Municipal Infrastructure Division
Department of Transportation and Infrastructure

MUNICIPAL WATER, SEWER AND ROADS MASTER CONSTRUCTION SPECIFICATIONS

MASTER TABLE OF CONTENTS

INTRODUCTION

SAMPLE SCHEDULE OF QUANTITIES AND PRICES

STANDARD FORMS TABLE OF CONTENTS

STANDARD DRAWINGS TABLE OF CONTENTS

DIVISION 1 TABLE OF CONTENTS

01000	Project Specific Specification
01001	Definitions
01002	Abbreviations
01003	Reference Documents
01005	General Instructions
01010	Mobilization & Demobilization
01015	Materials & Equipment Delivered to Site
01020	Cash Allowances
01045	Cutting, Fitting & Patching
01155	Weigh Scales
01200	Project Meetings
01300	Construction Progress Schedule
01320	Standby Compensation
01330	Substitution Procedures
01340	Shop Drawings, Samples and Submissions
01370	Schedule of Values
01400	Quality Control & Testing Laboratory Services
01500	Temporary Utilities and Construction Facilities
01545	Safety Requirements
01560	Environmental Requirements
01570	Traffic Regulation
01571	Informational Warning Devices

01572 Location & Placement of Signs
01573 Delineation Devices
01574 Barricades
01575 Miscellaneous Warning Devices
01580 Project Signs & Sign Supports
01582 Sign and Signpost Installations
01600 Material and Equipment
01610 Force Account Payments
01700 Closeout Procedures
01710 Reinstatement and Cleaning
01720 Closeout Submittals

DIVISION 2 TABLE OF CONTENTS

02070 Sitework Demolition & Removal of Structures
02104 Landscaping, Seeding, Sodding & Tree Preservation
02111 Clearing & Grubbing
02202 Rock Removal
02215 Site Work & Site Grading
02223 Excavation, Trenching & Backfilling
02224 Roadway Excavation, Embankment & Compaction
02226 Aggregates, General
02231 Scarifying & Reshaping
02232 Reshaping only (up to 100 mm)
02233 Selected Granular Base & Sub-Base Materials
02250 Calcium Chloride
02270 Rip-Rap Protection
02271 Armour Stone Protection
02272 Gabions
02282 Supply & Installation of Guide Rail
02283 Salvage & Reinstallation of Guide Rail

02284 Handrail
02410 Sub-Drains
02434 Pipe Culverts
02481 Channel Excavation, Cleaning & Deepening
02496 Timber Cribwork
02501 Corrected Maximum Dry Density
02528 Curbs, Gutters and Sidewalks
02547 Asphalt Tack Coat
02552 Hot Mix Asphaltic Concrete Pavement
02574 Reshaping & Patching Asphalt Pavement
02575 Cold Planing
02576 Pulverize Existing Asphalt
02577 Pavement Crack Cleaning & Filling
02580 Pavement Markings
02601 Maintenance Holes, Catch Basins & Ditch Inlets
02650 Sewage Pumping Station
02702 Sewer Mains
02704 Sanitary Sewer Outfall Pipe
02710 Foundation & Underslab Drainage
02713 Water Mains
02724 Sewage Force Mains
02726 Factory Pre-Insulated Piping Systems
02729 Water Wells
02831 Chain Link Fences & Gates
02832 Wildlife Wire Fences
02897 Filter Fabric (Geotextile)

DIVISION 3 TABLE OF CONTENTS

03100 Concrete Formwork and Falsework
03200 Concrete Reinforcement

03300 Cast-In-Place Concrete

03306 Underwater Concreting

03345 Concrete Floor Finishes

INTRODUCTION

This document reflects the combined efforts of the Province of Newfoundland & Labrador, Municipal Infrastructure Division of the Department of Transportation and Infrastructure, Heavy Civil Association of Newfoundland and Labrador Inc., Municipalities of Newfoundland and Labrador, and Association of Consulting Engineering Companies - Newfoundland and Labrador, who formed a joint committee on Municipal Contract Documents in response to problems voiced within the municipal servicing industry.

The Committee members for 2024 are:

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Thanks are due to Heavy Civil Association of Newfoundland & Labrador Water & Sewer Contractors Division, Municipalities Newfoundland and Labrador and Consulting Engineers of Newfoundland and Labrador for their continued support of this specification.

Appreciation is expressed for the many hours that past and present Committee members spent away from their offices in serving on this committee. The contribution made by these committee members should not go unnoticed by the municipal services industry.

This document represents the current (2024) version of the Government of Newfoundland & Labrador, Municipal Water, Sewer and Roads Master Construction Specifications. It is not intended to be a final document. Continual changes in the industry will necessitate periodic review of the standard to keep pace with new

technologies and construction methods. All parties are encouraged to provide input for improvements and additions.

Further sections of this standard specification shall be released for incorporation into this master document. All individuals holding a copy of the Standard for Municipal Contracts should consult the website for changes. A circular will be sent to all parties when updates are available on the website.

SAMPLE SCHEDULE OF QUANTITIES AND PRICES

The quantities set out in this schedule are estimated quantities only and are not to be taken as final quantities by the Contractor. The unit prices bid shall include all labour, plant, materials, overhead, duties, and profit and all other obligations and liabilities under the contract. Do not include taxes in unit or lump sum prices, taxes due are to be added on the last page of this schedule as indicated on the bottom. Totals shall be determined by multiplying the quantity by the tendered unit price.

DIVISION 1

SECTION	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
01005	General Instructions				
1. Overhaul		m^3km	Unit	_____	_____
2. Maintain Existing Supply of Water to Occupants		L.S.	Unit	_____	_____
3. Maintain Existing Sewer Services to Occupants		L.S.	Unit	_____	_____
01010	Mobilization & Demobilization				
(not greater than 5 % if on the Island, or 10 % if in Labrador, or 15 % north of Cartwright of Sub-Total, including this item, before HST)		L.S.	Unit	_____	_____
01020	Cash Allowances (to be entered by Consultant)				
1. Pole Relocation		Allowance			_____
2. Shoring/Bracing		Allowance			_____
3. Contribution in Aid (Hydro/Utilities)		Allowance			_____
4. Temporary Supply of Water to Occupants (Section 01005 2.14)		Allowance			_____
5. Temporary Sewer Service to Occupants (Section 010005 2.14)		Allowance			_____
6. Other (Specify)		Allowance			_____
01500	Temporary Utilities and Construction Facilities				
1. Owner Site Office		L.S.	Unit	_____	_____
01560	Environmental Requirements				
1. Silt Fence		m	_____	_____	_____

SECTION	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
01570	Traffic Regulation				
1. Flag Person Wages		Hour	_____	_____	_____
2. Traffic Control		L.S.	Unit	_____	_____
3. Temporary/Detour Road		L.S.	Unit	_____	_____
01580	Projects Signs & Sign Supports				
1. Project Sign – Provincial		L.S.	Unit	_____	_____
2. Project Sign – Federal		L.S.	Unit	_____	_____
3. Other Signs		L.S.	Unit	_____	_____
01582	Sign and Signpost Installations				
1. Type A – X (specify sign)		Each	_____	_____	_____
2. Type B – X (specify sign)		Each	_____	_____	_____
3. Type C – L/W (specify sign)		Each	_____	_____	_____
4. Type D – L/W (specify sign)		Each	_____	_____	_____
5. Other Signs		Each	_____	_____	_____
01710	Reinstatement and Cleaning				
1. Fencing		m	_____	_____	_____
2. Ditching		m	_____	_____	_____
3. Remove, Relocate and/or Reinstall Culverts		m	_____	_____	_____
4. Other Structures (specify)		Specify	_____	_____	_____
5. Manual Seeding		m^2	_____	_____	_____
6. Temporary Cover for Seed Protection		m^2	_____	_____	_____
7. Hydraulic Seeding & Mulching		m^2	_____	_____	_____
8. Terraseeding		m^2	_____	_____	_____
9. Supply & Placing Topsoil		m^2	_____	_____	_____
10. Supply & Placing Agricultural Limestone		m^2	_____	_____	_____
11. Supply & Application of Fertilizer		m^2	_____	_____	_____
12. Supply & Placement of Sods		m^2	_____	_____	_____
13. Driveway Reinstatement/Patching		m^2	_____	_____	_____

DIVISION 2

SECTION	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
02070	Sitework, Demolition & Removal of Structures				
1.	Removal of Concrete Base	m^2	_____	_____	_____
2.	Removal of Concrete Pavement	m^2	_____	_____	_____
3.	Removal of Asphalt Covered Concrete Pavement	m^2	_____	_____	_____
4.	Removal of Concrete Sidewalk	m^2	_____	_____	_____
5.	Removal of Curb & Gutter	m	_____	_____	_____
6.	Removal of Catch Basins, Maintenance Holes & Ditch Inlets	Each	_____	_____	_____
7.	Removal of Fences	m	_____	_____	_____
8.	Removal of Guide Rails	m	_____	_____	_____
9.	Removal of Sanitary Sewers	m	_____	_____	_____
10.	Removal of Water Lines	m	_____	_____	_____
11.	Removal of Culverts	m	_____	_____	_____
12.	Removal of Storm Sewers	m	_____	_____	_____
13.	Removal of Bridges	Each	_____	_____	_____
14.	Removal of Mass Concrete	m^3	_____	_____	_____
15.	Removal of Asbestos Cement Pipe	m	_____	_____	_____
16.	Removal of Other Items	Specify	_____	_____	_____
02104	Landscaping, Seeding, Sodding & Tree Preservation				
1.	Manual Seeding	m^2	_____	_____	_____
2.	Temporary Cover for Seed Protection	m^2	_____	_____	_____
3.	Hydraulic Seeding & Mulching	m^2	_____	_____	_____
4.	Terraseeding	m^2	_____	_____	_____
5.	Supply & Placing Topsoil	m^2	_____	_____	_____
6.	Supply & Placing Agricultural Limestone	m^2	_____	_____	_____
7.	Supply & Application of Fertilizer	m^2	_____	_____	_____
8.	Supply & Placement of Sods	m^2	_____	_____	_____
9.	Shrub & Tree Preservation	Each	_____	_____	_____
02111	Clearing & Grubbing				
1.	Clearing	ha	_____	_____	_____
2.	Grubbing	ha	_____	_____	_____
3.	Clearing and Grubbing	ha	_____	_____	_____

SECTION	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
	4. Close Cut Clearing	ha	_____	_____	_____
	5. Underbrush Clearing and Grubbing	ha	_____	_____	_____
	6. Isolated Trees	Each	_____	_____	_____
02215	Site Work & Site Grading				
	1. Mass Rock Excavation	m^3	_____	_____	_____
	2. Mass Common Excavation	m^3	_____	_____	_____
	3. Imported Mass Common Backfill	m^3	_____	_____	_____
	4. Supply, Placing & Spreading Topsoil	m^2	_____	_____	_____
02223	Excavation, Trenching & Backfilling				
	1. Main Trench Excavation				
	1. Rock	m^3	_____	_____	_____
	2. Common	m^3	_____	_____	_____
	2. Service Trench Excavation				
	1. Rock	m^3	_____	_____	_____
	2. Common	m^3	_____	_____	_____
	3. Imported Common Backfill	m^3	_____	_____	_____
	4. Sheeting & Bracing Left in Place	m^2	_____	_____	_____
	5. Granular Pipe Bedding				
	1. Type 1	m^3	_____	_____	_____
	2. Type 2	m^3	_____	_____	_____
	3. Type 3	m^3	_____	_____	_____
	3.1 Type Imported	m^3	_____	_____	_____
	6. Rock Underbedding	m^3	_____	_____	_____
	7. Trucking, Handling, Stockpiling, Filling, Conditioning, and Reuse of Wet Common Material	m^3	_____	_____	_____
	8. Supply & Placement of Marking Tape				
	1. Plastic Tape	m	_____	_____	_____
	2. Metal Tape	m	_____	_____	_____
02224	Roadway Excavation, Embankment & Compaction				
	1. Mass Excavation & Backfill				
	1. Rock	m^3	_____	_____	_____
	2. Common	m^3	_____	_____	_____
	2. Imported Backfill				

SECTION	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
	1. Rock	m^3	_____	_____	_____
	2. Common	m^3	_____	_____	_____
	3. Place & Spreading Topsoil	m^2	_____	_____	_____
02231	Scarifying & Reshaping				
	1. Scarifying & Reshaping incl. Compaction	m^2	_____	_____	_____
02232	Reshaping Only (up to 100 mm)				
	1. Reshaping up to 100 mm incl. Compaction	m^2	_____	_____	_____
02233	Selected Granular Base & Sub Base Materials				
	1. Class “A” Granular Base	m^3	_____	_____	_____
	2. Class “B” Granular Sub-Base	m^3	_____	_____	_____
02250	Calcium Chloride				
	1. Calcium Chloride	tonne	_____	_____	_____
02270	Rip-Rap Protection				
	1. Rip-Rap Hand Laid Dry Wall	m^3	_____	_____	_____
	2. Rip-Rap Hand Laid with Sod	m^3	_____	_____	_____
	3. Rip-Rap Grouted	m^3	_____	_____	_____
	4. Rip-Rap Random	m^3	_____	_____	_____
02271	Armour Stone Protection				
	1. Supply & Placement of Armour Stone (size X)	m^3	_____	_____	_____
	2. Supply & Placement of Armour Stone (size Y)	m^3	_____	_____	_____
	3. Supply & Placement of Armour Stone (size Z)	m^3	_____	_____	_____
02272	Gabions				
	1. Supply & Placement of Gabions incl. Fill by Hand (wire type)	m^3	_____	_____	_____
02282	Supply & Installation of Guide Rail				

SECTION	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
	1. Type “A” Standard Type Guide Rail with Additional Posts	m	_____	_____	_____
	2. Type “B” Standard Type Guide Rail	m	_____	_____	_____
	3. Sloped & Buried Guide Rail Section	Each	_____	_____	_____
02283	Salvage & Reinstallation of Guide Rail				
	1. Salvage & Reinstallation of Guide Rail				
	1. On New Posts	m	_____	_____	_____
	2. On Salvaged Posts	m	_____	_____	_____
02284	Handrail				
	1. Handrail Drawing 04170				
	1. Base Plate	m	_____	_____	_____
	2. O.M. Conditions	m	_____	_____	_____
	3. Core & Grout Option	m	_____	_____	_____
	2. Handrail Form 1216-1	m	_____	_____	_____
02410	Sub-Drains				
	1. Supply & Placement of Bedding Gravel	m^3	_____	_____	_____
	2. Supply & Placement of Granular Filter Material	m^3	_____	_____	_____
	3. Supply & Placement of Sub-Drains (size)	m	_____	_____	_____
02434	Pipe Culverts				
	1. Supply & Placement of Pipe Culvert (size), (thickness), (type)	m	_____	_____	_____
	2. Supply & Placement of Cut-off Collars	Each	_____	_____	_____
	3. Supply & Placement Prefab. End Sections	Each	_____	_____	_____
	4. Supply & Placement of Debris Racks	Each	_____	_____	_____
	5. Supply & Placement of Concrete Head Walls	m^3	_____	_____	_____
02481	Channel Excavation, Cleaning & Deepening				
	1. Channel Excavation				
	1. Rock	m^3	_____	_____	_____

SECTION	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
	2. Common	m^3	_____	_____	_____
	2. Cleaning & Deepening of Existing Channels	m	_____	_____	_____
02496	Timber Crib work				
	1. Timber Cribwork	m^3	_____	_____	_____
02528	Curbs, Gutters and Sidewalks				
	1. Supply & Place Granular Base Material	m^3	_____	_____	_____
	2. Concrete Walks (width), (thickness)	m	_____	_____	_____
	3. Combined Curb & Sidewalk (width), (thickness)	m	_____	_____	_____
	4. Driveway Ramps				
	1. With Curb, (width), (thickness)	m	_____	_____	_____
	2. Without Curb, (width), (thickness)	m	_____	_____	_____
	5. Curb & Gutter	m	_____	_____	_____
	6. Curb	m	_____	_____	_____
02547	Asphalt Tack Coat				
	1. Supply & Placement of Asphalt Tack Coat	m^2	_____	_____	_____
02552	Hot Mix Asphaltic Concrete Pavement				
	1. Asphaltic Concrete				
	1. Base Course	tonne	_____	_____	_____
	2. Surface Course	tonne	_____	_____	_____
	3. Asphaltic Concrete Adjustment	tonne	_____	_____	_____
	2. Asphaltic Concrete Walkways				
	1. (thickness) (width)	m	_____	_____	_____
	3. Asphaltic Concrete Ditch				
	1. (thickness) (width)	m	_____	_____	_____
02574	Reshaping & Patching Asphalt Pavement				
	1. Removal of Asphalt Pavement	m^2	_____	_____	_____
	2. Patching of Asphalt Pavement	m^2	_____	_____	_____
	3. Removal and Replacement of Asphalt	m^2	_____	_____	_____

SECTION	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
Pavement (For Road Projects Only)					
4. Temporary Patching of Asphalt Pavement		m^2	_____	_____	_____
5. Cutting of Asphalt Pavement		m	_____	_____	_____
02575	Cold Planing	m^2	_____	_____	_____
02576	Pulverizing Existing Asphalt	m^2	_____	_____	_____
02577	Pavement Crack Cleaning & Filling	m	_____	_____	_____
02580	Pavement Markings				
1. Pavement Marking		L.S.	Unit	_____	_____
02601	Maintenance Holes, Catch Basins & Ditch Inlets				
1. Supply & Placement of Pre-Cast Maintenance Holes Depth (including cover):					
1. 2 m or less		Each	_____	_____	_____
2. > 2 m to 2.5 m		Each	_____	_____	_____
3. > 2.5 m to 3 m		Each	_____	_____	_____
4. > 3 m to 3.5 m		Each	_____	_____	_____
5. > 3.5 m to 4.0 m		Each	_____	_____	_____
6. > 4.0 m to 4.5 m		Each	_____	_____	_____
7. > 4.5 m to 5 m		Each	_____	_____	_____
8. > 5.0 m 5.5 m with Safety Landing		Each	_____	_____	_____
9. > 5.5 m to 6.0 m with Safety Landing		Each	_____	_____	_____
10. > 6.0 m to 6.5 m with Safety Landing (etc.)		Each	_____	_____	_____
2. Supply & Placement of Maintenance Hold Inflow Protectors		Each	_____	_____	_____
3. Outfall Structures		Each	_____	_____	_____
4. Drop Maintenance Holes		Each	_____	_____	_____
5. Special Maintenance Holes		Each	_____	_____	_____
6. Catch Basins (including cover)		Each	_____	_____	_____
7. Cast-in-Place Maintenance Holes		Each	_____	_____	_____

