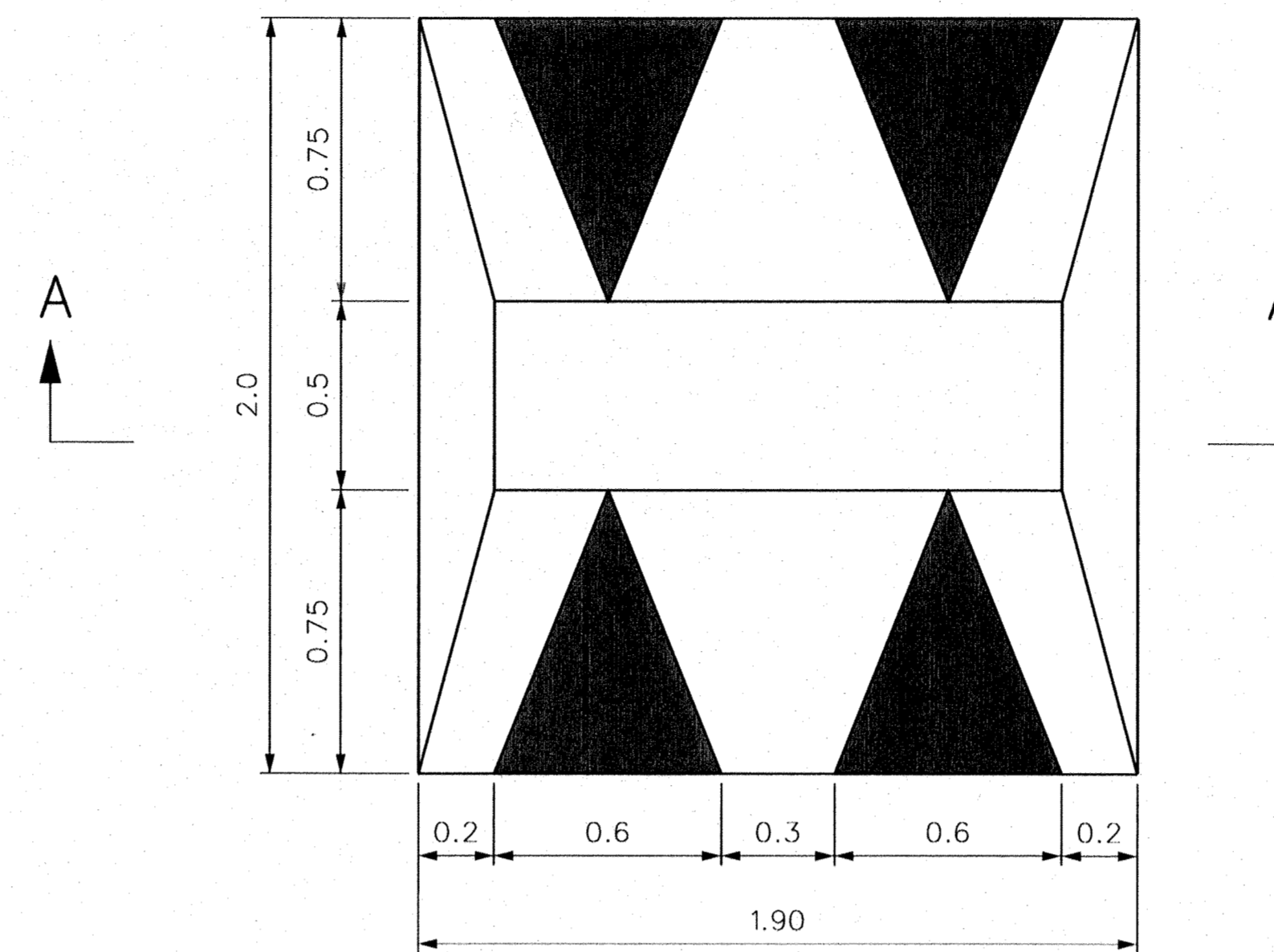
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HAMILTON STD No **RD-102.02**

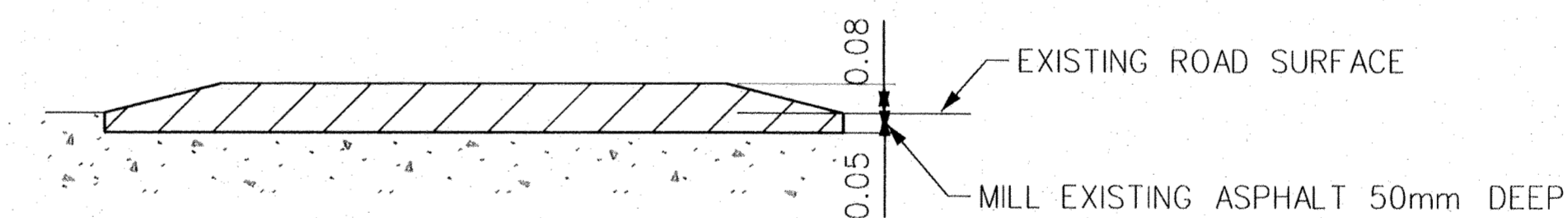


CONFIGURATION



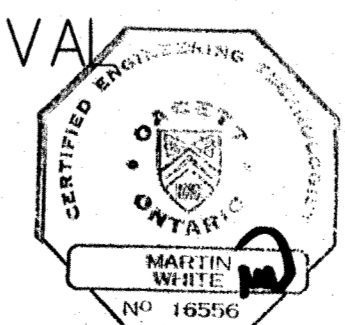
DIMENSIONS

GENERAL LAYOUT			
ROAD WIDTH A (m)	No. OF CUSHIONS	DIMENSIONS (m)	
		B	C
8.0	3	0.75	0.40
9.0	3	1.10	0.55
10.0	4	0.60	0.40
11.0	4	1.00	0.46