SECTION	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
	8. Adjustment of Maintenance Hole/Catch Basin Tops	Each	_____	_____	_____
	9. Sealing Existing Maintenance Hole/Catch Basin Tops	Each	_____	_____	_____
02650	Sewage Pumping Stations				
	1. (Pumping Station Identifier), (Pumps), (size in kW.), see contract documents	L.S.	Unit	_____	_____
	2. Supply and Commission Portable Diesel Generator	L.S.	Unit	_____	_____
02702	Sewer Mains				
	1. Supply & Placement of Sanitary Sewer				
	1. Main Line (size), (type), (thickness), (insulation)	m	_____	_____	_____
	2. Service Line				
	1. (size), (type), (thickness), (insulation)	m	_____	_____	_____
	2. Long Radius Bends	Each	_____	_____	_____
	2. Supply & Placement of Storm Sewer (size), (type), (thickness)	m	_____	_____	_____
	3. Supply & Install Tees c/w Bends	Each	_____	_____	_____
	4. Supply & Installation of End Caps	Each	_____	_____	_____
	5. Supply & Installation of Plugs	Each	_____	_____	_____
	6. CCTV Camera Inspection Services	m	_____	_____	_____
	7. Break Into & Connect to Existing Maintenance Holes	Each	_____	_____	_____
	8. Locate and Connect to Existing Sewer Mains	Each	_____	_____	_____
	9. Locate and Connect to Existing Sewer Stubs	Each	_____	_____	_____
02704	Sanitary Sewer Outfall Pipe				
	1. Outfall Sewer pipe (size), (type), (thickness)	m	_____	_____	_____
	2. Concrete for Bedding and	m^3	_____	_____	_____

SECTION	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
	Encasement Pipes				
	3. Other bedding (specify)	m^3	_____	_____	_____
	4. Tees, Caps, Plugs, Other Fittings Concrete Head Blocks, Cradles & Supports (specify)	Each	_____	_____	_____
	5. Underwater Video and/or Photo Inspection	L.S.	Unit	_____	_____
02710	Foundation & Underslab Drainage				
	1. Supply and Install Foundation	L.S.	Unit	_____	_____
	2. Supply and Install Underslab Drainage	L.S.	Unit	_____	_____
02713	Water Mains				
	1. Supply & Installation of Water Main (type), (class), (size), (insulation)	m	_____	_____	_____
	2. Supply & Installation of Service Connections to ROW (type), (class), (size), (insulation)	m	_____	_____	_____
	3. Supply & Install of Fire Hydrants (depth), (insulation)	Each	_____	_____	_____
	4. Supply & Installation of Fitting (size) (insulation)				
	1. Wyes	Each	_____	_____	_____
	2. Crosses	Each	_____	_____	_____
	3. Reducers	Each	_____	_____	_____
	4. End Caps/Plugs	Each	_____	_____	_____
	5. Bends	Each	_____	_____	_____
	6. Tees	Each	_____	_____	_____
	7. Corporation Stops	Each	_____	_____	_____
	8. Saddles	Each	_____	_____	_____
	9. Curb Stops & Boxes	Each	_____	_____	_____
	10. Sleeve-type Couplings	Each	_____	_____	_____
	5. Supply & Install Sounding Point-Marker (size)	Each	_____	_____	_____
	6. Supply & Install of Hydrant Extensions (length), (insulation)	Each	_____	_____	_____
	7. Colour Coded Painting of Hydrants	Each	_____	_____	_____

SECTION DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
8. Supply & Install Valves Including Valve Boxes (size), (insulation)	Each	_____	_____	_____
9. Supply & Install of Valve Chambers	Each	_____	_____	_____
10. Supply & Install of Joint Restraints (size)	Each	_____	_____	_____
11. Supply & Install Combination Air Release-Vacuum Relief Valves (size)	Each	_____	_____	_____
12. Supply & Install Valve Box Extensions	Each	_____	_____	_____
13. Adjust Existing Valve Boxes to Grade	Each	_____	_____	_____
14. Swabbing of Water Lines (size)	m	_____	_____	_____
15. Locating Existing System	Each	_____	_____	_____
16. Connecting to Existing System	Each	_____	_____	_____
02724 Sewage Force Mains				
1. Supply & Installation of Sewage Force Mains (size), (class), (type), (insulation)	m	_____	_____	_____
2. Supply & Installation Combination Air Release-Vacuum Relief Valve & Chamber	Each	_____	_____	_____
3. Supply & Installation of Fittings Bends (size) (insulation)	Each	_____	_____	_____
4. Force Main Connection to Maintenance Holes	Each	_____	_____	_____
5. Break Into & Connect to Existing Maintenance Hole	Each	_____	_____	_____
6. Swabbing of Force Main (size)	m	_____	_____	_____
02729 Water Wells				
1. Drilling Unconsolidated Formation	m	_____	_____	_____
2. Drilling in Consolidated Formation	m	_____	_____	_____
3. Supply & Installation of Casing (type), (size)	m	_____	_____	_____
4. Supply & Install Drive Shoe	Each	_____	_____	_____
5. Supply & Installation of Well Screen (size)	L.S.	Unit	_____	_____
6. Supply & Placement of Gravel	kg	_____	_____	_____

SECTION	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
Packing					
7. Supply & Placement of Grouting (40 kg bags)		Each	_____	_____	_____
8. Well Development		Hour	_____	_____	_____
9. Disinfection of Well		L.S.	Unit	_____	_____
10. Test Pumping of Well		Hour	_____	_____	_____
11. Water Quality Testing		L.S.	Unit	_____	_____
12. Supply & Installation of Well Seals (size)		Each	_____	_____	_____
02831	Chain Link Fences & Gates				
1. Supply & Install of Chain Link Fence, Including Brace Panels & Gate Openings Requirements		m	_____	_____	_____
2. Supply & Install Barb Wire & Brackets		m	_____	_____	_____
3. Supply & Install of Chain Link Gates (size)		Each	_____	_____	_____
02832	Wildlife Wire Fences				
1. Supply & Erection of Wire Fences		m	_____	_____	_____
2. Supply & Erection of Wire Gates		Each	_____	_____	_____
02897	Filter Fabric (Geotextile)				
1. Supply & Install Filter Fabric		m^2	_____	_____	_____

DIVISION 3

SECTION	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
03300	Cast-In-Place Concrete				
1. Cast-In-Place Concrete		m^3	_____	_____	_____
2. Concrete Bedding		m^3	_____	_____	_____
3. Concrete Pipe Encasement		m^3	_____	_____	_____
4. Concrete Supports		m^3	_____	_____	_____
5. Concrete Thrust Blocks		m^3	_____	_____	_____
6. Concrete Cut-off Walls		m^3	_____	_____	_____

SECTION	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
03306	Underwater Concreting				
1. Underwater Concrete		m	_____	_____	_____
2. Underwater Video and/or Photo Inspection		L.S.	Unit	_____	_____
	HST (15% of Sub-Total)				_____

STANDARD FORMS TABLE OF CONTENTS

Forms are available on the website: https://www.gov.nl.ca/ti/mi/mwsr/#forms

FORM NO.	TITLE
1	Request for Information (RFI)
2	Certificate of Safety Training and Supervision
3	Equal or Substitute Product Request
3A	DGSNL Preliminary Application to Develop Land
4	Materials on Site
5	Contract Change Order Notice
5A	PCA Amendment – Change Order Notice
6	Daily Force Account Report
7	Testing & Reinstatement Allowance
8	Reinstatement Certificate
9	Not in Use
10	Statutory Declaration
11	Monthly Statement Regarding Outstanding Claims
12	Certificate of Substantial Performance
13	Certificate of Total Performance
14	Daily Contract Time Control Sheet
15	Contract Payment Certificate
16	Detail Sheet for Unit Price Contract
17	House Servicing Interview
18	Daily Site Report
19	Not in Use
20	Variance Form

STANDARD DRAWINGS TABLE OF CONTENTS

MUNICIPAL INFRASTRUCTURE

The following standard drawings are maintained by the Department of Transportation and Infrastructure Division of Municipal Infrastructure:

DRAWING NO.	DESCRIPTION
04010	Project Sign for Provincially Funded Projects
04020	Typical Trench Detail - Single Pipe
04030	Not in Use
04040	Typical Trench Detail – Multiple Pipes
04050	Typical Trench Detail Building Service Lines
04060	Precast Concrete Headwall for Opening Up to 1800mm
04070	Debris Rack
04080	Concrete Barrier Curb
04090	Concrete Curb & Gutter
04100	Concrete Sidewalk
04110	Concrete Joint Notes
04120	Not in Use
04130	Concrete Sidewalk Adjacent to Curb and Gutter
04140	Concrete Sidewalk Driveway Entrance Details
04141	Combined Concrete Curb & Sidewalk
04150	Curb Ramp on Radius
04160	Parallel Curb Ramp
04170	Handrail
04180	Asphalt Transition
04190	Precast Concrete Maintenance Hole
04200	Not in Use
04210	Not in Use
04220	Precast Concrete Maintenance Hole Components Various Sizes
04230	Not in Use
04240	Not in Use

DRAWING NO.	DESCRIPTION
04250	Precast Concrete Adjustment Units for Maintenance Holes and Catch Basins
04260	Not in Use
04270	Aluminum Safety Platform for Circular Maintenance Holes
04280	Maintenance Hole Steps – Solid
04290	Cast-in-Place Maintenance Hole Backdrop Structure
04300	Not in Use
04310	Internal Drop Structure for New Maintenance Holes
04320	Maintenance Hole Benching and Pipe Opening Alternatives
04330	Cast Iron, Square Frame with Circular Closed or Open Cover for Maintenance Holes
04340	Sewer Clean Out Details
04350	Precast Concrete Catch Basin 600 x 600mm
04360	Precast Concrete Twin Inlet Catch Basin 600 x 1450mm
04370	Not in Use
04380	Not in Use
04390	Precast Concrete Ditch Inlet 600 x 600mm or 1200mm x 1200mm
04400	Precast Concert Ditch Inlet 600 x 1200mm
04410	Galvanized Steel Honeycomb Grating for Ditch Inlets
04420	Cast Iron, Square Frame with Grate for Catch Basins
04430	Catch Basin Frame with Grate Installation at Curb and Gutter
04440	Catch Basin Frame with Grate Shoulder Installation at Concrete Barrier
04460	House Services Connection
04470	Sewer Services Connections for Flexible Main Pipe Sewer
04480	Sewer Services Connections for Rigid Main Pipe Sewer
04510	Water Service Connection Up to and Including 32mm Diameter Sizes
04520	Water Service Connection 38 and 50mm Diameter Sizes
04530	Not in Use
04540	Sliding Type Valve Box

DRAWING NO.	DESCRIPTION
04550	Typical Hydrant Detail
04560	Hydrant Connection
04570	Hydrant Maker
04580	Concrete Support Cradle
04590	Water Main Thrust Blocks Type ‘A’
04600	Water Main Thrust Blocks Type ‘B’
04610	Sounding Point / Marker Detail for Non-Metallic Water Main
04620	Not in Use
04630	Not in Use
04640	Not in Use
04650	Typical Cross Section Municipal Road

Transportation and Infrastructure – Traffic Control Manual
The standard drawings from the Traffic Control Manual are maintained by the Department of Transportation and Infrastructure, Highway Design and Construction Division and can be accessed at the following website, https://www.gov.nl.ca/ti/hdc/ or directly at https://www.gov.nl.ca/ti/files/publications-traffic-control-2018.pdf

Transportation and Infrastructure – Highway Specifications Book
The standard drawings from the TI, Highway Specifications Bookare maintained by that division of the Department of Transportation and Infrastructure and can be accessed at the following website, https://www.gov.nl.ca/ti/hdc/ or directly at https://www.gov.nl.ca/ti/files/Division-12-Combined.pdf.

DIVISION 1

01000 PROJECT SPECIFIC SPECIFICATION

PART 1 DESCRIPTION OF WORK
PART 2 LIST OF DRAWINGS
PART 3 SITE ACCESS CONDITIONS AND OR LIMITATIONS
PART 4 SPECIFICATIONS
PART 5 MEASUREMENT OF PAYMENT FOR ADDITIONAL ITEMS

01001 DEFINITIONS
01002 ABBREVIATIONS

PART 1 TERMS / ABBREVIATIONS
PART 2 SI TERMS

01003 REFERENCE DOCUMENTS

PART 1 ORGANIZATIONS
PART 2 PUBLICATIONS

01005 GENERAL INSTRUCTIONS

PART 1 REFERENCES
PART 2 GENERAL
- 2.1 DOCUMENTS REQUIRED ON SITE
- 2.2 DATUM
- 2.3 PRIVATE LANDS
- 2.4 CODES AND NATIONAL STANDARDS
- 2.5 SETTING OUT OF WORK
- 2.6 NATURE OF SITE
- 2.7 LOCATION OF EQUIPMENT AND FIXTURES
- 2.8 CONCEALMENT
- 2.9 EXISTING UNDERGROUND SERVICES
- 2.10 ALTERATIONS, ADDITIONS OR REPAIRS
- 2.11 RELICS AND ANTIQUITIES
- 2.12 EQUIPMENT RENTAL
- 2.13 EXCESS EXCAVATION MATERIALS
- 2.14 TEMPORARY SUPPLY OF WATER AND SEWER SERVICES TO OCCUPANTS
- 2.15 MAINTAIN EXISTING SUPPLY OF WATER OR SEWER SERVICES TO OCCUPANTS
- 2.16 FIRE COMMISSIONER'S BULLETINS
- 2.17 ATTENDANCE UPON THE OWNER’S REPRESENTATIVE
- 2.18 COMPACTION DENSITIES
- 2.19 REQUESTS FOR INFORMATION (RFI)

PART 3 PRODUCTS
- 3.1 NOT APPLICABLE

PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01010 MOBILIZATION & DEMOBILIZATION

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 GENERAL
2.2 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01015 MATERIALS AND EQUIPMENT DELIVERED TO SITE

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 GENERAL
2.2 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01020 CASH ALLOWANCES

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 –GENERAL
2.1 MONITORING AND COORDINATION OF CASH ALLOWANCES
2.2 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01045 CUTTING, FITTING AND PATCHING

PART 1 REFERENCES
1.1 NOT APPLICABLE

PART 2 GENERAL
2.1 –GENERAL
2.2 APPROVALS
2.3 INSPECTION
2.4 PERFORMANCE
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 PREPARATION
PART 5 BASIS OF PAYMENT

01155 WEIGH SCALES

PART 1 REFERENCES
PART 2 GENERAL
2.1 REGULATORY AGENCIES
PART 3 PRODUCTS
3.1 EQUIPMENT
PART 4 EXECUTION
4.1 INSTALLATION
4.2 OPERATION
4.3 MAINTENANCE
PART 5 BASIS OF PAYMENT

01200 PROJECT MEETINGS

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 ADMINISTRATIVE
2.2 PRE-CONSTRUCTION MEETING
2.3 PROGRESS MEETINGS
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01300 CONSTRUCTION PROGRESS SCHEDULE

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 CONSTRUCTION SCHEDULE REQUIREMENTS
2.2 SCHEDULE FORMAT
2.3 CRITICAL PATH SCHEDULING

2.4 SUBMISSION TIMING
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01320 STANDBY COMPENSATION

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
2.2 SCHEDULE
2.3 SUBMISSION
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01330 SUBSTITUTION PROCEDURES

PART 1 REFERENCES
1.1 RELATED DOCUMENTS
PART 2 GENERAL
2.1 DEFINITIONS
2.2 ACTION SUBMITTALS
2.3 QUALITY ASSURANCE
2.4 PROCEDURES
PART 3 PRODUCTS
3.1 SUBSTITUTIONS
PART 4 EXECUTION
PART 5 BASIS OF PAYMENT

01340 SHOP DRAWINGS, SAMPLES & SUBMISSIONS

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 GENERAL
2.2 SUBMISSIONS REQUIRED
2.3 SHOP DRAWINGS AND PRODUCT DATA
2.4 SAMPLES
2.5 MATERIAL CERTIFICATION
2.6 CONCRETE MATERIAL CERTIFICATION
2.7 MIX DESIGN SUBMISSION

PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01370 SCHEDULE OF VALUES

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 SUBMITTAL REQUIREMENTS
PART 3 PRODUCTS
3.1 SUBSTITUTIONS
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT
5.1 NOT APPLICABLE

01400 QUALITY CONTROL AND TESTING LABORATORY SERVICES

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 APPOINTMENT AND PAYMENT
2.2 CERTIFIED INSPECTION AGENCIES
2.3 PROCEDURES
2.4 CONTRACTOR'S RESPONSIBILITY
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01500 TEMPORARY UTILITIES AND CONSTRUCTION FACILITIES

PART 1 REFERENCES
PART 2 GENERAL
2.1 INSTALLATION AND REMOVAL
2.2 DEWATERING
2.3 WATER SUPPLY
2.4 TEMPORARY HEATING AND VENTILATING
2.5 TEMPORARY POWER AND LIGHTING
2.6 FIRE PROTECTION
2.7 SANITARY FACILITIES
2.8 TEMPORARY COMMUNICATION

2.9 REMOVAL OF TEMPORARY FACILITIES
2.10 SCAFFOLDING
2.11 HOISTING
2.12 SITE STORAGE/LOADING
2.13 ACCESS
2.14 OWNER'S SITE OFFICE
2.15 EQUIPMENT, TOOL AND MATERIAL STORAGE
2.16 CLEAN-UP
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01545 SAFETY REQUIREMENTS

PART 1 REFERENCES
PART 2 GENERAL
2.1 GENERAL
2.2 PROJECT SAFETY PLAN
2.3 SAFETY MONITORING
2.4 SAFETY REGULATIONS
2.5 SAFETY OPERATIONS
2.6 FIRE SAFETY REQUIREMENTS
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01560 ENVIRONMENTAL REQUIREMENTS

PART 1 REFERENCES
PART 2 GENERAL
2.1 DEFINITIONS
2.2 GENERAL
2.3 MEASUREMENT FOR PAYMENT
2.4 SUBMITALS
2.5 ENVIRONMENTAL COMPLIANCE INSPECTIONS
2.6 DUST CONTROL
2.7 FIRES
2.8 DRAINAGE
2.9 SITE CLEARING AND PLANT PROTECTION
2.10 WORK ADJACENT TO WATERWAYS
2.11 POLUTION CONTROL

2.12 WASTE DISPOSAL AREAS
2.13 TEMPORARY EROSION AND SEDIMENTATION CONTROL
2.14 VEHICULAR MOVEMENTS
2.15 ENVIRONMENTAL MITIGATION
2.16 FUEL STORAGE AND HANDLING
2.17 ENVIRONMENTAL REQUIREMENTS AND APPROVALS
2.18 NOTIFICATION
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01570 TRAFFIC REGULATION

PART 1 REFERENCES
PART 2 GENERAL
2.1 PROTECTION OF PUBLIC TRAFFIC
2.2 MEASUREMENT FOR PAYMENT
2.3 INFORMATIONAL WARNING DEVICES
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 CONTROL OF PUBLIC TRAFFIC
4.2 FLAG PERSONS
PART 5 BASIS FOR PAYMENT

01571 INFORMATIONAL WARNING DEVICES

PART 1 REFERENCES
PART 2 GENERAL
2.1 GENERAL
2.2 CLASSIFICATION OF TEMPORARY CONDITION SIGNS
2.3 COLOURS AND SHAPES
2.4 DIMENSIONS OF REGULATORY SIGNS
2.5 DIMENSIONS OF TEMPORARY CONDITION WARNING SIGNS
2.6 DIMENSIONS OF INFORMATION SIGNS
2.7 DIMENSIONS OF SIGN SUPPORTS
2.8 DIMENSIONS OF MOUNTING HEIGHT
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01572 LOCATION & PLACEMENT OF SIGNS

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 GENERAL
2.2 ADVANCE SIGNING
2.3 APPROACH SIGNING
2.4 AT SITE SIGNS
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01573 DELINEATION DEVICES

PART 1 REFERENCES
PART 2 GENERAL
2.1 APPLICATION
2.2 LOCATION OF DELINEATION DEVICES
2.3 SPACING OF DELINEATORS
2.4 DESIGN AND COLOUR
2.5 FORMS OF DELINEATORS
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01574 BARRICADES

PART 1 REFERENCES
PART 2 GENERAL
2.1 FUNCTION AND LOCATION OF BARRICADES
2.2 LIGHT BARRICADES
2.3 HEAVY BARRICADES
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01575 MISCELLANEOUS WARNING DEVICES

PART 1 REFERENCES

PART 2 GENERAL
2.1 APPLICATION
2.2 HIGH LEVEL WARNING DEVICES
2.3 TRUCKS WITH FLASHERS
2.4 MISCELLANEOUS
2.5 PORTABLE LANE CONTROL SIGNALS
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01580 PROJECT SIGNS & SIGN SUPPORTS

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 TIMING
2.2 PROJECT SIGN AND SIGN SUPPORTS
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01582 SIGN AND SIGNPOST INSTALLATIONS

PART 1 REFERENCES
PART 2 GENERAL
2.1 CLASSIFICATION OF SIGNPOST INSTALLATIONS
2.2 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 GENERAL
3.2 ADDITIONAL MATERIALS TYPE A INSTALLATIONS
3.3 ADDITIONAL MATERIALS TYPE B INSTALLATIONS
3.4 ADDITIONAL MATERIALS TYPE C INSTALLATIONS
3.5 ADDITIONAL MATERIALS TYPE D INSTALLATIONS
3.6 MATERIALS USED FOR THE INSTALLATION OF SIGNS ONTO SIGNPOSTS
PART 4 EXECUTION
4.1 GENERAL
4.2 ASSEMBLY OF TYPES A AND TYPES B
4.3 ASSEMBLY OF TYPES C
4.4 ASSEMBLY OF TYPES D
4.5 INSTALLATION

4.6 ADDITIONAL INSTALLATION REQUIREMENTS FOR TYPES A AND B
4.7 ADDITIONAL INSTALLATION REQUIREMENTS FOR TYPES C AND D
4.8 ADDITIONAL INSTRUCTIONS FOR THE SIGN BOARD
4.9 REMOVAL
PART 5 BASIS OF PAYMENT

01600 MATERIAL AND EQUIPMENT

PART 1 REFERENCES
PART 2 GENERAL
2.1 QUALITY
2.2 AVAILABILITY
2.3 STORAGE, HANDLING AND PROTECTION
2.4 TRANSPORTATION
2.5 MANUFACTURERS' INSTRUCTIONS
2.6 PERFORMANCE
2.7 CONSTRUCTION EQUIPMENT
2.8 QUALITY OF WORK
2.9 CO-ORDINATION
2.10 CONCEALMENT
2.11 CUTTING AND REMEDIAL WORK
2.12 LOCATION OF FIXTURES
2.13 FASTENINGS – GENERAL
2.14 FASTENINGS – EQUIPMENT
2.15 PROTECTION OF WORK IN PROGRESS
2.16 EXISTING UTILITIES
2.17 SELECTION OF MATERIAL AND EQUIPMENT
2.18 SUBSTITUTION OF MATERIAL AND EQUIPMENT
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01610 FORCE ACCOUNT PAYMENT

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 GENERAL
2.2 EQUIPMENT RENTAL RATE SCHEDULE
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

01700 CONTRACT CLOSE-OUT

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 FINAL INSPECTIONS AND DECLARATION PROCEDURES
2.2 RE-INSPECTION
2.3 FINAL CLEANING
2.4 INSPECTION/TAKEOVER PROCEDURES
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01710 REINSTATEMENT AND CLEANING

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
2.2 PROJECT CLEANLINESS
2.3 GENERAL REINSTATEMENT
2.4 FINAL CLEANING
2.5 FINISHING OF THE PROJECT
2.6 MAINTENANCE
2.7 REINSTATEMENT OF ROADS
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

01720 PROJECT RECORD DOCUMENTS

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 QUALITY ASSURANCE
2.2 SUBMISSION
2.3 FORMAT
2.4 CONTENTS OF EACH VOLUME
2.5 AS-BUILTS AND SAMPLES
2.6 RECORDING AS-BUILT CONDITIONS
2.7 FINAL SURVEY

2.8 EQUIPMENT AND SYSTEMS
2.9 MATERIALS AND FINISHES
2.10 MAINTENANCE MATERIALS
2.11 DELIVERY, STORAGE, AND HANDLING
2.12 PRE-WARRANTY MEETING
2.13 WARRANTIES AND BONDS
2.14 WARRANTY TAGS
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

PART 1 DESCRIPTION OF WORK

1.1

PART 2 LIST OF DRAWINGS

2.1

PART 3 SITE ACCESS CONDITIONS AND OR LIMITATIONS

3.1

PART 4 SPECIFICATIONS

4.1

PART 5 MEASUREMENT OF PAYMENT FOR ADDITIONAL ITEMS

5.1

Additional Excavation	all excavation ordered in writing by the Owner beyond that specified.
Aquifer	part of a formation or a group of formations of underground rock that is water-bearing.
Asphalt Binder Content	the percentage of asphalt binder in the asphalt concrete mixture.
Available Draw Down	difference in elevation between static level and top of screen, or between static level and 2 m above bottom of well in the case of wells with no screen.
Borrow	common material derived from excavation outside site and approved for incorporation into work.
Back Slope	the slope in a cut between the invert of the roadside ditch and the point where the slope intersects original ground.
Business Day	any day other than a Saturday, Sunday or Provincial statutory holiday in the Province.
Clearing	the cutting of all standing trees, brush, bushes and other vegetation at or below 150 mm above original ground and the disposal of felled materials, windfalls and surface litter.
Close-Cut Clearing	the cutting of all standing trees, stumps, brush, bushes and other vegetation at ground level and disposal of felled material, windfalls and other surface litter.
Clearing Isolated Trees	cutting off to not more than a specified height above ground of trees designated, and disposing of felled trees and debris.
Common Excavation	excavation of materials of whatever nature that are not included under definitions of rock excavation including, dense tills, hardpan, frozen materials, soft or previously blasted rock or broken stone, and partially cemented materials, that can be ripped and excavated with heavy construction equipment.

Cohesionless Soil	for compaction purposes is: 1. Materials having less than 20% passing 0.075 mm sieve, regardless of plasticity of fines. 2. Materials containing between 20% and 50% passing 0.075 mm sieve, and having a liquid limit less than 25 and a plasticity index less than 6 when tested to ASTM D4318.
Cohesive Soil	for compaction purposes, is soil not having properties to be classified as cohesionless.
Consolidated Formation	a geologic formation of bedrock.
Department	unless the context indicates otherwise, means the department presided over by the Minister of Transportation and Infrastructure.
Design Mix Formula (DMF)	the laboratory determination of the precise proportions of asphalt binder, additives and aggregates to be blended together to meet the specified properties for a given asphalt concrete mix.
Ditching	the excavation in earth or rock for all water courses. The term will include roadside ditches, all excavation lying beyond the end of drainage structures, and stream and watercourse diversions and corrections.
Drawdown	difference in elevation, between static level and pumping level.
Earth	all soils, and any other material to be excavated not classified as rock.
Embankment	material derived from usable excavation and placed above original ground or stripped surface up to subgrade elevation.
Equivalent Opening Size (EOS)	diameter in micrometers of the standard sieve having openings closest in size to the diameter of uniform particles, that will have 95% by mass retained by the geotextile, when shaken in the prescribed manner.
Excavation classes	only two classes of excavation will be recognized, rock excavation and common excavation.

Existing rock surface	the rock surface, as measured after removal of overburden, but before rock excavation.
Filtration	the process of allowing water to easily escape from the soil, while retaining soil in place.
Free Haul	distance that excavated material is to be hauled without compensation. Free haul distance to be 2 km.
Front Slope	the slope in a cut section between the edge of shoulder and the invert of the roadside ditch.
Job Mix Formula (JMF)	the resultant establishment of the single definite percentage for each sieve fraction of aggregate and asphalt binder content that will produce the desired asphalt concrete mix properties under field conditions.
Geotextile	a synthetic textile structure that is produced by weaving, or by a process such as spun bonding, needle punching, or by other similar processes.
Grubbing	the excavation and disposal of stumps and roots, boulders and rock fragments to not less than 150 mm below original ground surface.
Mean of the Deviations	the sum of the absolute values of the deviations divided by the number of tests in the lot.
Mix Property	measured for product acceptance and price adjustments are as follows: Gradation: Passing 4.75 mm and 75 µm sieves, Asphalt Binder Content, Binder Grade, Marshall Air Voids, Thickness, Application Rate, Density and Smoothness.
Overhaul	authorized hauling of excavated material in excess of 2 km from the point of excavation.
Over Excavation	all excavation beyond that specified, performed without the written order of the Owner.

Overbreak	that portion of any rock that is excavated, displaced, or loosened outside and beyond the established payment lines, regardless of whether the overbreak is due to the inherent character of any rock formation encountered, or to any other cause.
Pavement Structure	combination of layers of unbound or stabilized granular sub-base, base, and asphalt or concrete surfacing.
Product	products, materials, equipment and articles referenced throughout this specification.
Pumping Level	difference in elevation between well datum and water level when well is being pumped at stated L/s rate.
Recovery	the time taken for water level to return from pumping level to static level after pumping stops.
Referee Sample	the portion of the loose or core sample that is set aside by the laboratory in the case of an appeal of binder content, gradation, and/or density by the Contractor.
Right-of-Way (ROW)	a legal right of passage on/under another person’s land.
Rock Excavation	excavation of material from solid beds or masses of igneous, sedimentary, or metamorphic rock that, prior to its removal was integral with its parent mass and that cannot normally be excavated without blasting, ripping, or hydraulic hammer, and boulders or rock fragments having individual volume in excess of 0.5 m^3 determined from three mutually perpendicular dimensions. Removal of rock with teeth on a bucket is not rock excavation.
Sample Mean	the arithmetic mean of the group of test results derived from the randomly selected samples.
Structure	any bridge, concrete culvert, retaining wall, building, sign support, pipe sewer, maintenance hole, catch basin, ditch inlet, pavement, concrete base cement, treated base, curb and gutter system, sidewalk, fence, guide rail and guide post.
Side Slope	the slope in a fill between the edge of shoulder and the point where the slope intersects original ground.

Stripping	the removal of top soil and other material from fill areas, and the removal of top soil from the surface of the excavation areas.
Suitable Material	common material derived from excavation and approved by the Owner for incorporation into work.
Sub-grade Elevation	elevation immediately below pavement structure.
Static Level	difference in elevation between well datum and level of water in well when no pumping has been conducted for at least 6 hours.
Stratified Random Sample	a stratified random sample is defined as a representative sample taken in an unbiased manner, by dividing a Lot into approximately equal segments. A random sample is taken from each area or segment.
Specialty Item	A Product that is designed and fabricated specifically for the Work and cannot be easily incorporated into other Work.
Specific Capacity	ratio of pumping rate to draw down, expressed in litres per minute per metre of draw down.
Thickness	the specified application rate indicated in the contract documents divided by the average bulk relative density obtained from the core samples for a given Lot. Price adjustments for thickness will be applied to new construction only.
Topsoil	material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
Underbrush Clearing	consists of removal from treed areas of undergrowth, deadwood, and disposing of all fallen timber and surface debris.
Unsuitable Material	common material derived from excavation and unsuitable for incorporation into work.
Waste Material	material unsuitable for use in work or surplus to requirements.

Well Datum	top of outer casing or similar fixed point of wellhead with elevation tied to geodetic or suitable local datum.
Work Area	the location in the Work Site on which Work is being carried out.
Work Permit	a statutory requirement of a Federal and/or Provincial Government agency and/or Local Authority approving the methodology of work.
Work Site	the lands and premises owned by the Owner or in which the Owner has proprietary interest, upon which the Work is to be performed and as defined in the Contract Documents.

PART 1 TERMS / ABBREVIATIONS

APCP	Air Pollution Control Plan
AWG	American Wire Gauge
c/w	complete with
CCA	Chromated Copper Arsenate
CCTV	Closed-Circuit Television
CFCSA	Canadian Federation of Construction Safety Associations
CofA	Certificate of Approval (from DGSNL)
COR	Certificate of Recognition (from the CFCSA)
CPP	Contaminant Prevention Plan
DC	Direct Current
DFO	Federal Department of Fisheries and Oceans
DGSNL	Department of Digital Government and Service NL
DMF	Design Mix Formula
DS	Designated Substances
DVD	Digital Video Disc
ECC	Department of Environment and Climate Change
EEPROM	Electrically Erasable Programmable Read-Only Memory
EMM	Environmental Management Manual
EPP	Environmental Protection Plan

EPS	Entry-Level Power Supply
ESCP	Erosion and Sedimentation Control Plan
F.O.B.	Freight on Board
FM	Factory Mutual Research Corporation
FTE	Fritted Trace Elements
GFCI	Ground Fault Circuit Interrupter
GU	General Use cement
HDPE	High-Density Poly Ethylene
I.D.	Inside Diameter
IPP	Identification and Protection Plan
ITP	Quality Control Inspection Testing Plan
JHA	Job Hazard Analysis
LCD	Liquid-Crystal Display
LED	Light-Emitting Diode
LNT	Lowest Normal Tide
MAG	Minimum Acceptable Germination
MAP	Minimum Acceptable Purity
MI	Division of Municipal Infrastructure
MMSAC	Municipal Master Specification Advisory Committee
MPA	Department of Municipal and Provincial Affairs
MPEG	Movie Photographic Experts Group

MSDS	Material Safety Data Sheets
MTW	Machine Tool Wire
MUTCDC	Manual of Uniform Traffic Control Devices for Canada
NASSCO	North American Society of Sewer Service Companies
NLCSA	Newfoundland and Labrador Construction Safety Association
NPT	National Pipe Thread
O.C.	On Centre
O.D.	Outside Diameter
OH&S/OHS	Occupational Health and Safety
OM	Original Material
PCP	Pre-cast Concrete Pipe
PACP	Pipeline Assessment and Certification program
PE	Polyethylene
PGAB	Performance Grade of Asphalt Binder
PGAC	Performance Graded Asphalt Cement
PH	Precipitate Hardening
PLC	Programmable Logic Controller
PLS	Pure Live Seed
PTP	Pesticide Treatment Plan
PVC	Polyvinyl Chloride
QA	Quality Assurance

RAP	Reclaimed Asphalt Pavement
RCP	Reinforced Concrete Pipe
RCU	Residential Collector Undivided
RLU	Residential Local Undivided
RMS	Root Mean Square
RTU	Remote Terminal Unit
ROW	Right-of-Way
TAC	Transportation Association of Canada
TCH	Trans-Canada Highway
TCP	Traffic Control Plan
TDH	Total Dynamic Head
TDG	Transportation of Dangerous Goods
THW	Thermoplast, Heat- and Water-resistant
TI	Department of Transportation and Infrastructure
TSR	Tensile Strength Ratio
SCP	Spill Control Plan
SI	International System of Units
SPPP	Stormwater Pollution Prevention Plan
SS	Stainless Steel
SWDP	Solid Waste Disposal Plan
UFC	Ultra High Frequency

UL/ULC	Underwriters Laboratories of Canada
WHMIS	Workplace Hazardous Materials Information System
WMP	Wastewater Management Plan

PART 2 SI TERMS

.1 The following table of common metric terms and abbreviations shall apply to all Work carried out under the terms of the Standard Specifications.

.2 Other terms and abbreviations may be used if they are referenced in the context in which they are used.

.3 Where no units are indicated on the Plans for the measurement of length or distance, the unit of measure shall be millimetres.

.4 Metric units shall be used from the referenced documents. If required, imperial units may be given in brackets.

Physical Quantity	Common SI Units	SI Symbol
Area	Square millimetre	mm^2
	Square metre	m^2
	Hectare	ha
	Square Kilometre	km^2
Concentration	Parts per million	ppm
Density	Gram per cubic metre	g/m^3 (mg/L)
	Kilogram per cubic metre	kg/m^3
	Tonne per cubic metre	$tonne/m^3$
Energy	Joule (Newton metre)	J
	Kilojoule	kJ
	Megajoule	MJ
Force	Newton	N
	Kilonewton	kN
	Meganewton	MN
Length	Millimetre	mm
	Metre	m

Physical Quantity	Common SI Units	SI Symbol
	Kilometre	km
Mass	Milligram	mg
	Gram	g
	Kilogram	kg
	Tonne	t
Permeability	Metre per second	m/s
	Metre per year	m/a
Power	Watt	W
	Kilowatt	kW
Pressure	Pascal	Pa
	Kilopascal	kPa
	Megapascal	MPa
Retroreflectivity	Candela per lux per square metre	cd/lux/m^2
Stress	Newton per square metre	N/m^2
	Kilonewton per square metre	kN/m^2
	Meganewton per square metre	MN/m^2
Temperature	Degree Celsius	° C
Time	Second	sec
	Minute	min
	Hour	hr
	Day	d
	Year	yr
Torque	Newton metre	N·m
Unit Weight	Kilonewton per cubic metre	kN/m^3
Velocity	Metre per second	m/s
	Kilometre per hour	km/hr
	Revolutions per minute	rpm
Viscosity Dynamic	Millipascal second	mPa·s

Physical Quantity	Common SI Units	SI Symbol
	Pascal second	Pa·s
Viscosity Kinematic	Square millimetre per second	mm^2/s
	Square metre per second	m^2/s
Volume Solid	Cubic metre	m^3
Volume Fluid	Millilitre	mL
	Litre	L
Volume Rate of Flow	Cubic Metre per second	m^3/s
	Litre per second	L/s

References throughout the Master Construction Specifications to other codes, specifications, standards, guides, legislation, etc. are to the latest version at time of bid solicitation.