SECTION A-A

NOTE: ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED

0	2019.03	EZ	NEW DRAWING
No.	DATE	DRAWN	REVISION DETAILS
DESIGN: SC	CITY OF HAMILTON STANDARD DRAWING		
CHECKED: <i>MS</i> <i>S.F.</i>	SPEED CUSHIONS		
SCALE: N.T.S	PREPARED BY THE CITY OF HAMILTON, TRAFFIC ENGINEERING, PUBLIC WORKS DEPARTMENT		
Printed: 3/06/19	APPROVAL		
DRAWING No.: DT:0119-02	 MANAGER OF TRANSPORTATION OPERATIONS		18 Mar 19 MM/DD/YY

STANDARD DESIGN FOR SPEED CUSHIONS DT:0119-02

DRAWING No.	DATE	DESCRIPTION
WM-200.01	May 2013	Bedding & Backfill for Concrete & PVC Watermains and Water Services
WM-200.02	November 2005	Bedding & Backfill for Ductile Iron Watermains and Water Services
WM-201.01	June 2017	1200mm Dia. Precast Valve Chamber for 300mm Dia. Watermains & Smaller
WM-201.02	June 2017	Tapping Valve Installation for D.I. Watermain 300mm Dia. and Smaller
WM-201.03	June 2017	Level Valve Chamber – 150mm Dia. to 300mm Dia. Watermains
WM-201.04	June 2019	Air Valve Snorkel
WM-202	June 2017	Valve Box Installation For 100mm to 400mm Dia. Watermains
WM-203.01	November 2005	Hydrant Installation
WM-203.02	November 2005	Hydrant Installation using Anchor Tee
WM-203.03	November 2005	Relocation of Ditches at Hydrants
WM-203.04	January 2011	Operating Nut Adaptor for Use on Open Right (Clockwise) Valves
WM-204.01	January 2011	Concrete Anchor Blocks For 300mm Dia. Watermains And Smaller
WM-204.02	January 2011	11-1/4° & 22-1/2° Angle Anchor Block Details for 400mm to 600mm Dia. D.I. Watermains
WM-204.03	January 2011	45° Angle Anchor Block Details for 400mm to 600mm Dia. D.I. Watermains
WM-204.04	January 2011	45° Angle Anchor Block with Leg for 400mm to 600mm Dia. D.I. Watermains
WM-204.05	January 2011	90° Angle Anchor Block Details for 400mm to 600mm Dia. D.I. Watermains
WM-204.06	January 2011	90° Angle Anchor Block with Leg for 400mm to 600mm Dia. DI Watermains
WM-204.07	January 2011	Tee Anchor Block Details for 400mm to 600mm Dia. D.I. Watermain Branches
WM-204.08	January 2011	Tee Anchor Block with Leg for 400mm to 600mm Dia. D.I. Branch Watermains

*24" x 36" size drawings are not bound in this document

DRAWING No.	DATE	DESCRIPTION
WM-204.09	January 2011	Concrete Thrust Block for 400mm to 600mm Dia. D.I. Watermains
WM-204.10	January 2011	Concrete Anchor Blocks for 100mm to 300mm Dia. D.I. Watermains at 11 1/4° & 22 1/2° Vertical Bends
WM-204.11	January 2011	Concrete Anchor Blocks for 100mm to 300mm Dia. D.I. Watermains at 45° Vertical Bend
WM-204.12	January 2011	Vertical Bend Anchor Block 7 1/2° to 22 1/2° for 400mm Dia. D.I. Watermain
WM-204.13 (1 of 2)	November 2018	Concrete Anchor Block for 100mm to 300mm Dia. Watermain Lowering
WM-204.13 (2 of 2)	January 2011	Concrete Anchor Block for 100mm to 300mm Dia. Watermain Lowering
WM-204.14	November 2018	Vertical Bend Anchor Block 45° for 400mm Dia. D.I. Watermain
WM-205.01	March 2008	50mm Dia. Watermain Looping in Cul De Sacs (20.0 m R.O.W.)
WM-205.02	March 2008	50mm Dia. Watermain Looping in Cul De Sacs (18.0 m R.O.W.)
WM-206	November 2005	50mm Dia. Dead End Blow-Off
WM-207.01	November 2005	Piping Arrangement for 19-25mm Dia. Water Service Connection and Yard Service
WM-207.02	November 2005	Piping Arrangement for 19-25mm Dia. Water Service Connections in a Common Trench
WM-207.03	November 2005	Insulation Details for Water Services at Gooseneck
WM-207.04	January 2020	Piping for 100mm to 300mm Dia. Water Service Connection & Yard Service to Meter with Cut in Tee & Sleeve
WM-207.05	January 2020	Piping for 100mm to 300mm Dia. Water Service Connection & Yard Service to Meter using Tapping Sleeve & Valve
WM-207.06	January 2020	Piping Arrangement for 50mm Dia. Water Service Connection and Yard Service
WM-208	November 2005	Remote Receptacle Installation for Meter Chambers
WM-209.01	January 2020	Piping and Chamber for Residential 16mm to 50mm Dia. Meter Installation
WM-209.02	January 2020	Piping and Chamber for Multi-Unit Residential (3 Storeys and Above) or ICI Moderate Hazard 16mm to 50mm Dia. Meter Installation