PART 1 ORGANIZATIONS

AASHTO	American Association of State Highway and Transportation Officials
ACA	Atlantic Concrete Association
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CAN/CSA	Canadian Standards Association
CCIL	Canadian Council of Independent Laboratories
CCME	Canadian Council of Ministers of the Environment
CEC	Canadian Electrical Code (published by CSA)
CEMA	Canadian Electrical Manufacturer’s Association
CGSB	Canadian General Standards Board
CISC	Canadian Institute of Steel Construction
CLA	Canadian Lumberman's Association
CPCA	Canadian Painting Contractor's Association

CPCI	Canadian Prestressed Concrete Institute
CRCA	Canadian Roofing Construction Association
CSA	Canadian Standards Association
CSC	Construction Specifications Canada
CSI	Construction Specifications Institute
EEMAC	Electrical Engineering Manufacturers Association of Canada
FM	Factory Mutual Engineering Corporation
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
ISO	International Organization of Standards
NAAMM	National Association of Architectural Metal Manufacturers
NASSCO	North American Society of Sewer Service Companies
NBC	National Building Code
NEMA	National Electrical manufacturers' Association
NFPA	National Fire Protection Association
NLGA	National Lumber Grades Authority
NSF/ANSI	NSF International
PAPC	Pipeline and Assessment Certification Program
PPI	Plastic Pipe Institute
TAC	Transportation Association of Canada
TTMAC	Terrazzo, Tile and Marble Association of Canada

UL	Underwriters Laboratories
ULC	Underwriters Laboratories of Canada
USCC	US Composting Council
Uni-Bell	Uni-Bell PVC Pipe Association
WRc	Water Research Centre

PART 2 PUBLICATIONS

Canada Seeds Act and Regulations

Canadian Electrical Code (CEC)

Canada Fertilizers Act and Regulations

Canadian Construction Safety Code

Canadian Blasting Association Standards

Composting Council Fact Sheet - 40 CFR 503 Regulation (Federal Sewage Sludge Rule USA)

Filtrexx Canada Standard Specifications and Design Manual

Government of Newfoundland and Labrador, Department of Environment and Climate Change, Pollution Prevention Division, Asbestos Waste Disposal Guidance Document

Government of Newfoundland and Labrador, Department of Environment and Climate Change, Water Resources Management Division, Aquifer Testing Guidelines

Government of Newfoundland and Labrador, Department of Environment and Climate Change, Water Resources Management Division, Guidelines for Sealing Groundwater Wells, February 1997

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure (TI), Highway Design and Construction Division, Highway Specifications Book

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure, NL Master Specification Guide for Public Funded Buildings

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure, Traffic Control Manual

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure, Universal Design Standard

Government of Newfoundland and Labrador, Occupational Health and Safety Act, Chapter O-3

Government of Newfoundland and Labrador Regulation 5/12, Occupational Health and Safety Regulations, 2012

Government of Newfoundland and Labrador Regulation 63/03, Well Drilling Regulations, 2003 under the Water Resources Act (O.C. 2003-221)

Government of Newfoundland and Labrador Regulation 65/03, Environmental Control Water and Sewage Regulations, 2003 under the Water Resources Act (O.C. 2003-231)

ISO 9001 Quality Management Systems - Requirements

National Building Code of Canada

National Fire Code of Canada (NFC)

National Lumber Grades Authority (NLGA)

National Plumbing Code of Canada (NPC)

Regulations of the Canadian Lumber Standards Accreditation Board

Statutes of Canada, Weights and Measures Act and Regulations

The Canadian Council of Ministers of the Environment (CCME) Guidelines

Timber Design Manual 1974 issued by Laminated Timber Institute of Canada

Transportation of Dangerous Goods Act, 1992

Transportation Association of Canada, Manual of Uniform Traffic Control Devices for Canada

US Composting Council (USCC) Test Method for the Examination of Composting and Compost (TMECC) guidelines

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure (TI), Municipal Infrastructure Division:

Equipment Rental Rate Schedule

ASTM International

D698	Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft/lbf/ft^3 (600 kN/m/m^3))

PART 2 GENERAL

2.1 DOCUMENTS REQUIRED ON SITE

.1 Maintain at job site, one copy each of following:

- .1 Contract Documents, including this specifications document
- .2 Amendments
- .3 Reviewed shop drawings
- .4 Shop drawing log and list of outstanding shop drawings
- .5 Change Orders
- .6 Other modifications to contract
- .7 Request for Information (RFI)
- .8 Field test reports
- .9 Copy of approved Work schedule
- .10 Manufacturers' installation and application instructions
- .11 Occupational Health and Safety Act and Regulations
- .12 Training certificates
- .13 Material Safety Data Sheet (MSDS)
- .14 All applicable approvals, certificates, and permits from the various Authorities Having Jurisdiction required to complete the Work. E.g. Departments of Environment and Climate Change, Transportation and Infrastructure, Natural Resources, etc.
- .15 Guide to OHS Legislation NL – Trenching and Excavating
- .16 Transportation of Dangerous Goods Certificates
- .17 Site Specific Safety Plan including:
  - .1 WHMIS and MSDS
  - .2 Copies of Site Inspections

.3 Copies of Hazard Assessments
.4 Copies of Tool Box Meetings Minutes with list of attendees

.18 Copy of Contractor's Safety Manual including a valid Certificate of Recognition (COR) certified from the Newfoundland and Labrador Construction Safety Association (NLCSA) and Accident Investigations
.19 All OH&S Meeting Minutes
.20 Emergency contact numbers
.21 Emergency Rescue or Response Plans and Equipment
.22 TI Traffic Control Manual or Approved Municipality Traffic Control Manual

2.2 DATUM

.1 All levels refer to the datum defined on the Contract Drawings.

.2 Establish bench marks on the site. The Contractor is fully responsible for this and verification will not be by the Owner. The Contractor is to notify the Owner of any errors found immediately.

2.3 PRIVATE LANDS

.1 The Contractor shall not enter upon, or occupy, with workers, equipment, tools, or materials of any nature any lands other than public streets and roadways, except for the rights-of-way shown on the drawings, or other areas designated by the Owner and required for the performance of the Work, without the written permission of the owner of the land to be used. The Contractor shall pay for the temporary use of any such private land if requested by the property owner. This cost is incidental to the work.

.2 The overall widths of the rights-of-way shall not be greater than that shown on the drawings, unless the Contractor has obtained consent from the proper parties and a certified copy of such consent shall be furnished to the Owner.

2.4 CODES AND NATIONAL STANDARDS

.1 Perform Work in accordance with the latest edition of any code of national, provincial or local application provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.

.2 Materials and quality of Work shall be in accordance with applicable standards of American Association of State Highway and Transportation Officials (AASHTO), American Society of Mechanical Engineers (ASME International), American Society for Testing and Materials (ASTM International), American Water Works Association (AWWA), Canadian

General Standards Board (CGSB) and Canadian Standards Association (CSA Group), Transportation Association of Canada (TAC) and other referenced organizations.

.3 Conform to latest revisions of dated referenced standards, as reaffirmed or revised to date of tender. Standards or Codes not dated shall be deemed editions in force on date of specifications.

2.5 SETTING OUT OF WORK

.1 The Owner will provide only those survey control points and set such stakes as necessary to define general location, alignment and elevations of Work. Give the Owner reasonable notice of requirements for such control points and stakes.

.2 Before the commencement of any Work, the accuracy of the lines, positions, elevations, and grades shown on the drawings shall be checked and agreed upon at the site jointly by the Contractor and the Owner.

.3 Set grades and lay out Work in detail from control points and grades established.

.4 Assume full responsibility for and execute complete layout of Work to locations, lines and elevations indicated.

.5 Provide devices, including stakes and survey markers, required to lay out and construct Work.

.6 The checking of, or setting out, of lines or levels by the Owner shall not in any way relieve the Contractor of their responsibility for the correctness thereof and the Contractor shall carefully protect and preserve all bench marks, profiles and other things used in setting out the Works. If at any time during the progress of the Works, any error shall appear or arise in the Works, the Contractor shall at their own expense rectify such error to the satisfaction of the Owner, unless such error is based on incorrect data supplied in writing by the Owner.

.7 The Contractor shall keep the Owner informed a reasonable time in advance of the time and places at which he wishes to do the Work in order that information lines, elevations and grades may be confirmed and necessary measurements for record and payment purposes may be made with the minimum of inconvenience. No payment shall be made for the cost to the Contractor of any Work or delay occasioned by establishing or checking lines and grades or making other measurements and no extensions of time shall be allowed for any delay occasioned thereby.

2.6 NATURE OF SITE

.1 Investigate and become familiar with the nature of the ground in which the Works are to be constructed and all other matters affecting the installation of the Works.

.2 The ground water table on part of the site may be at such a level as to cause flotation or other damage to the structures. Observe all precautions against flotation of the structures during construction, and be responsible for any damage caused by flotation.

.3 Excavate any trial holes and do any other Work necessary for locating existing structures, pipelines, cables and other obstructions, shown on the contract documents, affecting the construction of the Works.

2.7 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform the Owner of impending installation and obtain their approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by the Owner.

2.8 CONCEALMENT

.1 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

.2 Before installation, inform the Owner if there is a contradictory situation. Install as directed by the Owner.

2.9 EXISTING UNDERGROUND SERVICES

.1 Where Work involves breaking into or connecting to existing services, carry out Work at times directed by the Owner, with minimum disturbance to pedestrian and vehicular traffic.

.2 Before commencing Work, establish location and extent of known service lines, pipelines, cables, structures and other obstructions in area of Work and notify the Owner of findings. Protect all known underground services affected by operations under this contract and repair any damage caused by such operations, either directly or indirectly, and pay all costs.

.3 Submit schedule to, and obtain approval from, the Owner for any shut-down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.

.4 Where unknown services are encountered, immediately advise the Owner and confirm findings in writing.

.5 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by the Owner.

.6 Record locations of maintained, re-routed and abandoned service lines.

.7 Protect, relocate or maintain existing active services as required. When inactive services are encountered, cap off in a manner approved by Authorities Having Jurisdiction over service.

.8 Should it be necessary to connect to lines which are controlled by another utility company other than the Owner, carry out such connections in accordance with the specific instructions of the representative of the utility concerned.

.9 No valve or other control on any existing water system or other utility shall be operated for any purpose by the Contractor without the prior written approval of the Owner. Such approval requires 4 days written notice unless otherwise specified by the Owner. The Owner or representatives of the Owner or operator of the utility will be present when these controls are operated.

.10 Where a Contractor is required to install storm or sanitary sewer mains beginning at an existing maintenance hole or section of main, the Contractor shall install temporary 6 mm mesh screen over the outlet pipe of the first downstream maintenance hole to prevent silt and gravel from entering the existing system from the new Work. If this location is not appropriate, the Owner may chose a more suitable location.

2.10 ALTERATIONS, ADDITIONS OR REPAIRS

.1 Execute work with least possible interference or disturbance to occupants, public and normal use of premises. Arrange with the Owner to facilitate execution of work.

.2 Where security has been reduced by work of contract, provide temporary means to maintain security.

.3 Provide temporary dust screens, barriers, warning signs in locations where work is adjacent to facilities used by public.

2.11 RELICS AND ANTIQUITIES

.1 Relics and antiquities and items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found on site or in buildings to be demolished, shall remain the property of Owner. Protect such articles and request directives from the Owner.

.2 Give immediate notice to the Owner if evidence of archaeological finds are encountered during construction, and await their written instructions before proceeding with Work in this area.

.3 If Work cannot proceed elsewhere then the work may be paused without penalty to the Owner or Contractor until approval to proceed is received.

2.12 EQUIPMENT RENTAL

.1 Make available to the Owner upon written request, available equipment which the Owner may wish to rent to carry out Work beyond the scope of bid items. Rental rates will be in accordance with current Government of Newfoundland and Labrador, Department of Transportation & Infrastructure, Municipal Infrastructure Division Equipment Rental Rate Schedule and Section 01610. Hourly rental of equipment will be measured in actual working time and necessary travelling time of equipment within limit of project.

2.13 EXCESS EXCAVATION MATERIALS

.1 The priority of claim for use of waste material shall be:

- .1 First: Other areas of the project where there is a deficiency of material.
- .2 Second: Areas designated in the contract drawings. (Maximum quantities shall be specified.)
- .3 Third: Other locations selected by the Owner as a dump site.
- .4 Fourth: Other locations selected by the Contractor and approved as a dump site by the Owner.

.2 Overhaul shall only apply to subsections 2.13.1.1 and 2.13.1.3 listed above and 2.13.1.2 when maximum quantities are exceeded and only to that portion over the quantities specified.

.3 .Where indicated in the specifications, additional payment will be made for excavated materials hauled in excess of the free haul limit. Clearing and Grubbing, Clearing, Grubbing, Granular Base Courses, Asphaltic Courses, etc., are not considered excavated materials, and no payment for overhaul will be made in connection with these items. Overhaul distance will be

measured in one kilometre units from the end of the two kilometre free haul limit. Fractional kilometres will be allowed as full kilometres.

.4 Overhaul will be at the Unit Price bid for each cubic metre for each additional kilometre beyond the free haul limit for rock or other material.

.5 The dump site or sites shall be graded by the Contractor and left in a condition acceptable to the Owner. The Contractor shall also ensure that approved disposal sites are available so that the Work shall not be delayed.

2.14 TEMPORARY SUPPLY OF WATER AND SEWER SERVICES TO OCCUPANTS

.1 Where buildings have wells which are used as a source of potable water and should loss of water occur in individual wells as a result of lowering of the ground water table due to carrying out the Work, the Owner will supply affected occupants with water on a temporary basis. If the Owner requires that the Contractor supply water on a temporary basis, the Contractor shall be paid for this additional Work as a Cash Allowance item. The method of payment shall be in accordance with Section 01020. The Contractor will not be responsible for finding an alternative supply. The Contractor will test the temporary system as required by the Owner.

.2 If it is not feasible, as determined by the Owner, to maintain the existing system and the Contractor is required to install and operate a temporary system; the Contractor shall be paid for this additional Work as a Cash Allowance item. The method of payment shall be in accordance with Section 01020.

2.15 MAINTAIN EXISTING SUPPLY OF WATER OR SEWER SERVICES TO OCCUPANTS

.1 Where buildings are supplied potable water by a piped system that is indicated on the drawings, the Contractor shall be responsible to maintain the existing system. The method of payment to the Contractor for maintaining the existing system shall be a lump sum item as per the MERX Schedule of Quantities and Prices.

.2 Where buildings are serviced by a piped system that is indicated on the drawings, the Contractor shall be responsible to maintain the existing system. The method of payment to the Contractor for maintaining the existing system shall be a lump sum item as per the MERX Schedule of Quantities and Prices.

2.16 FIRE COMMISSIONER'S BULLETINS

.1 All Work and installations shall comply with installation, safety and fire requirements of the Provincial Fire Commissioner.

2.17 ATTENDANCE UPON THE OWNER'S REPRESENTATIVE

.1 The Contractor shall provide, at the Owner's request, whatever assistance is required to aid the Owner in their measurement and inspection of the Work.

2.18 COMPACTION DENSITIES

.1 Unless specified otherwise all compaction densities are 95 % Standard Proctor Density in accordance with ASTM D698 and corrected in accordance with Section 02501.

2.19 REQUESTS FOR INFORMATION (RFI)

.1 In the event that the General Contractor or any Subcontractor involved in the Work, determines that some portion of the drawings, specifications, or other contract documents requires clarification or interpretation by the Owner, the General Contractor shall submit a Request for Information (RFI) in writing to the Owner.

.2 RFI’s may only be submitted by the General Contractor and shall only be submitted on the RFI Form as required by the Owner. Any RFI’s submitted, not on the official RFI Form will be returned to the Contractor unreviewed.

.3 In the RFI, the General Contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed from the Owner.

.4 In the RFI, the General Contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.

.5 The Owner will review all RFI’s to determine whether they are valid RFI’s. If it is determined that the document is not a valid RFI, it will be returned to the General Contractor, unreviewed, with an explanation why it was deemed not valid.

.6 An RFI Response shall be issued within five (5) business days of receipt of the request from the General Contractor unless the Owner determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Owner, the Owner will, within

five (5) business days of receipt of the request, notify the General Contractor of the anticipated response time.

.7 If the General Contractor submits an RFI on an activity with five (5) business days or less of float on the current project schedule, the General Contractor shall not be entitled to any time extension due to the time it takes the Owner to respond to the request provided that the Owner's responds within the five (5) business days set forth above.

.8 An RFI Response from Owner will not change any requirement of the Contract Documents. In the event the General Contractor believes that the RFI Response will cause a change to the requirements of the Contract Documents, the General Contractor shall within five (5) business days give written notice to the Owner stating that the General Contractor believes the RFI Response will result in a Change Order and the Contractor intends to submit a "Proposed Change Order" request. Failure to give such written notice of five (5) business days shall waive the General Contractor's right to seek additional time or cost under the requirements of the Contract Documents.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 With the exception Parts 2.14 and 2.15, no separate or direct payment will be made for Work as outlined in this specification. Parts 2.14 and 2.15, if required, will be included as pay items in the MERX Schedule of Quantities and Prices either under this specification or 01020 as indicated. Costs of all other Work specified in this section is deemed to be included in the lump sum and unit prices quoted in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for mobilization and demobilization of Work sites.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 GENERAL

.1 Mobilization shall be defined as the loading, transportation, and unloading of all plant, materials, equipment, and articles necessary to complete the Work associated with the contract.

.2 Demobilization shall be defined as the loading, transportation, and unloading of all plant, materials, equipment, and articles after the Work associated with the contract is completed.

2.2 MEASUREMENT FOR PAYMENT

.1 The unit price for this item, on the Island portion of the Province, shall not be greater than 5 % of the initial contract price but not including HST.

.2 The unit price for this item, in the Labrador portion of the Province, shall not be greater than 10 % of the initial contract price but not including HST. For projects north of Cartwright, the unit price for this item shall not be greater than 15 % of the initial contract price including this item but not including HST.

.3 50 % of the total for this item shall be paid on mobilization and 50 % on final demobilization.

.4 There will be no change in the price for mobilization and demobilization due to contract extensions or changes in the work.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this specification and as included in the MERX Schedule of Quantities and Prices

This specification outlines the requirements for payment for materials and equipment delivered to the site, which will be incorporated into the Work.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 GENERAL

.1 The Contractor is responsible for accuracy of the shop drawing in accordance with the requirements of the Contract documents, and coordination with all other trades.

.2 Contractor is responsible for bringing materials to site. Materials and equipment delivered to the site of the Work shall be defined as the purchase and transportation to the job site, of materials and equipment to be incorporated as part of the Work during the current construction season or as otherwise agreed to by the Owner.

.3 Materials and equipment delivered to site will be stored, handled, and protected in accordance with Section 01600.

.4 Materials and equipment delivered to site shall be stored on property owned or leased by the Owner or at a location approved or directed by the Owner.

.5 Storage of materials and equipment shall be in accordance with all Regulatory Agencies, Manufacturer's recommendations or as directed by the Owner.

.6 MSDS for all materials stored on site shall be readily available in the site office.

.7 Contractor is fully responsible for ensuring the Products stored on site are used for the Work.

.8 Contractor is responsible for ensuring the quantity delivered is what will be required for the Work. The values in the MERX Schedule of Quantities and Prices are estimates at time of design. Contractor shall verify quantity prior to purchasing and delivering.

2.2 MEASUREMENT FOR PAYMENT

.1 Measurement for payment will be the Freight on Board (F.O.B.) value of materials and equipment secured on-site and not yet incorporated in the

Work, not exceeding the quantities specified in the MERX Schedule of Quantities and Prices.

.2 Specialty items require documentation from the supplier at time of shop drawing submittal by the Contractor, as to whether or not the item can be returned if not used in the Work.

.1 After shop drawing approval, those specialty items that cannot be returned, and are no longer needed for the Work, are the responsibility of the Owner.

.3 Pipes, fittings and pre-cast maintenance holes not incorporated in the Work, up to quantities specified in the MERX Schedule of Quantities and Prices, shall be

.1 purchased by the Owner at the invoiced price from the supplier plus 10 %, or

.2 supplier restocking fee shall be paid by the Owner up to a maximum of 15 % of the contract unit price, plus transportation at cost (i.e. Force Account without mark-ups) to the Contractor's closest storage facility.

.3 This applies to full units (packages, lengths, etc.).

.4 Partially used Products will not be purchased.

.5 Granular material shall be measured for payment, up to the quantity included in the MERX Schedule of Quantities and Prices, only if it will not be incorporated into the Work in the current construction season. The Contractor shall verify the quantities required. At the end of the project there will be no payment for unused materials.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 Payment will be made based on a completed Materials on Site form approved by the Owner that includes backup invoices for materials and equipment. However, total payable will be for the quantity used, not only delivered, and as verified by the Owner.

.2 Payment for granular materials stockpiled shall not exceed 50 % of the unit price and a minimum of 30 %.

.3 No separate or direct payment will be made for Work specified in this specification. Costs of all Work specified are deemed to be included in the lump sum and Unit Prices quoted in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for Work performed under a Cash Allowance item as specified in the MERX Schedule of Quantities and Prices. These items are to be used if the scope of the Work is unable to be finalized prior to tender.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 MONITORING AND COORDINATION OF CASH ALLOWANCES

.1 Expend each allowance as directed. Allowances will be adjusted to actual cost in accordance with General Conditions, GC 19 - Valuation and Certification of Changes in the Work.

.2 The Contract Price will be adjusted by written order to provide for an excess, or deficit, to each cash allowance as per General Conditions GC 18 - Changes in the Work and GC 19 - Valuation and Certification of Changes in the Work. No excess work beyond the original cash allowance is to be completed until this written order is received.

.3 Progress payments on account of Work authorized under cash allowances shall be included in the monthly application for payment.

.4 A schedule shall be prepared jointly by the Owner and Contractor to show when items called for under cash allowance are required so that the progress of the Work will not be delayed.

.5 The Contractor and Owner will each track the use of cash allowances and review expended amounts of an individual cash allowance item as needed to provide the Owner with sufficient notice of any potential changes.

.6 The Contractor shall be responsible for the co-ordination of all cash allowance items.

.7 Cash allowances cover net cost to Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage installation and other authorized expenses incurred in performing the Work.

.8 Overhead and Profit markups (with the exception of Contribution in Aid (Utilities) invoices) are not to be paid under this item as they are considered to be bid in the tender originally.

2.2 MEASUREMENT FOR PAYMENT

.1 Pole relocation, shoring and/or bracing when required by a Utility Company and/or the Owner will be paid for under this section. The normal limit for payment of 1 metre outside the theoretical trench width does not apply.

.2 Contribution in Aid (Utilities) will be paid for under this section.

.3 As per Section 01005, if the Owner requires that the Contractor supply temporary water to occupants as part of a Cash Allowance, it shall be paid out in accordance with this Section.

.4 As per Section 01005, if the Owner requires that the Contractor supply temporary sewer service to occupants as part of a Cash Allowance, it shall be paid out in accordance with this Section.

.5 Other cash allowances may be added to the MERX Schedule of Quantity and Prices. When these are in use, an explanation will be provided in the Project Specific Specifications.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 Payment for the cash applicable allowance shall be made with each progress estimate. The amount to be paid on any given claim will be equal to the amount of work actually completed as calculated in accordance with the Monitoring and Coordination of Cash Allowances subsection of this Section.

.2 Back up for each cash allowance item will be required with each progress estimate.

.3 For payment purposes, the Contractor may charge up to 5% markup of a Utility Company invoice. No addition for Contractor profit will be accepted.

This specification outlines the requirements for incidental cutting, fitting, and patching required to complete the Work or to make its many parts fit together properly.

PART 1 REFERENCES

1.1 NOT APPLICALBE

PART 2 GENERAL

2.1 GENERAL

.1 Where new Work connects with existing and where existing Work is altered, cut and patch and make good to match existing Work.

.2 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.

.3 Fit the several parts together to integrate with other Work.

.4 Remove and replace defective and non-conforming Work.

.5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

2.2 APPROVALS

.1 Obtain Owner's approval before cutting, boring or sleeving load-bearing members or pipes under pressure or any Work that affects:

.1 Structural integrity of any element of Project.
.2 Integrity of weather-exposed or moisture-resistant elements.
.3 Efficiency, maintenance, or safety of any operational elements.
.4 Visual qualities of sight-exposed elements.
.5 Work of Owner or separate Contractor.

2.3 INSPECTION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

2.4 PERFORMANCE

.1 Execute Work by methods to avoid damage to other Work, and that will provide proper surfaces to receive patching and finishing.

.2 Use material to match existing where practical.

.3 For a change in material submit a request for substitution in accordance with Section 01330 and the General Conditions.

.4 Cut materials using appropriate equipment for the trade involved.

.5 Restore Work with new products in accordance with requirements of Contract Documents.

.6 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.7 At penetration of fire-rated wall, ceiling, or floor construction, completely seal voids with fire-rated or fire-resistant material, as may be required by the Provincial Fire Commissioner's Office, to full thickness of the construction element.

.8 Refinish surfaces to match adjacent finishes: for continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 PREPARATION

.1 Provide supports to assure structural integrity of surroundings, devices and methods to protect other portions of project from damage.

.2 Provide protection from elements for areas which may be exposed by uncovering Work; maintain excavations free of water.

PART 5 BASIS OF PAYMENT

.1 No separate or direct payment will be made for Work specified in this specification. Costs of all Work specified is deemed to be included in the lump sum and unit prices quoted in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for truck weigh sales for weighing of materials where measurement for payment is based on weight or mass.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Government of Canada

Weights and Measures Act and Regulations

PART 2 GENERAL

2.1 REGULATORY AGENCIES

.1 Prior to use, have weigh scales certified in accordance with latest Weights and Measures Act and Regulations. Display certificate in a prominent position.

PART 3 PRODUCTS

3.1 EQUIPMENT

.1 Weigh Scales: Of sufficient capacity to weigh loaded vehicles in a single operation. The weigh scale shall be calibrated in SI units. Calibration and recalibration as per manufacturers requirements and verified by suitable agency. Recalibration after each move.

.2 Scale House:

.1 To enclose mass indicator and in which the Owner's representative can perform Work and maintain records.

.2 To be waterproof and have a minimum 750 luxes of illumination, one sliding window facing scale platform, one other window for cross ventilation, shelf desk at least 0.6 x 1.8 metres and heat to maintain inside temperature at 20 °C. Entrance door not to face onto scale platform.

.3 Provide sufficient number of approved weigh tickets, in triplicate, with consecutive serial numbers.

.4 Time/Date to be included on tickets at scales

PART 4 EXECUTION

4.1 INSTALLATION

.1 Provide, install and maintain scales and scale house convenient to project site at location approved by the Owner.

.2 Remove scales and scale house when no longer required. Level approach ramps.

.3 Repair damages to paving, roadwork, gravel, and structures resulting from scale install, use and removal.

4.2 OPERATION

.1 Provide scale operator unless otherwise directed by the Owner, in which case the Owner's representative at scales will weigh materials.

4.3 MAINTENANCE

.1 Maintain scale platform and scale mechanism clean and free from gravel, asphalt, snow, ice and debris.

.2 Maintain approach ramps in good condition free from sags and ruts.

.3 Have scales retested and re-certified if requested by the Owner and as required by Standards.

PART 5 BASIS OF PAYMENT

.1 No separate or direct payment will be made for Work as outlined in this specification. Costs of all Work specified are deemed to be included in the lump sum and Unit Prices quoted in the MERX Schedule of Quantities and Prices for items that are measured by weighing.

This specification outlines the requirements for site and co-ordination meetings for all parties in contract, parties in subcontract and other Contractors.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 ADMINISTRATIVE

.1 Attend project meetings, scheduled and administered by the Owner, throughout the progress of the Work and approve times and locations proposed by the Owner.

.2 Cooperate with the Owner in the preparation of agendas for meetings.

.3 Distribute written notice of each meeting to Subcontractors five (5) business days in advance of meeting date.

.4 Provide physical space and make arrangements for meetings.

.5 The Owner or Owner’s Representative will record the minutes, include significant proceedings and decisions, identify 'action by' parties and submit a copy of the minutes to the Contractor, Owner’s Representative or Owner, Department, and other meeting participants within five business days after each meeting.

.6 The Contractor shall reproduce copies of minutes forthwith and distribute to the Subcontractors, meeting participants, and affected parties not in attendance.

.7 Representatives of the Contractor, Subcontractor and suppliers attending meetings shall be qualified and authorized to act on behalf of the party each represents.

.8 All meetings shall start with a brief safety minute.

2.2 PRE-CONSTRUCTION MEETING

.1 Within 10 business days after award of Contract, and prior to starting construction, request a meeting with the Consultant/Owner to discuss and resolve administrative procedures and responsibilities.

.2 Senior representatives of the Owner, Department, Consultant, Contractor, major Subcontractors and field inspectors will be in attendance.

.3 Agenda shall follow the MI template including but not limited to:

.1 Appointment of official representative of participants in the Work
.2 Identification of Sub-contractors
.3 Award Letter
.4 Scope Review and Outcomes
.5 Project Sign
.6 Construction and record (01720) drawings
.7 Submittals required before work starts and other documentation
.8 Permits
.9 Liability for engineering fees
.10 Monthly progress claims, and administrative procedures.
.11 Schedule of Work, and progress scheduling (Section 01300)
.12 Substantial performance and deficiencies
.13 Total performance
.14 Safety requirements
.15 Environmental requirements
.16 Contemplated change orders, procedures, approvals required, time extensions, and administrative requirements (General Conditions, GC 21 - Certificates and Payments)
.17 Requirements for temporary facilities, site signs, offices, storage sheds, utilities, and fences (Section 01500)
.18 Surveying and layout
.19 Schedule of submission of shop drawings, samples, and colour chips (Section 01340)
.20 Special Owner requirements
.21 Reinstatement
.22 Pipe bedding
.23 Asphalt quality control
.24 Changes in project team
.25 Delivery schedule of specified equipment
.26 Maintenance manuals (Section 01720)
.27 Take-over procedures, acceptance, and warranties (Section 01720)
.28 Site security in accordance with Section 01005, 01574, 1600, and 02831.)
.29 Owner provided products.
.30 Appointment of inspection and testing agencies or firms

2.3 PROGRESS MEETINGS

.1 During course of Work and the weeks prior to project completion, schedule progress meetings, not less than monthly or as directed by the Owner.

.1 The Department, Owner, Contractor, major Subcontractors involved in Work and the Consultant are to be in attendance.

.2 Agenda to include the following:

.1 Safety
.2 Review, and approval of minutes of previous meeting.
.3 Review of Work progress and construction schedule since previous meeting.
.4 Field observations, problems, and conflicts.
.5 Problems which impede construction schedule.
.6 Review of off-site fabrication delivery schedules.
.7 Corrective measures and procedures to regain projected schedule.
.8 Revisions to construction schedule, if required.
.9 Progress, and schedule, during succeeding Work period.
.10 Review submittal schedules: expedite as required.
.11 Maintenance of quality standards.
.12 Pending changes and substitutions.
.13 Review proposed changes for effect on construction schedule and on completion date.
.14 Other business.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

No separate or direct payment will be made for Work as outlined in this specification. Costs of all Work specified is deemed to be included in the lump sum and Unit Prices quoted in the MERX Schedule of Quantities and Prices.

This specification outlines the Contractor's responsibilities in the preparation and submission of construction schedules with the form and requirements for periodic revisions.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 CONSTRUCTION SCHEDULE REQUIREMENTS

.1 In accordance with schedule and in form acceptable to the Owner, provide within 10 (ten) business days after Contract award, and prior to starting construction, schedule showing dates for:

- .1 The complete sequence of construction activities.
- .2 The dates for the commencement and completion of each major element of construction.
- .3 Any planned interruptions, shutdown or closure activity.
- .4 The timing of temporary services.
- .5 Submitting of shop drawings, material lists, product data, and samples.
- .6 Dates for submitting, review time, resubmission time, last date for meeting fabrication schedule.
- .7 Delivery of items of equipment and materials.
- .8 Final completion date within time period required by Contract Documents.

2.2 SCHEDULE FORMAT

.1 Prepare schedule using a horizontal Gantt chart with a separate bar for each trade or operation using a horizontal time scale identifying the first Work day of each week and using Critical Path Scheduling.

.2 Format for listings to use the Table of Contents of this specification. Identification of listings to use Specification Section Numbers.

2.3 CRITICAL PATH SCHEDULING

.1 Include complete sequence of construction activities.

.2 Include dates for commencement and completion of each major element of construction.

.3 Show projected percentage of completion of each item as of first day of month.

.4 Indicate progress of each activity to date of submission schedule.

.5 Show changes occurring since previous submission of schedule:

.1 Major changes in scope.

.2 Activities modified since previous submission.

.3 Revised projections of progress and completion.

.4 Other identifiable changes.

.6 Provide a narrative report to define:

.1 Problem areas, anticipated delays, and impact on schedule.

.2 Corrective action recommended and its effect.

.3 Effect of changes on schedules of other prime contractors.

2.4 SUBMISSION TIMING

.1 Submit initial construction schedule within 10 business days after award of Contract and prior to starting construction. The Owner will review schedule and return comments within five (5) business days after receipt.

.2 Resubmit finalized construction schedule within five (5) business days after return of reviewed copy.

.3 Provide revised construction progress schedule with each application for payment or when requested.

.4 Interim review of Work progress based on Work schedule will be conducted as decided by the Owner and schedule updated by Contractor in conjunction with and to approval of the Owner.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

No separate or direct payment will be made for Work specified in this specification. Costs of all Work specified are deemed to be included in the lump sum and unit prices quoted in the MERX Schedule of Quantities and Prices.

This specification outlines the Owner's responsibilities in the situation where Work, or any part of it, is suspended by order of the Owner for a reason which is not related to the Contractor's performance of the Work. The Owner may consider a claim for payment of standby costs which are incurred by the Contractor.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure (TI), Municipal Infrastructure Division:

Equipment Rental Rate Schedule

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 When such costs are claimed, they shall be legitimate, reasonable, and supported by proper documentation as required by the Owner.

.2 Such costs shall be submitted in accordance with Section 01610: Force Account Payment with 50 % of the Department of Transportation and Infrastructure, Municipal Infrastructure Division Equipment Rental Rate Schedule rates used.In some instances the actual rental/lease rate may apply, with the appropriate invoices, where that cost is higher than the proposed rate.Use of this Equipment Rental Rate Schedule is as outlined Section 01610.

.3 The Owner will not pay for standby costs related to any of the following:

- .1 Weather or other natural conditions;
- .2 Failure by the Contractor to carry out orders given by the Owner;
- .3 Any failure by the Contractor to comply with a requirement or provision of the Contract;
- .4 Any failure by the Contractor to provide for the safety of the public or theirs, the Owner's or the Owner’s Representative’s work force;
- .5 Any failure by the Contractor to protect the property of the Owner or others;
- .6 Any delay occurring while defects or failures in the Work are being remedied;
- .7 Any change in the quantity of any item of Work from the estimated quantity shown in the MERX Schedule of Quantities and Prices;

.8 Any equipment or workforce which was not actually present and actively working on the Work immediately prior to the suspension of the Work;
.9 Any haul trucks or their drivers used on the Work;
.10 Any suspension of the Work that is less than four (4) hours in duration in a single business day;
.11 Any suspension of the Work that is less than four (4) hours in duration over any three (3) consecutive business days; or
.12 Testing of Material or Work for compliance with Specifications and Plans.

.4 When the Owner fails to provide right-of-way necessary for access to the Work, and has not so notified the Contractor in the special provisions of the Contract, and in the Owner's opinion alternate Work areas are not available or practical to allow continued prosecution of the Work, the Owner may consider the payment of a claim for standby, which shall not in any case exceed 10 business days.

.5 When a claim for standby is considered by the Owner, direct costs which, in the opinion of the Owner, could not have been avoided by the judicious handling of forces, equipment or plant, will be paid to the Contractor in an amount that the Owner may find to be fair and reasonable. No item of cost other than idle time rate of equipment and necessary payments for idle time of workers will be considered.

.6 Compensation for standby time of workers and equipment will be determined by the Owner, and in accordance with the following:

.1 The time paid for will not exceed ten hours in any one day;
.2 Those days not part of the normal schedule will be excluded (i.e. Holidays, days off, etc.); and
.3 Overhead and profit will be excluded.
.4 Upon termination of the suspension by the Owner, the Contractor shall resume operations at once.

2.2 SCHEDULE

.1 The project schedule will be considered to be extended by the number of days incurred approved during delay.

2.3 SUBMISSION

.1 The Force Account forms with the appropriate backup are to be submitted daily and agreed upon by the Owner's Representative.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 Payment for Standby Compensation shall be made with each progress payment, based on Daily Force Account Reports (excluding Overhead and Profit) complete with change order signed by the Regional Engineer, and detailed invoices in accordance with General Conditions, GC 18 - Changes in the Work and GC 19 - Valuation and Certification of Changes in the Work, as approved by the Consultant/Owner. All Daily Force Account Reports are to be signed daily by the Owner’s Representative to ensure accuracy.

This specification includes administrative and procedural requirements for substitutions.

PART 1 REFERENCES

1.1 RELATED DOCUMENTS

.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

PART 2 GENERAL

2.1 DEFINITIONS

.1 Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by General Contractor.

.2 Substitutions for Cause: Changes proposed by General Contractor that are required due to changed Work conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

.3 Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Work requirements but may offer advantage to General Contractor or Owner. No substitutions for convenience are permitted.

2.2 ACTION SUBMITTALS

.1 Substitution Requests: Submit one (1) copy of each request, in PDF format, for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section Number and Title, and Drawing Numbers and Titles.

.1 Substitution Request Form: Use form provided at the end of this section.

.2 Documentation: Show compliance with requirements for substitutions and the following, as applicable:

.1 Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

.2 Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

.3 Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

.4 Product Data, including drawings and descriptions of products and fabrication and installation procedures.