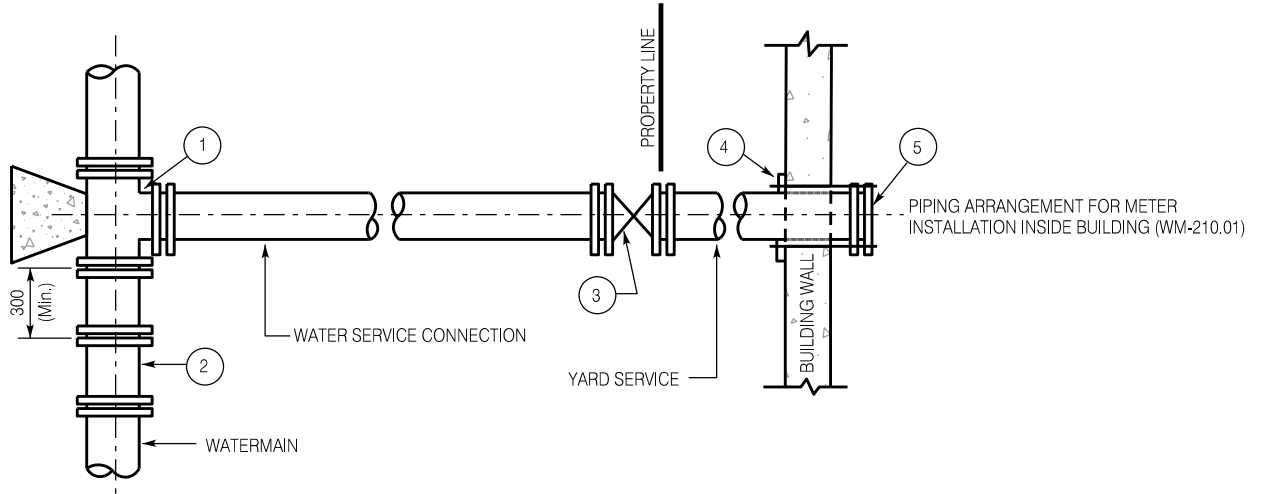
*24" x 36" size drawings are not bound in this document

DRAWING No.	DATE	DESCRIPTION
WM-209.03	January 2020	Piping and Chamber for ICI High Hazard 16mm to 50mm Dia. Meter Installation
WM-210.01	June 2019	Piping for Multi-Unit Residential (3 Storeys and Above) or ICI Moderate Hazard 16mm to 50mm Dia. Meter for Internal Installation
WM-210.02	June 2019	Piping for Multi-Unit Residential (3 Storeys and Above) or ICI Moderate Hazard 100mm to 250mm Dia. Meters for Internal Meter Installation
WM-210.03	June 2019	Piping for ICI, High Hazard 16mm to 50mm Dia. Meter for Internal Installation
WM-210.04	June 2019	Piping for ICI, High Hazard 100mm to 250mm Dia. Meter for Internal Installation
WM-211.01	November 2005	Standard Remote Installation for 16-25mm Dia. Meters
WM-211.02	November 2005	Alterations of Existing 16-25mm Dia. Piping Prior to Meter Installation
WM-211.03	June 2019	Piping for Residential 16mm to 50mm Dia. Meter for Internal Installation
WM-211.04	November 2005	Meter Pipe Spacer Installation
WM-211.05	June 2019	Satellite Meter Installation for 16mm to 25mm Dia. Services
WM-212.03	November 2005	Valve Key Frame & Cover
WM-213	November 2005	Chamber End Plates for 100mm Dia. to 300mm Dia. Watermains
WM-214	November 2005	Removable Slab Lifting Hole Details & Lifting Hook Detail for Chambers
WM-215.01	November 2005	Valve Support
WM-215.02	November 2005	Pipe & Valve Support
WM-215.03	November 2018	Concrete Pipe Support Details for 750mm to 1200mm Dia. Watermains
WM-216	November 2005	Blow-Off Connection at Access Chamber
WM-217	November 2005	Pitometer Connection for Steel & Concrete Pipe
WM-230	June 2019	2400mm Precast Valve chamber for 400mm Dia. Concrete or Ductile Iron Pipe with 50mm Air Valve & 100mm Blow-Off. *(24" x 36")

*24" x 36" size drawings are not bound in this document

DRAWING No.	DATE	DESCRIPTION
WM-231	June 2019	Precast Valve Chamber for 450mm, 500mm and 600mm Dia. Concrete Pipe or Ductile Iron Pipe *(Size 24" x 36")
WM-232	June 2019	1800mm Precast Valve Chamber for 400mm to 500mm Dia. Concrete or Ductile Iron Pipe with 50mm Air Valve & 100mm Blow-Off *(Size 24" x 36")
WM-233	June 2019	1800mm x 3000mm Precast Valve Chamber for 400mm Dia. Concrete or Ductile Iron Pipe with 100mm to 300mm Dia. Branch *(Size 24" x 36")
WM-234.01	June 2019	Piping and Chamber for Multi-Unit Residential 100mm to 250mm Dia. Meter Installation (1800mm X 2400mm/3000mm/3500mm Precast Meter Chambers) *(Size 24" x 36")
WM-234.02	June 2019	Piping and Chamber for Multi-Unit Residential (3 Storeys and Above) or ICI Moderate Hazard 100mm to 250mm Dia. Meter Installation (1800 X 2400mm and 1800mm X 3000mm Precast Meter Chambers) *(Size 24" x 36")
WM-234.03	June 2019	Piping and Chamber for ICI, High Hazard 100mm to 250mm Dia. Meter Installation (1800mm X 2400mm and 1800mm X 3000mm Precast Meter Chambers) *(Size 24" x 36")
WM-235	November 2005	1800mm x 2400mm Precast Tapping Valve Chamber for 100mm to 300mm Dia. D.I. Pipe Tapping off 400mm to 600mm Dia. Watermain *(Size 24" x 36")
WM-236.01	June 2019	3400mm x 4700mm Precast Valve Chamber for 750mm and 900mm Dia. Concrete Pressure Pipe with Butterfly Valve, 100mm Dia. Air Release Valve and 150mm Dia. Blow Off Valves *(Size 24" x 36")
WM-236.02	June 2019	3400mm x 4700mm Precast Valve Chamber for 1050mm and 1200mm Dia. Concrete Pressure Pipe with Butterfly Valve, 100mm Dia. Air Release Valve and 150mm Dia. Blow Off Valves *(Size 24" x 36")