.5 Samples, where applicable or requested.

.6 Certificates and qualification data, where applicable or requested.

.7 List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

.8 Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

.9 Detailed comparison of General Contractor’s construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

.10 Cost information, including a proposal of change, if any, in the Contract Sum.

.11 General Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

.12 General Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

.3 Owner Action: If necessary, Owner will request additional information or documentation for evaluation within five (5) working days of receipt of a request for substitution. Owner will notify General Contractor of acceptance or rejection of proposed

substitution within ten (10) working days of receipt of request, or five (5) working days of receipt of additional information or documentation, whichever is later.

.1 Forms of Acceptance: Change Order, Construction Change Order, or Owner Supplemental Instructions for minor changes in the Work.

.2 Use product specified if Owner does not issue a decision on use of a proposed substitution within time allocated.

2.3 QUALITY ASSURANCE

.1 Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

2.4 PROCEDURES

.1 Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 3 PRODUCTS

3.1 SUBSTITUTIONS

.1 Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than fifteen (15) days prior to the time required for preparation and review of related submittals.

.1 Conditions: Owner will consider General Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Owner will return requests without action, except to record noncompliance with these requirements:

.1 Requested substitution is consistent with the Contract Documents and will produce indicated results.

.2 Requested substitution provides sustainable design characteristics that specified product provided.

.3 Substitution request is fully documented and properly submitted.

.4 Requested substitution will not adversely affect General Contractor's construction schedule.

.5 Requested substitution has received necessary approvals of authorities having jurisdiction.

.6 Requested substitution is compatible with other portions of the Work.

.7 Requested substitution has been coordinated with other portions of the Work.

.8 Requested substitution provides specified warranty.

.9 If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

.2 Substitutions for Convenience: Not permitted.

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 No separate or direct payment will be made for Work specified in this specification. Costs of all Work specified is deemed to be included in the lump sum and unit prices quoted in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements and procedures for Contractor's submissions of shop drawings, product data, samples and mock-ups to the Owner for review.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 GENERAL

.1 Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Coordinate each submission with requirements of Work and Contract Documents. Individual submissions will not be reviewed until all related information is available.

.3 Do not proceed with Work until relevant submissions are reviewed by the Owner.

.4 Present shop drawings, product data, samples and mock-ups in SI units. Where items or information are not produced in SI units, converted values may be acceptable.

.5 Review submittals before submission to Owner. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Owner, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify site measurements and affected adjacent Work are coordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Owner's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Owner's review.

.10 Indicate cross references to Contract drawings and specifications including reference drawing section or specification number.

.11 Keep one reviewed copy of each submission on site.

2.2 SUBMISSIONS REQUIRED

.1 Submit the following schedules:

.1 Submittal Schedule for Shop Drawings and Product Data
.2 Submittal Schedule for Samples
.3 Submittal Schedule for Timeliness of Owner Furnished Products
.4 Product Delivery Schedule
.5 Cash Allowance Schedule for Purchasing Products

2.3 SHOP DRAWINGS AND PRODUCT DATA

.1 In accordance with the General Conditions, GC 41 - Shop Drawings.

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of the Section under which the adjacent items will be supplied and installed.

.4 Allow five (5) business days from the date of receipt by the Owner's office, for the Owner's review of each submission, unless otherwise indicated in the Contract Documents or additional time for the Owner to reasonably review complex shop drawings.

.5 Adjustments made on shop drawings by the Owner are not intended to change the Contract Price. If adjustments affect the value of Work, state such in writing to the Owner and obtain an approved change order prior to proceeding with the Work.

.6 Accompany submissions with transmittal letter, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data, and sample.
- .5 Other pertinent data.

.7 Submissions shall include:

- .1 Date and revision dates
- .2 Other pertinent dates
- .3 Project title and number
- .4 Name and address of:
  - .1 Subcontractor
  - .2 Supplier
  - .3 Manufacturer
- .5 Contractor's stamp, signed by Contractors authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .6 Details as applicable including:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting out or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent Work.

.8 After the Owner's review, the Contractor shall distribute finalized copies to the Owner, Owner's Representative, MI, and subcontractors.

.9 Submit to the Owner an electronic PDF copy of shop drawings and/or product data sheets and/or brochures for each requirement requested in specification Sections and as the Owner may reasonably request.

.10 Submit electronic PDF copies of test reports for requirements requested in specification Sections.

- .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system

to be provided has been tested in accord with specified requirements.

.2 Testing must have been within 3 years of date of Contract award for project.

.11 Submit electronic PDF copies of certificates for requirements requested in specification Sections.

.12 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.13 Certificates must be dated after award of Contract complete with project name.

.14 Submit electronic PDF copies of manufacturers installation instructions and operation and maintenance manuals requested in specification Sections.

.1 Pre-printed material describing installation of product, system or material, including special notices and Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit electronic PDF copies of Site Reports for requirements requested in specification Sections.

.16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.17 Submit electronic PDF copies of Operation and Maintenance Data for requirements requested in specification Sections.

.18 Delete information not applicable to project.

.19 Supplement standard information to provide details applicable to project.

.20 If upon review by the Owner, no errors or omissions are discovered or if only minor corrections are made, a marked up copy with shop drawing stamp will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through the same procedure indicated above, shall be performed before fabrication and installation of Work may proceed.

.21 The review of shop drawings by the Owner is for the sole purpose of ascertaining conformance with the general concept.

.1 This review shall not mean that the Owner approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and Contract Documents.

.2 Without restricting the generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains to fabrication processes or to techniques of construction and installation and for co-ordination of the Work of all Subcontractors.

.22 Structural shop drawings or shop drawings for structurally attached equipment must be stamped by a Structural Professional Engineer permitted to practice in the Province of Newfoundland and Labrador.

2.4 SAMPLES

.1 Submit for review samples as requested in respective specification Sections. Label samples as to origin and intended use in the Work.

.2 Deliver samples prepaid to Owner’s business address.

.3 At least ten 10 business days prior to commencing Work, inform the Owner of proposed source of materials and provide access for sampling.

.4 Notify Owner in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.5 Where colour, pattern or texture is criterion, submit full range of samples.

.6 Adjustments made on samples by Owner are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Owner prior to proceeding with Work.

.7 Make changes in samples, which Owner may require, consistent with Contract Documents.

.8 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

.9 Submit drawings stamped and signed by Professional Engineer registered or licensed in the Province of Newfoundland and Labrador.

2.5 MATERIAL CERTIFICATION

.1 At least ten (10) business days prior to commencing Work, submit manufacturer's test data and certification that materials meet requirements of this Section.

.2 Deliver samples prepaid to the Owner's business address.

.3 Notify the Owner in writing, at the time of submission of deviations in samples from requirements of Contract Documents.

.4 Adjustments made on samples by the Owner are not intended to change the Contract Price. If adjustments affect the value of Work, state such in writing to the Owner and obtain an approved change order prior to proceeding with the Work.

.5 Make changes in samples that the Owner may require, consistent with Contract Documents.

2.6 CONCRETE MATERIAL CERTIFICATION

.1 Prior to starting concrete Work, submit to the Owner manufacturer's test data and certification that the following material meets the requirements of this specification:

.2 Portland cement.

.3 Admixtures.

.4 Joint sealants.

.5 Curing materials.

2.7 MIX DESIGN SUBMISSION

.1 Submit mix designs to the Owner for approval 10 business days prior to commencing Work.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

No separate or direct payment will be made for Work specified in this specification. Costs of all Work specified are deemed to be included in the lump sum and Unit Prices quoted in the MERX Schedule of Quantities and Prices.

This specification outlines the form and content for Contractor's subsequent preparation and submittal of periodic applications for payment in Stipulated Price Contracts and Unit Price Contracts. The Schedule then becomes basis for the Owner’s evaluation of cost of Work completed to cut-off date for payment and for certificate of payment to Owner.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 SUBMITTAL REQUIREMENTS

.1 Notify the Owner sufficiently in advance of operations to permit required measurements for payment.

.2 Submit applications for payment on a monthly basis in accordance with the Agreement Between Owner and Contractor Article 4: Payment, and General Conditions, GC -20 Application for Payment and GC 21 – Certificates and Payment.

.3 These monthly progress applications shall consist of one (1) type written copy of:

.1 the Contract Payment Request,
.2 Detail Sheets for Unit Price Contract (if applicable),
.3 Materials on Site forms,
.4 Testing and Reinstatement Allowance form,
.5 Reinstatement Certificate,
.6 Force Account Forms,
.7 Variance Forms,
.8 Statutory Declaration (if applicable),
.9 Revised Construction Schedule as per Section 01300,
.10 and any other such forms as will be required by the Owner.

.4 Proposed change orders that have not been signed by the Regional Engineer shall not be included for payment until they are approved.

.5 These monthly certificates shall be signed by the Contractor prior to submission for payment.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

5.1 NOT APPLICABLE

This specification outlines the requirements for inspection and testing that is specified to be carried out by testing laboratory designated by the Owner. The appointment and direction for this inspection and testing are under direct control of the Owner.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 APPOINTMENT AND PAYMENT

.1 The Owner’s authorized representative will approve and the Owner shall pay for services of testing laboratory outside of this contract except for the following:

- .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
- .2 Inspection and testing performed exclusively for Contractor's convenience.
- .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
- .4 Mill tests and certificates of compliance.
- .5 Tests specified in this specification to be carried out by Contractor under the supervision of the Owner.

.2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, the Contractor shall pay costs for additional tests or inspections as the Owner may require to verify acceptability of corrected Work.

2.2 CERTIFIED INSPECTION AGENCIES

.1 Where required by Appointment and Payment subsection of this specification, certified inspection/testing agencies will be approved by the Owner for the purpose of inspecting and/or testing portions of Work.

.2 Provide assistance to testing agency where required for executing inspection and testing by the appointed agencies.

.3 Employment of inspection/testing agencies does not relax the responsibility to perform Work in accordance with the Contract Documents.

.4 If defects are revealed during inspection and/or testing, the appointed agency will request additional inspection and/or testing to ascertain full degree of defect. The Contractor shall correct defects and irregularities as

advised by the Consultant at no cost to the Owner. Contractor shall pay all testing and costs related to the defining and correction of all discovered defects.

2.3 PROCEDURES

.1 Notify the appropriate agency and the Owner in advance of the requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in the specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

2.4 CONTRACTOR'S RESPONSIBILITY

.1 Contractor shall furnish labour and facilities to:

.1 Allow inspection/testing agencies access to the Work, or off-site manufacturing and fabrication plants.
.2 Co-operate to provide reasonable facilities for such access.
.3 Make good Work disturbed by inspection and testing.
.4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.

.2 Contractor shall pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by the Owner.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 No separate or direct payment will be made for Work specified in this specification. Costs of all Work specified are deemed to be included in the lump sum and Unit Prices quoted in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for the provision of the Owner's office and associated equipment by the Contractor and the provision of temporary utilities and construction facilities required for the proper implementation of the contract.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

CSA Group

S269.2	Access Scaffolding for Construction Purposes
Z797	Code of Practice for Access Scaffold

PART 2 GENERAL

2.1 INSTALLATION AND REMOVAL

.1 Provide construction facilities and temporary utilities in order to execute work expeditiously.

.2 Remove from site all such work after use.

2.2 DEWATERING

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

2.3 WATER SUPPLY

.1 Provide a continuous supply of potable water for construction use.

.2 Arrange for connection with owner and pay costs for installation, maintenance and removal.

.3 Pay for usage charge as invoiced by the owner.

2.4 TEMPORARY HEATING AND VENTILATING

.1 Pay for costs of temporary heat and ventilation used during construction, including costs of installation, fuel, operation, maintenance and removal of equipment.

.2 Construction heaters used inside buildings must be vented to outside or be flameless (vent free) type. Solid fuel salamanders are not permitted.

.3 Provide temporary heat and ventilation in enclosed areas as required to:

.1 Facilitate progress of Work.
.2 Protect Work and products against dampness and cold
.3 Prevent moisture condensation on surfaces.
.4 Provide temperatures and humidity levels for storage, installation and curing of materials.
.5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain minimum temperature of ten (10) °C as soon as finishing Work is commenced and maintain until acceptance of structure by the Owner.

.1 Maintain temperature and humidity levels as required for comfort of office personnel.

.5 Ventilating:

.1 Prevent accumulations of dust, fumes, mists, vapours, or gases in areas occupied during construction.
.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substance into atmosphere of occupied areas.
.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
.4 Ventilate storage spaces containing hazardous or volatile materials.
.5 Ventilate temporary sanitary facilities.
.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful elements.
.7 On completion of Work for which permanent heating system is used, replace filters.
.8 Date of Substantial Performance and Warranties for heating system do not start until entire system is in as near original condition as possible and is certified by the Owner.

.6 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform with applicable codes and standards.
.2 Enforce safe practices.
.3 Prevent abuse of services.
.4 Prevent damage to finishes.
.5 Vent direct-fired combustion units to outside.

.7 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

2.5 TEMPORARY POWER AND LIGHTING

.1 Arrange, provide and pay for connection with the appropriate Utility Company for temporary power required during the construction of the Works. Pay for all costs for installation, maintenance and removal of cables, distribution and branch panel boards.

.2 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.

.3 Electrical power and lighting systems installed under this Contract may be used for construction requirements with prior approval of the Owner provided that guarantees and warranties are not affected.

.1 Make good any damage.
.2 Replace lamps that have been used for a period exceeding 3 months.

2.6 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on Site.

2.7 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Provide washroom facilities complete with flush or chemical type toilet, lavatory and mirror and maintain supply of paper towels, toilet tissue, and hand sanitizer or soap and water.

.3 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

.4 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building. Permanent facilities may be used on approval of the Owner.

2.8 TEMPORARY COMMUNICATION

.1 Where cellular phone services are not available and landline is available, provide and pay for temporary telephone and internet access necessary for own use and use of the Owner. The Owner will pay for long distance calls placed by the Owner.

2.9 REMOVAL OF TEMPORARY FACILITIES

.1 Remove temporary facilities from site when directed by the Owner.

.2 When project is to be closed down at end of construction season keep facilities operational until close down is approved by the Owner.

2.10 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA S269.2 and CAN/CSA Z797

.2 Construct and maintain scaffolding in rigid, secure and safe manner.

.3 Erect scaffolding independent of walls. Remove promptly when no longer required.

.4 Refer to Section 01545 for scaffolding.

2.11 HOISTING

.1 Provide, operate and maintain hoists cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.

.2 Hoists cranes to be operated by qualified operator only. Provide training certificate of operator.

2.12 SITE STORAGE/LOADING

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load, or permit to load, any part of Work with weight or force that will endanger Work.

2.13 ACCESS

.1 Provide and maintain adequate access to project site

.2 Build and maintain temporary roads where indicated or directed and provide snow removal during period of Work.

.3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

2.14 OWNER'S SITE OFFICE

.1 Provide temporary office for the Owner. Inside dimensions minimum 3.0 m x 3.0 m x 2.4 m high, with floor 0.3 m above grade, complete with one (1) 50 % opening windows and one lockable door.

.2 Insulate building and provide heating system to maintain 22 °C inside temperature at -20 °C outside temperature.

.3 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colours. Finish floor with 19 mm thick plywood.

.4 Install electrical lighting systems to provide min 750 lux using surface mounted, shielded commercial fixture.

.5 Office furniture and equipment to be supplied as follows:

.1 Desk (1 m x 2 m) with lockable drawers.
.2 Drafting table (1 m x 2 m).
.3 Two chairs.
.4 Lockable steel filing cabinet, legal size, 4 drawer.
.5 One metre of shelving.
.6 Electrical outlet adjacent to drafting table.
.7 Coat rack and shelf.

.6 Clean, maintain, light and heat office and washroom throughout continuance of the Work.

.7 No work is to proceed on site until the Owner’s Site Office is ready for the Owner’s use and accepted by the Owner or Owner’s Representative in writing to the Contractor.

2.15 EQUIPMENT, TOOL AND MATERIAL STORAGE

.1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

2.16 CLEAN-UP

.1 Separate waste materials for reuse and recycling.

.2 Remove construction debris, waste materials, packaging material from work site daily.

.3 Clean dirt or mud tracked onto paved or surfaced roadways.

.4 Store materials resulting from demolition activities that are salvageable.

.5 Stack stored new or salvaged material not in construction facilities.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 With the exception of the Owner's Site Office and associated equipment, no separate or direct payment will be made for Work outlined in this specification. The Owner's site office, if required, will be included as a pay item in the MERX Schedule of Quantities and Prices. Costs of all other Work specified in this section are deemed to be included in the lump sum and Unit Price quoted in the MERX Schedule of Quantities and Prices.

.2 The pay item in the MERX Schedule of Quantities and Prices for the Owner's site office shall be prorated to the final Contract Price where a contract extension has been approved.

This specification outlines the requirements for safety procedures for work sites.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure (TI), Highway Design and Construction Division Specifications Book

Section 190	Occupational Health and Safety

CSA Group

Z94.1	Industrial Protective Headwear
Z94.3	Eye and Face Protectors
Z195	Protective Footwear

Other

Province of Newfoundland and Labrador, Occupational Health and Safety Act, Amended

Province of Newfoundland and Labrador, Regulation 5/12, Occupational Health and Safety Regulations

PART 2 GENERAL

2.1 GENERAL

.1 All Work is to be performed in accordance with the requirements of the Occupational Health and Safety Act and Regulations as amended.

.2 This specification is to be read in conjunction with TI, Highway Specifications Book, Section 190, Occupational Health and Safety and other sections as may be noted.

.3 The Contractor shall comply with and enforce compliance by employees, subcontractors, suppliers and visitors with all safety requirements of the Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with the Site Specific Health and Safety Plan (SSSP).

.4 The Contractor is responsible for all work coordination at the project site, safety oversight, and must maintain full ownership and control of safety within the project area at all times.

.1 The Contractor shall ensure co-ordination of work schedules and tasks, and communication thereof for the purpose of ensuring health and safety on the worksite.

.5 Owner may perform project due diligence, site visits, safety monitoring activities, make suggestions or recommendations for improvement, and/or request changes in how work is performed. Notwithstanding, the Contractor has full responsibility, authority, and accountability for safely performing all work on the project site and/or under the project. Owner solely relies on the Contractor to know how to safely perform all Work including making appropriate decisions on Owner recommendations or requests.

.6 The Contractor shall ensure that in addition to those requirements set forth in the OSH Act and Regulations, all persons, including those employed by the contractor or their subcontractors, shall wear the following mandatory Personal Protective Equipment at All times while working on the project.

.1 CSA approved safety boots meeting CSA Z195 Standard.
.2 CSA approved hard hat meeting CSA Z94.1 Standard
.3 CSA approved safety glasses meeting CSA Z94 Standard
.4 High visibility apparel as defined in the OHS Regulations
.5 Where noise exceeds standards set out in the OHS Regulations hearing protection shall be worn, and hearing conservation program implemented.
.6 Other personal protective equipment, as may be required by the work tasks, hazard assessments or the Contractor, depending on duties being performed.