*24" x 36" size drawings are not bound in this document



- ① MECHANICAL JOINT TEE
- ② MECHANICAL JOINT SLEEVE
- ③ GATE VALVE - MECHANICAL JOINT COMPLETE WITH VALVE BOX (WM-202)
- ④ 4-20mm DIA. GALVANIZED OR STAINLESS STEEL TIE RODS WITH NUTS, WASHERS AND PLATES
- ⑤ FLANGED END (ABOVE FLOORS ONLY)

NOTES:

1. PIPE TO BE DUCTILE IRON CEMENT LINED, WITH CAST IRON CEMENT LINED FITTINGS OR PVC IN ACCORDANCE WITH CITY STANDARDS.
2. BEDDING AND BACKFILL REQUIREMENTS (WM-200.01 OR WM-200.02).
3. ANNULAR SPACE AROUND PIPING THROUGH WALL TO BE FILLED WITH APPROVED WATERPROOF SEALANT.
4. PIPING ENTERING VERTICALLY THROUGH FLOORS TO BE SECURED WITH VERTICAL TIE RODS AND CONCRETE ANCHOR BLOCK.

City of Hamilton
Public Works Department

**PIPING FOR 100mm TO 300mm DIA. WATER SERVICE CONNECTION
& YARD SERVICE TO METER WITH CUT-IN TEE & SLEEVE**

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

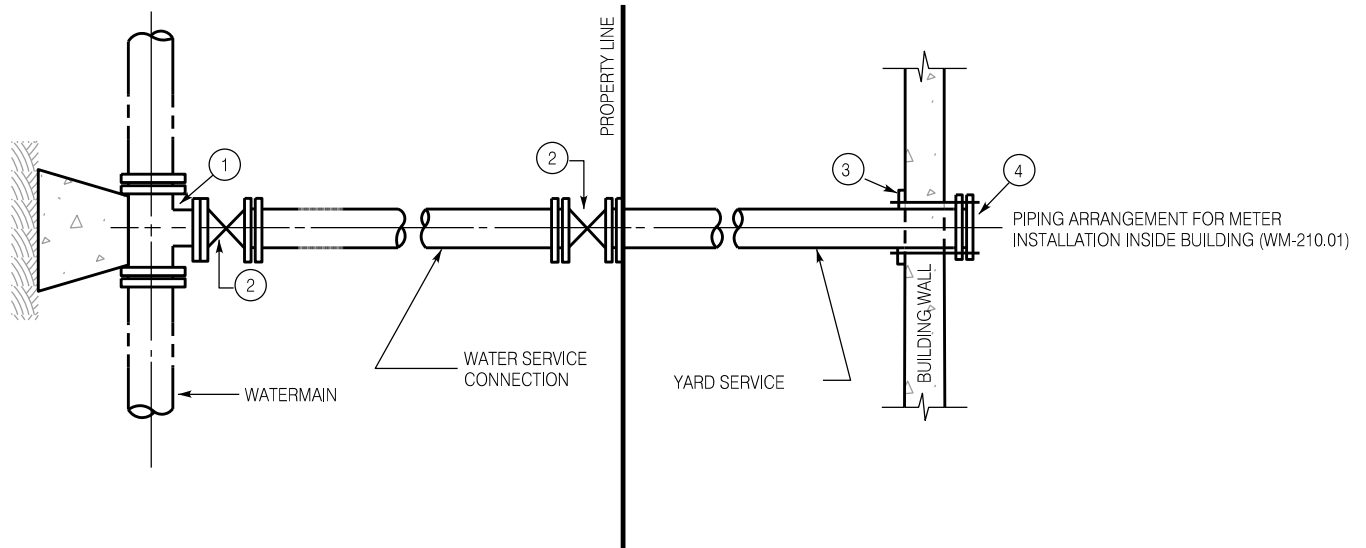
DATE
January 2020

REV No
1

FORMERLY: RWS 705

HAMILTON STD No

WM-207.04



- ① TAPPING SLEEVE - MECHANICAL JOINT
- ② GATE VALVE - MECHANICAL JOINT COMPLETE WITH VALVE BOX (WM-202)
- ③ 4-20mm DIA GALVANIZED OR STAINLESS STEEL TIE RODS WITH NUTS, WASHERS AND PLATES
- ④ FLANGED END (ABOVE FLOORS ONLY)

NOTES:

1. PIPE TO BE DUCTILE IRON CEMENT LINED, WITH CAST IRON CEMENT LINED FITTINGS OR PVC IN ACCORDANCE WITH CITY STANDARDS
2. BEDDING AND BACKFILL REQUIREMENTS (WM-200.01 OR WM-200.02).
3. ANNULAR SPACE AROUND PIPING THROUGH WALL TO BE FILLED WITH AN APPROVED WATERPROOF SEALANT.
4. PIPING ENTERING VERTICALLY THROUGH FLOORS TO BE SECURED WITH VERTICAL TIE RODS AND CONCRETE ANCHOR BLOCK.

City of Hamilton
Public Works Department

**PIPING FOR 100mm TO 300mm DIA. WATER SERVICE CONNECTION
& YARD SERVICE TO METER USING TAPPING SLEEVE & VALVE**

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

DATE
January 2020

REV No
1

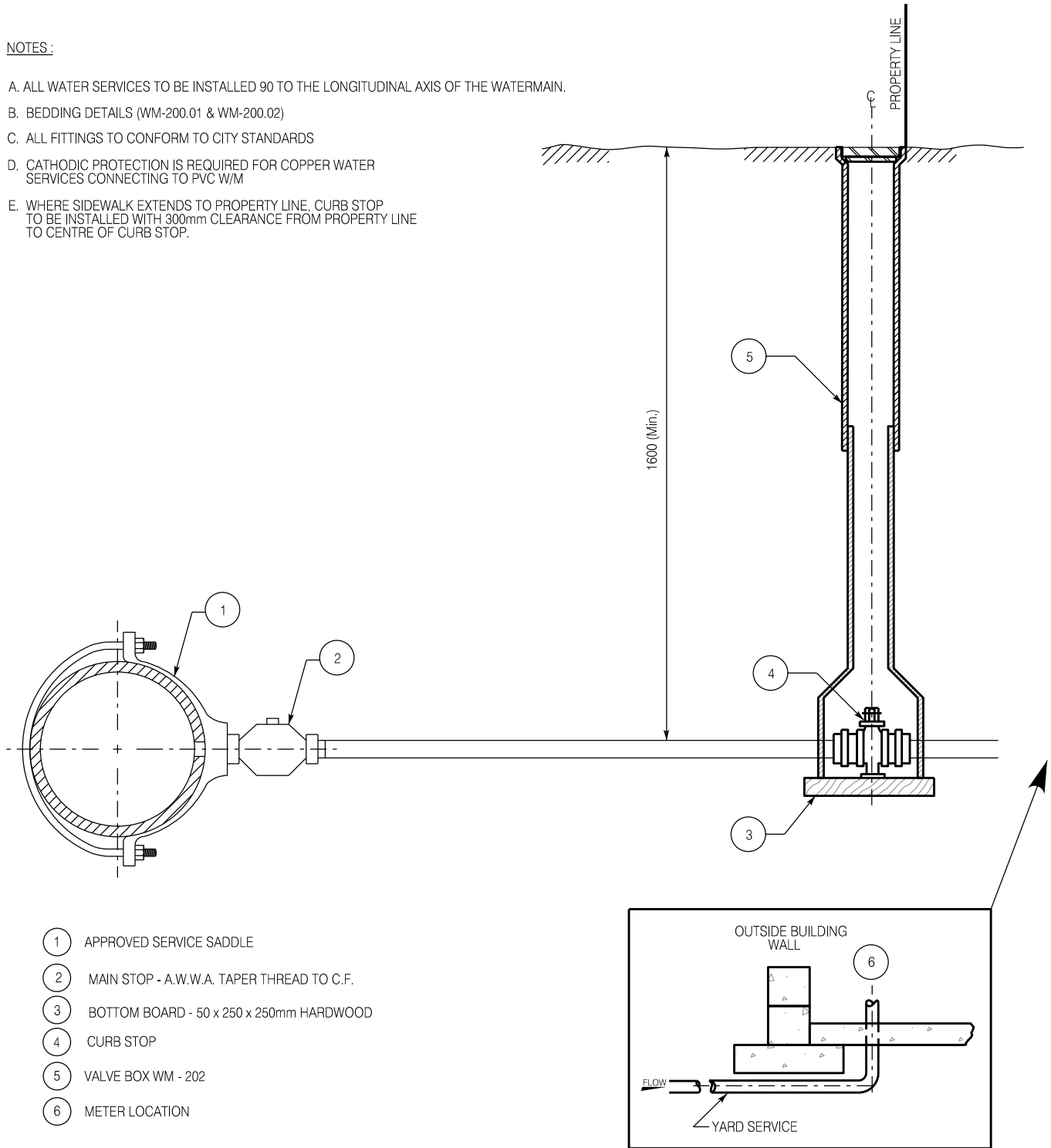
FORMERLY: RWS 706

HAMILTON STD No

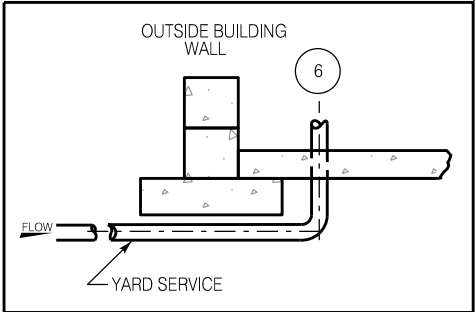
WM-207.05

NOTES:

- A. ALL WATER SERVICES TO BE INSTALLED 90 TO THE LONGITUDINAL AXIS OF THE WATERMAIN.
- B. BEDDING DETAILS (WM-200.01 & WM-200.02)
- C. ALL FITTINGS TO CONFORM TO CITY STANDARDS
- D. CATHODIC PROTECTION IS REQUIRED FOR COPPER WATER SERVICES CONNECTING TO PVC W/M
- E. WHERE SIDEWALK EXTENDS TO PROPERTY LINE, CURB STOP TO BE INSTALLED WITH 300mm CLEARANCE FROM PROPERTY LINE TO CENTRE OF CURB STOP.



- ① APPROVED SERVICE SADDLE
- ② MAIN STOP - A.W.W.A. TAPER THREAD TO C.F.
- ③ BOTTOM BOARD - 50 x 250 x 250mm HARDWOOD
- ④ CURB STOP
- ⑤ VALVE BOX WM - 202
- ⑥ METER LOCATION