.7 Subsequent to awarding of the bid and at least 10 (ten) business days prior to commencement of Work, the Contractor must submit to the Owner copies of:

.1 A detailed Site Specific Safety Plan.
.2 A Safety Record Letter from the Occupational Health and Safety Division.

.8 Responsibility for errors and omissions in the Project Site Specific Safety Plan and other submitted documents is not relieved by acceptance by Owner.

2.2 PROJECT SAFETY PLAN

.1 Refer to TI, Highway Specifications Book, Section 190.02 for details on the following Project Site Specific Safety Plan requirements:

.1 Project Safety Plan Requirements
.2 Project Site Specific Safety Plan (SSSP)

.3 Emergency Response Plan

2.3 SAFETY MONITORING

.1 Refer to TI, Highway Specifications Book, Section 190.03 for detail on the following Safety Monitoring requirements:

.2 Contractor Roles and Responsibilities

.3 Supervision

.4 Project Dedicated Full Time Contractor Safety Representative (CSR)

.5 Health and Safety Committee

.6 Reporting and Investigation

.7 Instruction and Training

.8 Construction Safety Measures

.9 Posting of Documents

.10 Notification

.11 Correction of Noncompliance

.12 Liquidated Damages for Noncompliance

2.4 SAFETY REGULATIONS

.1 Refer to TI, Highway Specifications Book, Section 190.04 for detail on the following Safety Regulation requirements:

.1 WHMIS
.2 Overloading
.3 Falsework
.4 Scaffolding
.5 Personal Protective Equipment
.6 Traffic Control
.7 Working at Height
.8 Working over Water
.9 Access, Egress and Walkways
.10 Rigging and Slinging
.11 Workplace Violence and Harassment

2.5 SAFETY OPERATIONS

.1 Refer to TI, Highway Specifications Book, Section 190.05 for detail on the following Safety Operations requirements:

.1 Excavation Operations

.2 Blasting Operations
.3 Heavy Equipment Operations
.4 Brush Clearing Operations
.5 Diving Operations
.6 Confined Space Operations
.7 Crane Operation
.8 Pit and Quarry Operations

2.6 FIRE SAFETY REQUIREMENTS

.1 Comply with the requirements of the Fire Commissioner.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 No separate or direct payment will be made for Work specified in this specification. Costs of all Work specified in this section are deemed to be included in the lump sum and unit prices quoted in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for environmental protection and general protection for air, water and soil during the course of the work.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure (TI), Highway Design and Construction Division, Highway Specifications Book:

Section 310	Use of Pits, Quarries and Stockpiles for Production of Materials Supplied by the Contractor
Section 405	Temporary Diversion of Streams
Section 520	Storage or Disposal of Old Asphaltic Pavement
Section 820	Storage and Handling of Fuels and Other Hazardous, Toxic or Dangerous Material
Division 12	Standard Drawings

Government of Newfoundland and Labrador, Environmental Protection Act (SNL 2002 cE 14.2)

Regulation 58/03, Storage and Handling of Gasoline and Associated Products and Regulations

Government of Newfoundland and Labrador, Water Resources Act

Regulation 65/03, Environmental Control Water and Sewage Regulations, 2003 under the Water Resources Act (O.C. 2003-231)

Government of Newfoundland and Labrador, Department of Environment and Climate Change (ECC), Policies

Infilling Bodies of Water W.R. 91-1

Use of Creosote Treated Wood in Fresh Water W.R. 92-2

Treated Utility Poles in Water Supply Areas W.R. 93-01

Land and Water Developments in Protected Public Water Supply Areas W.R. 95-01

Other

Fisheries Act of Canada, R.S.C., 1985, C. F-14

PART 2 GENERAL

2.1 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.

.2 Environment Protection: prevention/control of pollution and habitat or environment disruption during construction.

2.2 GENERAL

.1 All work is to be done in accordance with local, provincial and federal environmental regulations and any specific requirements for this contract are to be strictly adhered to by the Contractor.

.2 Particular attention is drawn to the requirements of the Federal Fisheries Act and regulations for works affecting fish habitat as stipulated by the Department of Fisheries and Oceans of Canada (DFO).

.3 The Owner's Representative is responsible for obtaining Permits required by the Provincial Department of Environment & Climate Change and the Federal Department of Fisheries and Oceans prior to tendering. Permit cost will be paid for under project costs outside of this contract.

.4 If any suspected artifacts of historical or archaeological value are uncovered or any endangered plant or animal species or any contaminated soil(s) are identified during the Work, the Contractor shall cease Work, in accordance with General Conditions, GC 8 - Delay, until the site has been reviewed by representatives of the appropriate agencies and the Owner has approved resumption of the Work.

2.3 MEASUREMENT FOR PAYMENT

.1 Silt fence will be paid by the linear meter.

.2 Dust control will be measured in accordance with 02250.

2.4 SUBMITTALS

.1 Submit in accordance with Section 01345.

.2 Submit Environmental Protection Plan (EPP) for review by Owner before delivering materials to site or commencing construction activities.

.3 EPP shall include comprehensive overview of known or potential environmental issues to be addressed on site during construction.

.4 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.5 Include in Environmental Protection Plan (EPP):

.1 Names of persons responsible for ensuring adherence to EPP.

.2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.

.3 Names and qualifications of persons responsible for training site personnel.

.4 Descriptions of environmental protection personnel training program.

.5 Submit a site-specific Stormwater Pollution Prevention Plan (SPPP) in accordance with Regulation 65/03, Environmental Control Water and Sewer Regulations. Include the site-specific Erosion and Sediment Control Plan (ESCP) identifying the type and location of erosion and sediment control measures to be provided on site. Include monitoring and reporting requirements to ensure that ESCP control measures are in compliance with erosion and sediment control plan, Federal and Provincial regulations, and Municipal by-laws.

.6 Submit drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.

.7 Submit a site-specific Traffic Control Plan (TCP) including measures to reduce erosion of temporary and existing roadbeds by construction traffic, especially during wet weather.

.1 TCP to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.

.8 Submit a Spill Control Plan (SCP) including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.9 Submit a Solid Waste Disposal Plan (SWDP) for non-hazardous solid wastes identifying methods and locations for solid waste disposal including clearing debris.

.10 Submit an Air Pollution Control Plan (APCP) detailing provisions to ensure that dust, debris, materials, and trash, are contained within the project site.

.11 Submit a site-specific Contaminant Prevention Plan (CPP) identifying the proper procedures and actions to be implemented to prevent potentially or expected hazardous substances due to the presence of any hazardous substances within the project site. The intent of the CPP is to:

.1 Prevent introduction of designated substances (DS) into air, water, or ground;

.2 Detail provisions for storage and handling of these materials in compliance with Federal, Provincial, and Municipal laws.

.12 Submit a Wastewater Management Plan (WMP) identifying methods and procedures for management [and][or] discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

.13 Owner to confirm if historical, archaeological, cultural, or biological resources and wetlands are likely to be present on site. If required by Owner, submit an Identification and Protection Plan (IPP) that defines procedures for identifying and protecting historical, archaeological, cultural and biological resources and wetlands.

.14 Submit a Pesticide Treatment Plan (PTP) identifying the presence of any pesticides within the site. PTP to be updated as required.

2.5 ENVIRONMENTAL COMPLIANCE INSPECTION

.1 The Contractor shall be responsible for designating an on-site environmental representative who is familiar with the Contractors submitted Environmental Protection Plan. They shall have the ability to address environmental issues, acquire staff, and procure

materials when there is the potential for water and runoff issues, including holidays and weekends.

.2 The Contractor's representative shall monitor the weather forecasts and prior, during, and after wind or rainfall events the entire site shall be inspected for environmental mitigation deficiencies, and any deficiencies immediately addressed. The erosion and sediment controls shall also be inspected periodically, at the start of each day of work. The Contractor shall report to the Owner on the inspections including any deficiencies and action taken to address.

.3 The Owner may retain an environmental inspector who, along with the consultant and construction technicians, will monitor the Work with regard to compliance with environmental requirements of the Drawings and Specifications as well as any applicable acts and regulations.

2.6 DUST CONTROL

.1 The Contractor shall ensure that dust does not become a problem for adjacent property Owners or construction site personnel or a hazard to vehicular traffic.

.2 When required, or as directed by the Owner’s representative, water or an acceptable dust suppressant such as calcium chloride shall be used by the Contractor on haul routes or other locations on the project to control dust.

2.7 FIRES

.1 Fires and burning of rubbish on site are not permitted.

2.8 DRAINAGE

.1 Ensure that the ESCP measures are provided and that its recommendations are followed on site, in accordance with the site-specific SPPP, at all times during construction.

.2 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.3 Do not pump water containing suspended materials into waterways, sewer or drainage system.

.4 Control disposal or run-off of water containing suspended materials or other harmful substances in accordance with Authority Having Jurisdiction.

.5 Construct temporary silt traps or sediment curtain of adequate height and length to effectively isolate sediment-laden water, as directed by Owner, prior to commencing excavation of any nature. Non-woven geotextile should never be used.

2.9 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties where indicated and as per Section 02104.

.2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 metres.

.3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbances or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.4 Minimize stripping of topsoil and footprint of disturbed vegetation. Adopt a segmented approach to construction whenever possible.

.5 Restrict tree removal to areas indicated or designated by the Owner.

2.10 WORK ADJACENT TO WATERWAYS

.1 All work must comply with Department of Environment and Climate Change requirements.

.2 Construction equipment to be operated on land only.

.3 Keep waterways free of excavated fill, waste material and debris.

.4 Design and construct temporary crossings to minimize erosion and sedimentation in waterways. Select the most appropriate sediment and erosion control measures specific to site characteristics and potential erosion/sedimentation sources. Submit sediment and erosion control plan as per this specification.

.5 Do not skid logs or construction materials across waterways.

.6 As required, and as per the sediment and erosion control plan, intercept sediment laden surface water run-off during cut operations and direct to silt traps before entry into waterways.

.7 As required, and as per the sediment and erosion control plan, sandbags to be used to construct sediment traps in active streams.

.8 Obtain approval in writing or permit from Department of Fisheries and Oceans of Canada prior to blasting or excavation under water or in inter-tidal zone of water courses and bodies.

.9 Coffer dams must be constructed of non-erodible materials as approved by the Owner. Water from work areas must be pumped a minimum of 50 metres from waterway into sediment traps, or as directed by the Owner.

.10 Extreme care must be taken to prevent entry of cement, lime or fresh concrete into waterway.

.11 Works performed in and around waterways will be carried out in accordance with regulations of local, provincial and / or federal authorities having jurisdiction.

.12 Cuts and fills adjacent to waterways are to be vegetated and stabilized, and ditch run-offs constructed to prevent entry of silt into waterway.

.13 On conclusion of construction, debris must be disposed of to prevent its entry into waterways, and the stream bed returned to its original configuration or as approved by the Owner.

.14 Do not use waterway beds for borrow material.

.15 Storage of machinery and equipment shall not be within 30 m of a watercourse.

.16 Ground vegetation within 30 metres of waterway may not be disturbed until actual start of waterway crossing construction commences.

.17 Erosion control features in accordance with the approved drawings shall be installed a minimum of 24 hours prior to crossing construction and approved by the Owner.

.18 Debris and excavated material within the Work Area shall be removed from the watercourse and adjacent areas for disposal or placement in a manner such that it cannot be returned to the watercourse.

.19 Precautions shall be taken by the Contractor to prevent discharge or loss of any harmful material into a watercourse including but not limited to creosote, hydrocarbons, biocides, fertilizers, cement, lime, paint or fresh concrete.

.20 No grubbing, excavation, embankment construction or installation of drainage structures shall take place within the buffer zones on both sides of each natural watercourse, as indicated in the Contract Documents, until the appropriate sediment and erosion control measures are installed in order to ensure that run-off, by the time it reaches a watercourse, does not have a suspended solids level in excess of:

.1 25 mg/L over background levels during any short term exposure, less than 24 hours.
.2 5 mg/L from background levels for longer term exposure, 24 hours to 30 days; or
.3 Other level approved by the Department.
.4 Installation, inspection, maintenance and repair of these structures shall be in accordance with the applicable Items from the Contract Documents.

.21 Within a buffer zone, any temporary Work Area access roads, haul roads and/or areas constructed for the installation of a drainage Structure, shall be surfaced with at least 100 mm of clean gravel or rock placed the same day they are built, to provide sufficient cover to the soil exposed so as to provide environmental protection to the watercourse from runoff.

.22 No blasting shall take place in or near a watercourse without prior written consent from Authorities Having Jurisdiction.

.23 Any ruts created by equipment within 30 m of a watercourse shall be immediately graded smooth and blanketed with hay/straw mulch.

.24 In order to prevent the spread of invasive plants, no washing of tools or machinery shall occur within 30 m or a watercourse of wetland.

.25 All exposed erodible material within 30 m of a watercourse or wetland shall be stabilized with hay mulch at the end of each work day.

2.11 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this contract in accordance with site specific SPPP.

.2 Control emissions from equipment and plant in accordance with local authorities' emission requirements. Check with local authorities for any environmental compliance requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.

.1 Provide temporary enclosures as required.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

2.12 WASTE DISPOSAL AREAS

.1 Develop waste disposal sites in a planned manner to dispose of surplus materials to satisfaction of Owner.

.2 Limits of waste disposal area shall be clearly defined and approved by the Owner prior to clearing and reinstating to conditions at start of Work.

.3 Establish temporary haul roads to and within designated sites to ensure disposal areas are fully utilized. Remove on completion.

.4 Establish temporary berms on lower side of waste disposal area. Ensure inside drainage pattern to appropriate point of concentration with drainage managed in accordance with subsection Drainage of this specification. Dump in a regular manner upstream of the drain.

.5 Establish side berms in a proactive manner as Work progresses with corresponding drainage.

.6 On completion of Work, push berms in to contain waste materials and establish final perimeter outside drainage pattern. Blend berms to general contours of site and materials contained and reinstate to original condition.

.7 Do not bury rubbish and waste materials on site.

.8 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

2.13 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Submit an Erosion and Sedimentation Control Plan as per this specification to control negative impacts on water and air quality; plan should meet these objectives:

- .1 Prevent loss of soil during construction by storm water run-off and wind erosion.
- .2 Protect stockpiled topsoil.
- .3 Prevent sedimentation of storm sewers, receiving streams and air pollution with dust or particulate matter.

.2 Erosion and sedimentation control measures shall be carried out as detailed in the contract documents and the submitted ESCP . Sediment and erosion control measures shall be inspected, maintained, and repaired prior to and after wind or rainfall events to the satisfaction of the Owner.

.3 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or

airborne dust to adjacent properties and walkways, according to requirements of Authorities Having Jurisdiction.

.4 Silt fences are to be installed as per the Standard Drawing Form 1238 of the TI, Highway Specifications Book.

.5 Inspect, repair, and maintain temporary erosion and sedimentation control measures during construction until permanent vegetation has been established.

.6 Remove temporary erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

2.14 VEHICULAR MOVEMENTS

.1 Confine vehicles and equipment to existing disturbed areas (access roads, borrow pits, disposal areas, highways and future right-of-ways).

2.15 ENVIRONMENTAL MITIGATION

.1 The Contractor shall complete the Work in accordance with Environmental Compliance Inspection of this section, and the following conditions:

.1 In dewatering an excavation, whether a roadway cut, foundation excavation, a pit or a quarry, the Contractor shall ensure that any turbid water pumped out or released has a suspended solids level, by the time it reaches a watercourse, of no more than 25 mg/L over background levels during any short term exposure (less than 24 hours) and 5 mg/L from background levels for longer term exposure (24 hours to 30 days) or other level approved by the Department.

.1 Erosion and sedimentation control measures required to achieve this level of compliance when dewatering is conducted for roadway or foundation excavations shall be constructed, inspected, maintained and repaired in accordance with the Contract Documents.

.2 It shall be the Contractor’s responsibility to install, inspect, and maintain, at their own expense, to the satisfaction of the Authority Having Jurisdiction any erosion control measures for pits and quarries that may be

required, and to obtain permission to pump or release any turbid water onto properties abutting and beyond.

.3 The Contractor shall be responsible to repair, at their own expense, any and all damage resulting from the dewatering.

.2 The Contractor shall not place an earth or rock causeway in the watercourse for the purpose of creating a temporary access Structure, without specific approval of the Owner and the appropriate regulatory authority(ies), in writing.

.3 Instream Work shall be carried out between June 1st and September 30th unless explicitly approved by the Authority Having Jurisdiction. Instream Work consists of work below the shoulder of the bank of the watercourse, whether wetted or not. The Contractor shall notify the Owner, in writing, at least 7 business days in advance of the anticipated date of commencement of instream Work.

.4 Water control for all culvert installations in natural watercourses, other than those for which a site-specific method and/or sequence is indicated in the Contract Documents, is specified, shall be accomplished using one of the following methods:

.1 Installing the new culvert in the dry and diverting the watercourse through it upon completion. This method is to be completed in accordance with TI, Highway Specifications Book, Section 405;

.2 Constructing a temporary clear/light coloured plastic-lined diversion channel in the dry; or

.3 Stemming the flow upstream and pumping the flow around the Work Area, ensuring the pump runs whenever there is sufficient water, and having the discharge back into the stream immediately below the Work Area.

.5 If it is necessary to isolate the stream from the Work Area, the Contractor shall construct cofferdams consisting of, as a minimum, a layer of 6-mil clear polyethylene sandwiched between an outer (stream-side) wall of sandbags and an inner wall of earth fill.

.6 The Owner, upon receiving notice from the Contractor as to when construction shall actually commence, will arrange an on-site meeting with representatives from the Department, of

Fisheries and Oceans Canada and the Contractor, prior to commencement of the instream Work.

.1 No Work shall commence until the Owner verifies with the regulatory agencies having jurisdiction that the Work Site is approved for the commencement of instream Work.

.7 Erosion control measures shall be as detailed in the Contract Documents and if additional measures are required in addition to those indicated, the Owner shall order and approve such Work under the appropriate Items.

.8 Natural materials produced and/or supplied by excavation or from pits and quarries shall not contain any friable, soluble or reactive minerals, or other deleterious materials or conditions that would make the material prone to decomposition or disintegration, or present any environmental hazard, from the presence of the parent material or its by-products, when exposed to the natural elements after placement in the Work.

.9 Additional conditions of approval as detailed in the Contract Documents, shall be carried out by the Contractor.

.10 A copy of all permits shall be kept on the Work Site for the duration of the Contract and shall be made available upon request of an inspector designated to act on behalf of the Department or an employee of an Authority Having Jurisdiction.

.11 Equipment shall not be stationed, and materials shall not be stored in a wetland at any time, and equipment operations shall be limited to the footprint of the existing roadbed or the new roadbed being constructed.