City of Hamilton
Public Works Department

**PIPING ARRANGEMENT FOR 50mm DIA. WATER SERVICE
CONNECTION AND YARD SERVICE**

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

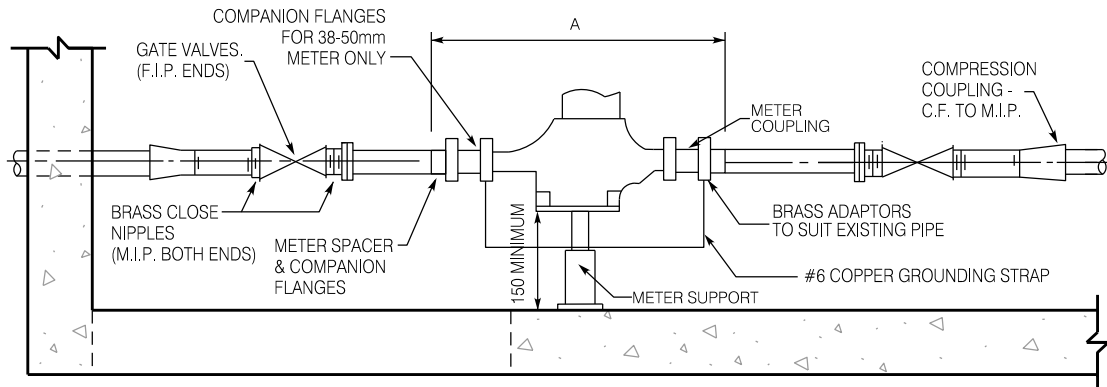
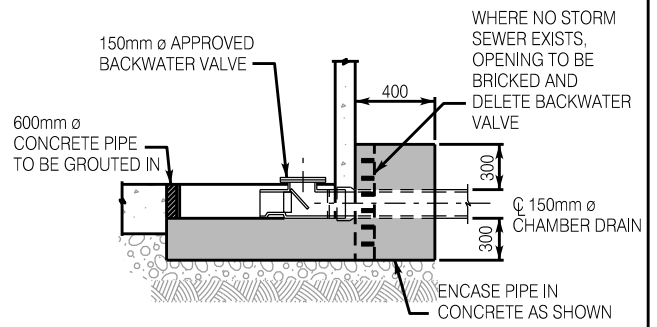
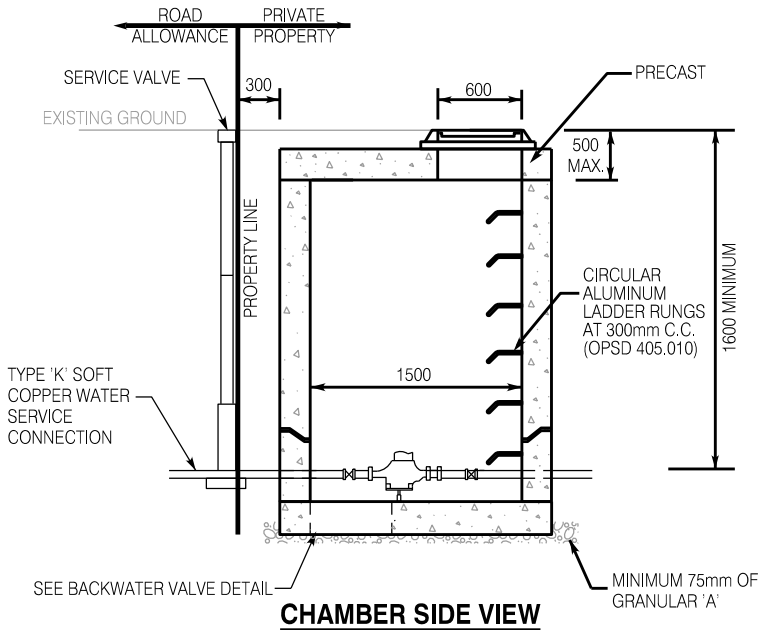
DATE
January 2020

REV No

FORMERLY:

HAMILTON STD No

WM-207.06



NOTES:

1. CHAMBER DIA. TO BE 1500mm.
2. CHAMBER FRAME AND COVER (OPSD 402.010)
3. PRECAST CONCRETE SECTIONS TO CONFORM TO A.S.T.M. C-478.
4. ALL CONCRETE TO BE 30 MPa., 28 DAY STRENGTH, TYPE 50 CEMENT.
5. ALL ADJUSTMENTS TO CHAMBER COVERS SHALL BE MADE WITH POURED CONCRETE.
6. STEPS TO BE ALUMINUM PLACED AT 300mm C.C. AS PER OPSD 405.010.
7. METER SUPPLIED AND INSTALLED BY CITY.
8. CHAMBER TO BE LOCATED ON PRIVATE PROPERTY AT THE PROPERTY LINE AS NOTED
9. METER TO BE PLACED MIN 150mm FROM CHAMBER FLOOR.
10. ALL VALVES TO BE GATE VALVES.
11. METER COUPLINGS TO BE F.I.P TO C.F.
12. COMPANION FLANGES FOR 38-50mm METER ONLY.

		MIN. DIMENSION A (mm)	
		THREADED FITTINGS	SOLDERED FITTINGS
METER SIZE (mm)	16	500	450
	20	575	475
	25	600	525
	38 - 50	750	750

City of Hamilton
Public Works Department

**PIPING AND CHAMBER FOR RESIDENTIAL
16mm TO 50mm DIA. METER INSTALLATION**

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

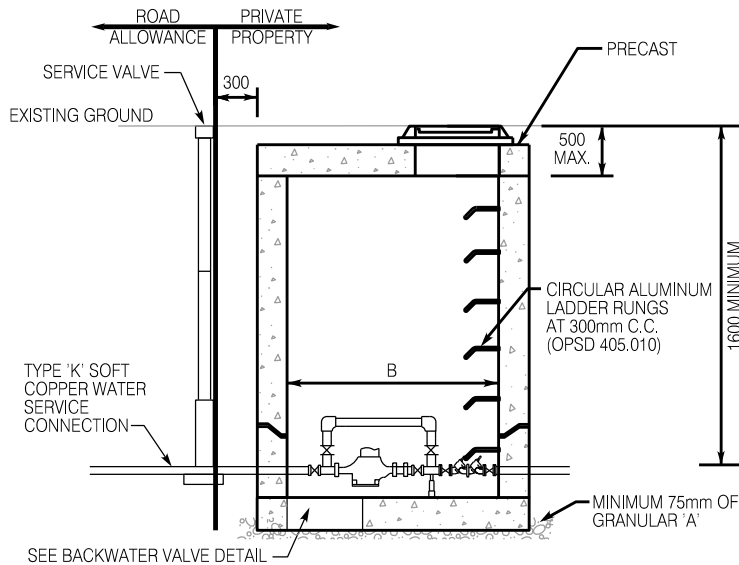
DATE
January 2020

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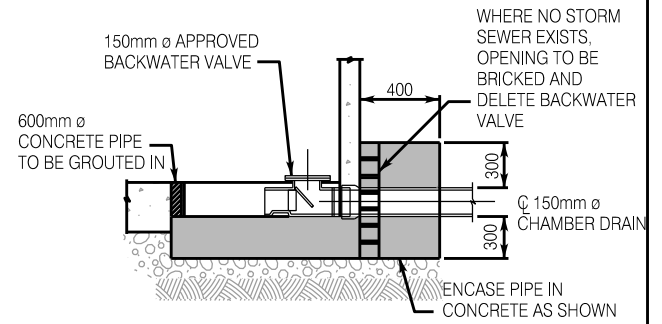
FORMERLY: WM-209

HAMILTON STD No

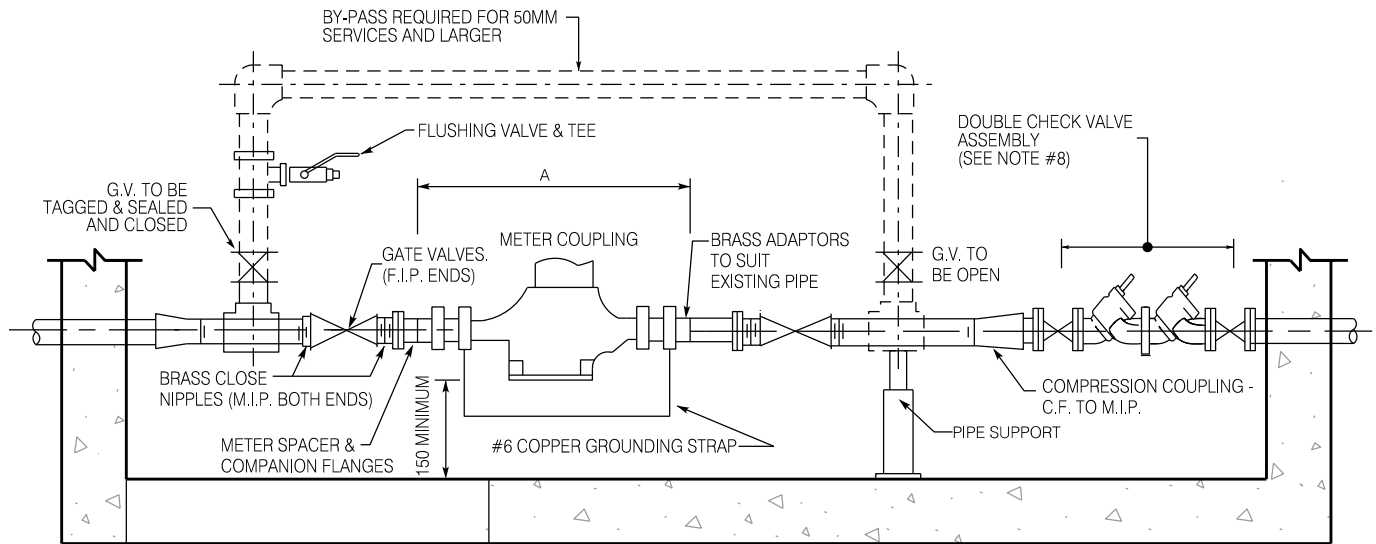
WM-209.01



CHAMBER SIDE VIEW



BACKWATER VALVE DETAIL



METER SIDE VIEW

NOTES:

1. CHAMBER FRAME AND COVER (OPSD 402.010).
2. PRECAST CONCRETE SECTIONS TO CONFORM TO A.S.T.M. C-478.
3. ALL CONCRETE TO BE 30 MPa., 28 DAY STRENGTH, TYPE 50 CEMENT.
4. ALL ADJUSTMENTS TO CHAMBER COVERS SHALL BE MADE WITH POURED CONCRETE.
5. METER SUPPLIED AND INSTALLED BY CITY.
6. METER TO BE PLACED MIN 150mm FROM CHAMBER FLOOR.
7. CHAMBER TO BE LOCATED ON PRIVATE PROPERTY AT THE PROPERTY LINE.
8. APPLICABLE BACKFLOW PREVENTION ASSEMBLY TO BE PLACED NO MORE THAN 3.0m DOWNSTREAM OF THE METER/BY-PASS ASSEMBLY.
9. WHERE UNABLE TO CONNECT TO STORM SEWER PLACE DOUBLE CHECK VALVE IN INSULATED ENCLOSURE AS PER WM-209.03.
10. ALL VALVES TO BE GATE VALVES.
11. METER COUPLINGS TO BE F.I.P TO C.F.
12. COMPANION FLANGES FOR 38-50mm METER ONLY.

PD - POSITIVE DISPLACEMENT METER
CMP - COMPOUND METER

METER SIZE	CHAMBER DIAMETER 'B' (mm)
16-25	1500
38 - 50	1800

		MIN. DIMENSIONS (mm)		
		A		
METER TYPE		METER SIZE	THREADED FITTINGS	SOLDERED FITTINGS
		PD	16	500
20	575		475	
25	600		525	
38 - 50	750		750	
CMP	50	850	850	

City of Hamilton
Public Works Department

**PIPING AND CHAMBER FOR MULTI-UNIT RESIDENTIAL
(3 STOREYS AND ABOVE) OR ICI MODERATE HAZARD
16mm TO 50mm DIA. METER INSTALLATION**

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

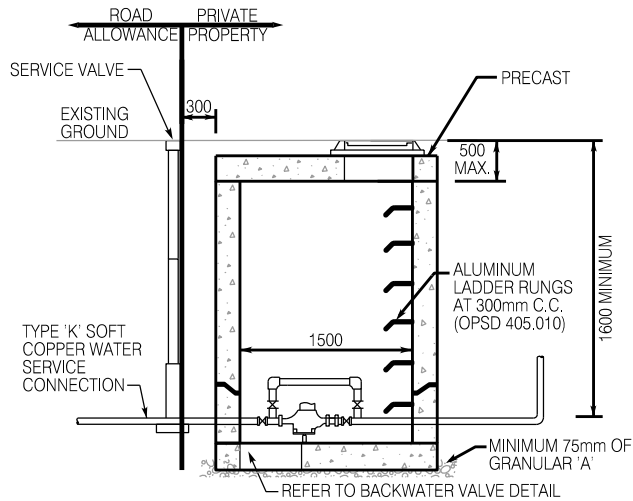
DATE
JANUARY 2020

REV No
1

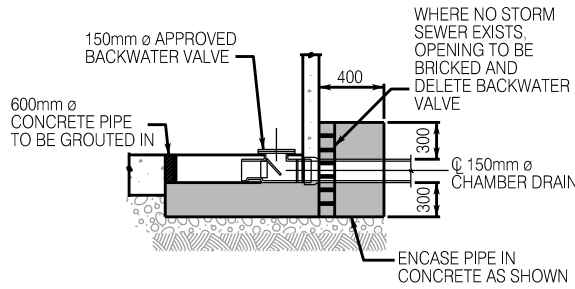
FORMERLY: WM209

HAMILTON STD No

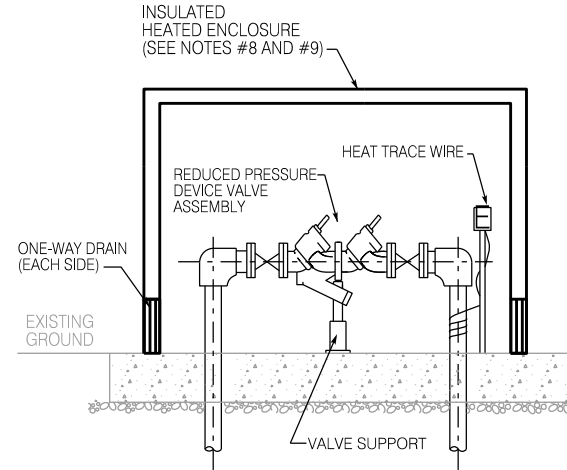
WM-209.02



CHAMBER SIDE VIEW



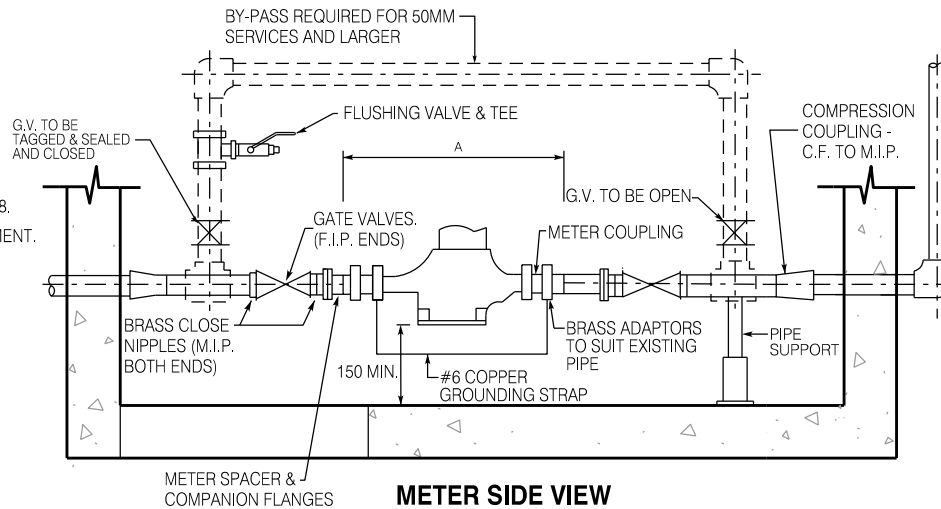
BACKWATER VALVE DETAIL



INSULATED ENCLOSURE

NOTES:

1. CHAMBER DIA. TO BE 1500mm.
2. CHAMBER FRAME AND COVER (OPSD 402.010).
3. PRECAST CONCRETE SECTIONS TO CONFORM TO A.S.T.M. C-478.
4. ALL CONCRETE TO BE 30 MPa., 28 DAY STRENGTH, TYPE 50 CEMENT.
5. ALL ADJUSTMENTS TO CHAMBER COVERS SHALL BE MADE WITH POURED CONCRETE.
6. METER SUPPLIED AND INSTALLED BY CITY.
7. METER TO BE PLACED MIN 150mm FROM CHAMBER FLOOR.
8. APPLICABLE BACKFLOW PREVENTION ASSEMBLY TO BE PLACED NO MORE THAN 3.0m DOWNSTREAM OF THE METER/BY-PASS ASSEMBLY.
9. FOR INSULATED ENCLOSURE INSTALLATION REFER TO BY LAW B64.10-11.
10. ALL VALVES TO BE GATE VALVES.
11. METER COUPLINGS TO BE F.I.P TO C.F.
12. COMPANION FLANGES FOR 38-50mm METER ONLY.



METER SIDE VIEW

		MIN. DIMENSIONS (mm)		
		A		
METER TYPE	METER SIZE	THREADED FITTINGS	SOLDERED FITTINGS	
	PD	16	500	450
20		575	475	
25		600	525	
38 - 50		750	750	
CMP	50	850	850	

PD - POSITIVE DISPLACEMENT METER
CMP - COMPOUND METER

City of Hamilton
Public Works Department

**PIPING AND CHAMBER FOR
ICI HIGH HAZARD
16mm TO 50mm DIA. METER INSTALLATION**

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

DATE
January 2020

REV No
1

FORMERLY: WM 209

HAMILTON STD No

WM-209.03