2.16 FUEL STORAGE AND HANDLING

.1 The Contractor shall take proper environmental protection measures, such as having spill clean-up and absorption materials at the Work Area, during fuelling and maintenance of the Equipment. Oil spills shall have oil specific absorbents applied to them immediately, and all contaminated soil and absorbent shall be collected for proper disposal within four hours after application. Leaking equipment and/or fuel lines shall be repaired and/or replaced immediately.

.2 Equipment shall not be fuelled within 30 m of a watercourse, wetland or groundwater source (private well).

.3 Fuel and other hazardous materials shall not be stored within 100 m of a watercourse, wetland or groundwater source (private well), as identified in the field by the Owner.

.4 Machinery and pollutants shall be located or stored in areas not in danger of floodwaters.

.5 Hydrocarbon storage shall be in accordance with TI, Highway Specifications Book, Section 820. Furthermore, all on-site storage and handling of petroleum shall comply with the Storage and Handling of Gasoline and Associated Products and Regulations, NLR 58/03. All storage tanks shall be registered and approved by Department of Digital Government and Service NL. The Contractor shall follow the procedure for spill reporting. Any spillage in excess of 70 L of gasoline or associated product, or of a substance that is deleterious to fish shall be reported immediately through the Environmental Emergencies telephone line at 1-800-563-9089.

.6 All storage tanks for fuel must be drained within one week after asphalt production has been completed. Fuel oil must not remain in tanks over the winter.

2.17 ENVIRONMENTAL REQUIREMENTS AND APPROVALS

.1 Pits and quarries shall be stripped, worked and at the completion of the work restored, in accordance with TI, Highway Specifications Book, Section 310, part 310.04 and 310.11.

.2 All asphalt being removed shall be disposed of in accordance with TI, Highway Specifications Book, Section 520 and as outlined in the Certificate of Approval issued from the Authority Having Jurisdiction. A well-defined area shall be designated for the temporary storage of off-spec and waste asphalt. Where possible, off-spec and waste asphalt shall be recycled on-site. Otherwise, this material shall be removed on a minimum of a weekly basis to either an approved waste disposal site for disposal, or an approved waste asphalt storage site for recycling. These sites must be approved by the Authority Having Jurisdiction.

.3 Any asphalt plant being operated within a radius of 1.5 km of a regularly used building, either residential or commercial, or an organized recreational area, must control their dust emissions such that compliance is obtained with the air standards enforced by the Department of Digital Government and Service NL. In order to comply, the efficient operation of either a baghouse dust collector or a wet scrubber on the drier emissions would be necessary. These controls may be waived in an area where there are three or

less regularly used buildings if the Contractor makes satisfactory arrangements with the owners and occupiers of all buildings. Under such circumstances, a written agreement between the Contractor and owner/occupier, signed by both parties, must be submitted to both the Owner and the Department of Digital Government and Service NL.

.4 All sections of the asphalt plant which could contribute to air or water pollution must be maintained in efficient operating condition.

.5 Where a wet scrubber and settling ponds are used it shall be operated as a closed loop system, with water for the scrubber re-circulated from the secondary settling pond. Systems that do not re-circulate scrubber are unacceptable.

.6 Contractors wishing to set up an asphalt plant (bag house or wet scrubber) at a site must first obtain an environmental approval from Department of Digital Government and Service NL before proceeding.

2.18 NOTIFICATION

.1 Owner will notify Contractor in writing of observed non-compliance with Federal, Provincial, or Municipal environmental laws or regulations, permits, and other elements of environmental protection.

.2 Contractor: after receipt of such notice, inform Owner of proposed corrective action and take such action as approved by the Authorities Having Jurisdiction.

.1 Take action only after receipt of written approval by the Authorities Having Jurisdiction.

.3 Owner may issue stop order of work until satisfactory corrective action has been taken.

.4 No time extensions will be granted or equitable adjustments allowed to Contractor for such suspensions.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 With the exception of silt fence, no separate or direct payment will be made for all Work specified in this specification. Silt fence, if required, will be included as a pay item in the MERX Schedule of Quantities and Prices. Costs of all other work specified in this section are deemed to be included in the lump sum and unit prices quoted in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements when roadway traffic is to be accommodated during construction. Under certain conditions, construction and maintenance activity on or along a roadway may require traffic lane restrictions including the use of a flag person to expedite the work and to safely guide motorists through the work site area. This section specifies the appropriate materials, equipment and signs to enable traffic lane restrictions under such circumstances.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure

TI Traffic Control Manual

Transportation Association of Canada

Transportation Association of Canada, Manual of Uniform Traffic Control Devices for Canada (MUTCDC)

PART 2 GENERAL

2.1 PROTECTION OF PUBLIC TRAFFIC

.1 Comply with requirements of the Department Traffic Control Manual and MUTCDC, Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out work or haul materials or equipment.

.2 Design and submit to the Owner for approval a Traffic Control Plan for the Project.

.3 When working on travelled way:

- .1 Place equipment in position to present minimum of interference and hazard to travelling public.
- .2 Keep equipment units as close together as working conditions will permit and preferably on same side of travelled way.
- .3 Do not leave equipment on travelled way overnight.

.4 Implementation of the Traffic Control Plan may not proceed without the approval of the Owner. Before re-routing traffic, erect suitable signs and devices in accordance with instructions contained in MUTCDC. Provide sufficient crushed gravel to ensure a smooth riding surface during work.

.5 Keep travelled way well graded, free of pot holes and of sufficient width that required number of lanes of traffic may pass.

.6 When deemed necessary by Owner, provide well graded, gravelled or paved detours or temporary roads to facilitate passage of traffic around restricted construction area. Maintain roadway. Provide and maintain signs and lights. Owner will pay for gravel surfacing, dust palliative or paving of detour or temporary road at Contract prices appropriate to such work.

.7 Provide and maintain reasonable road access for Public Traffic and egress to property fronting along or in vicinity of work under Contract unless other reasonable means of road access exist.

2.2 MEASUREMENT FOR PAYMENT

.1 Flag persons wages will be measured by the hour. If there is a change to the scope of work approved by the Regional Engineer then this quantity may be adjusted during construction. Contractors are advised that only employees who are trained in accordance with the Traffic Control Person Certification Training program administered through Workplace NL can be claimed under this section.

.2 Traffic control shall be measured by lump sum.

.3 The gravel surfacing, dust palliative, or paving of a detour or temporary road shall be measured by lump sum for the details provided in the Contract Documents.

2.3 INFORMATIONAL WARNING DEVICES

.1 Provide and maintain signs and other devices required to indicate construction activities or other temporary and unusual conditions resulting from project work that may require road user response.

.2 Design, supply and erect signs, delineators, barricades and miscellaneous warning devices in accordance with MUTCDC.

.3 Place signs and other devices in locations as approved in the Traffic Control Plan.

.4 Submit the Traffic Control Plan to the Owner for approval.

.5 Continually maintain traffic control devices in use by:

.1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.

.2 Removing or covering signs that do not apply to conditions existing from day to day.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 CONTROL OF PUBLIC TRAFFIC

.1 Traffic Control shall be Site and / or Project specific and in accordance with the Site Safety plan approved by Occupational Health and Safety Division.

4.2 FLAG PERSONS

.1 The TI Traffic Control Manual provides guidelines for flag persons and should be consulted when a flag person is required to comply with the MUTCDC and the Traffic Control Plan.

PART 5 BASIS OF PAYMENT

.1 The Owner will pay the flag person hourly wage at the unit price quoted in the MERX Schedule of Quantities and Prices up to the quantity given in the MERX Schedule of Quantities and Prices only. Any amount over that quantity is at the contractor’s expense and considered incidental to various other unit prices as appropriate. Contractors should check the quantity prior to tender closing as compared to their traffic control plan and notify the Owner if variations are significant and an amendment may be issued. If there is a change to the scope of work approved by the Regional Engineer then this quantity may be adjusted during construction.

.2 Contractors are advised that only employees who are trained in accordance with the Traffic Control Person Certification Training program administered through Workplace NL or similar can be claimed under this section.

.3 No payment will be made for flag person’s wages for repairs of defective work.

.4 All other costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for the classification, placement, supply and installation of information warning devices.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure

TI Traffic Control Manual

Transportation Association of Canada

Transportation Association of Canada Manual of Uniform Traffic Control Devices for Canada (MUTCDC)

PART 2 GENERAL

2.1 GENERAL

.1 Unless modified by the following, the specifications in MUTCDC and, municipally approved manual by Digital Government and Service NL or TI Traffic Control Manual will apply to temporary condition signs in all details concerning symbols, lettering, illumination, reflectorization, position, erection, material, support and maintenance.

.2 The provisions for public protection established herein are for application by contractors employed under this contract. Traffic safety in construction zones should be an integral and high priority element of every project. The goal should be to route traffic through such areas, with temporary condition signs and devices, as nearly as possible comparable to those for normal situations.

.3 The responsibility for temporary condition signs and devices rests with the contractor. Thus, while this specification provides standards for design and application of temporary condition signs and devices installations, it is not a substitute for good judgment. The decision to use a particular device at a particular location should be made on the basis of a study of the location.

.4 The provisions for public protection established herein are for application by contractors performing any work under this contract. All costs associated with temporary condition signing to standards as outlined in the contract documents shall be the responsibility of the contractor. Cost of

signs, handling, installation, materials and labour shall be paid by the contractor and no payment shall be considered by the Owner.

.5 All traffic signs used for temporary conditions are designed and erected for the safety and convenience of travelling public, and for the safety of the workers on the construction projects.

.6 The Owner shall be contacted 15 business days in advance for approval in signing major construction detours.

.7 All temporary condition signs not mounted on portable sign supports shall be mounted on the right side of the roadway at a height of 1.5 metres above the road surface and not less than 2 metres from the edge of the travelled portion of the roadway. Signs mounted on portable sign supports shall be erected on the right-hand side of the road in a level position at a height of not less than 1 metre from the road surface to the bottom of the sign and not less than 1.3 metres from the edge of the travelled portion of the highway.

.8 All signs shall conform to the required standards in shape, colour, size and position, as outlined in this specification for Temporary Condition Signing.

.9 All temporary condition signs shall have a fully reflectorized background.

.10 One sign only shall be placed on each support with exception of tab signs erected to provide supplementary or complementary information associated with warning signs or detour signs.

.11 Poorly maintained, defaced, damaged or dirty temporary condition signs are ineffective and shall be replaced, repaired or cleaned without delay.

.12 No construction work will be permitted to commence until all traffic control devices are erected in position, as shown in this specification and approved by the Owner.

.13 After a project is completed, all traffic signs used on construction shall be removed immediately. Any erected signs not applicable during a phase of construction shall be removed or covered.

.14 Objects within the roadway or immediately adjacent to the roadway, which constitute a hazard to traffic, shall be marked with "Hazard Markers".

.15 Construction Speed Zones shall be implemented only as shown in this specification.

.16 After dark all signs shall be checked for visibility and those that cannot be clearly seen shall be cleaned, replaced, adjusted or illuminated.

2.2 CLASSIFICATION OF TEMPORARY CONDITION SIGNS

.1 Regulatory Signs shall be in accordance with the TI Traffic Control Manual. Reference to regulatory signs in this part will be limited to their application on portions of roadway where construction activities or other temporary and unusual conditions require road user response.

.2 Warning Signs as described in this specification are temporary condition warning signs.

.3 Information Signs shall be in accordance with the TI Traffic Control Manual. Reference to information signs in this part is limited to their application for guiding traffic through portions of roadway where construction activities or other temporary and unusual conditions may otherwise create confusion. Application for guiding traffic through detours associated with the above roadway conditions is also included. In all cases, detours signing shall be continuous and complete to guide the road user back to their normal route.

2.3 COLOURS AND SHAPES

.1 Warning Signs shall have black symbols or lettering on an orange reflectorized background of High Intensity grade.

.2 Regulatory and Information Signs, which may be used for temporary traffic control or guidance, shall have the same colour and shape in accordance with the TI Traffic Control Manual.

2.4 DIMENSIONS OF REGULATORY SIGNS

.1 Shall be of the same minimum dimensions in accordance with TI Traffic Control Manual with the exception that when regulatory signs are used on sections of roadway where the maximum speed is 90 km /hr., their minimum dimensions shall be as follows:

.1 rectangular signs: 90 cm x 75 cm
.2 square signs: 90 cm x 90 cm

2.5 DIMENSIONS OF TEMPORARY CONDITION WARNING SIGNS

.1 The minimum dimensions of this class of signs will vary with speed and with the type of road. In each case the following minimum sizes shall be maintained.

	Minimum Dimensions of Warning Signs (cm)	
	Condition #1*	Condition #2**
Trans-Canada Highway or Equivalent	90 x 90	90 x 90
Rural Roads	90 x 90	75 x 75
Urban Streets	75 x 75	75 x 75

*Advance signing preceding a reduction in speed

**Signs following a reduction in speed

2.6 DIMENSIONS OF INFORMATION SIGNS

.1 The size and dimensions of information signs shall be in accordance with the TI Traffic Control Manual.

2.7 DIMENSIONS OF SIGN SUPPORTS

.1 When conditions are encountered where signs are required for only a relatively short duration of time or where they are moved at frequent intervals, the supports may be on weighted bases or folding frames provided the signs are held rigidly and maintained in a proper position, in accordance with General Conditions.

2.8 DIMENSIONS OF MOUNTING HEIGHT

.1 The mounting of signs described in this part shall normally be on a single post although those wider than 1200 mm should generally be mounted on two posts.

.2 Signs mounted on portable supports are suitable for temporary conditions not longer than seven (7) calendar days in duration.

.3 Variations however, may be considered only to improve the visibility of the signs.

.4 All installations of temporary condition signs shall be to the approved MUTCDC or TI Traffic Control Manual depending on jurisdiction or as directed by the Owner.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 All costs associated with temporary condition signing to standards as outlined in this specification shall be the responsibility of the Contractor. Cost of the signs, handling, installation, materials, and labour shall be paid by the Contractor and no payment shall be considered by the Owner.

This specification outlines the requirements for the location, placement, supply and installation of signs relative to Work Sites, namely, Advance, Approach and At Site.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 GENERAL

.1 Three categories of signing are distinguished with regard to location of devices relative to Work Sites, namely, Advance, Approach and At Site.

.2 The Work Site as used in this specification is defined by the beginning of tapers or the Work Area itself when delineation is not used.

2.2 ADVANCE SIGNING

.1 This category includes all the signs used to give advance notice to road users of an activity or road obstruction ahead. Advance signs shall be accompanied by a tab indicating the distance to the beginning of the work site.

.2 These signs are normally required only when the work fully or partially closes a traffic lane. The distance between the first sign of this category and the work site shall be:

Roadway Type	Distance (m)
Trans-Canada Highway or equivalent	450 – 800
Rural roads other than TCH or equivalent	250 – 500
Urban streets	150 – 300

.3 In cases of shoulder work where advance signing may be desirable, the above mentioned distance may be reduced by one-half.

2.3 APPROACH SIGNING

.1 This category includes the warning and regulatory signs placed in the immediate approach to the work site.

.2 They shall inform the road users of the nature of the activity or obstruction, and indicate any required action. All the signs shall be placed in accordance with the following distance criteria:

.1 Distance between the first sign of the sequence and the Work Site shall be as follows:

Roadway Type	Minimum (m)	Maximum (m)
TCH or equivalent	150	300
Rural roads other than TCH or equivalent	100	250
Urban Streets	50	100

.2 Distance from the last sign in the sequence to the Work Site shall be as follows:

Roadway Type	Minimum (m)	Maximum (m)
TCH or equivalent	60	150
Rural roads other than TCH or equivalent	50	100
Urban Streets	15	25

.3 The maximum distance between the last sign in the advance sequence and the first sign of the approach sequence shall be 700 m.

.4 The distance between two consecutive signs in the sequence is a function of the maximum speed and shall be:

Regulatory Speed Limit	Minimum (m)	Maximum (m)
90 km/h	90	300
60 to 80 km/h	60	90
50 km/h or less	30	90

2.4 AT SITE SIGNS

.1 This category includes the warning signs required to advise the motorist of activities or obstructions. Regulatory and information signs shall be erected at the Work Site as required to advise the motorist of the regulations and to guide them through the Work Site Area and to their destination.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 All costs associated with temporary condition signing to standards as outlined in this specification shall be the responsibility of the Contractor. Cost of the signs, handling, installation, materials, and labour shall be paid by the Contractor and no payment shall be considered by the Owner.

This specification outlines the requirements for the location, placement, supply and installation of delineation devices relative to Work Sites.

PART 1 REFERENCES

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure

TI Traffic Control Manual

PART 2 GENERAL

2.1 APPLICATION

.1 Delineation devices shall be used to channelize traffic when the traffic flow is impeded as a result of obstructions, Work Areas or a narrowing of the roadway. They form part of the general category called Traffic Control Devices and shall be used as a supplement to signs and barricades.

.2 Where the temporary condition will exist during the hours of darkness, delineation shall be achieved by the use of construction markers, traffic barrels, barricades, chevron markers, delineator posts, flashing beacons or similar devices. In all cases, markers used to achieve delineation during the hours of darkness shall be retro-reflectorized using high intensity grade sheeting to show the same colour and shape by night as by day. Fluorescent paint shall not be used as a reflectorized substitute and is not acceptable.

.3 Delineators including all construction markers, chevrons, barricades etc. shall be in reasonable condition to be effective for both day and night conditions. While delineation devices cannot always be in new condition, they shall always be in reasonable condition. Unacceptable conditions that warrant replacing shall be those which are: covered in asphalt splatter, dirt, dust or snow; have several large abrasions or tears; have deformation and dented considerably; have significant loss of lettering; lettering has been touched up or poorly modified; message is partly missing or illegible; have colour fading or loss of more than 20 % of its reflectivity.

.4 Traffic cones may be used where the temporary condition will exist during daylight hours only and where the roadway will be in its normal operations, they shall be reflectorized.

2.2 LOCATION OF DELINEATION DEVICES

.1 Any construction or maintenance activity on or within 1 metre of a roadway shall be marked by delineators along the approaches to the work site or obstruction. Delineation devices shall also be placed alongside the obstruction in order to guide the road user.

.2 The angle at which the delineations are placed across the closed portion of the road is called the taper and should vary according to both the nature of the road and the maximum regulatory speed and shall be as follows:

Regulatory Speed Limit (km/h)	Minimum Taper Length (m)
100	180
90	110
80	90
70	60
60	40
50	30

.3 If the work area effects more than one traffic lane width, each traffic lane shall be closed separately and a tangent section provided between the two tapers. The minimum length of the tangent section shall be as follows:

Regulatory Speed Limit (km/h)	Minimum Tangent Between Tapers
90 or greater	240
80	150
60 to 70	100
50 or less	50

2.3 SPACING OF DELINEATORS

.1 The centre-to-centre distance between delineators varies with the regulatory speed for both tapers and tangents. Refer to the Construction Distance Table 799-1 in the TI Traffic Control Manual for further details.

.2 Examples of temporary conditions signing illustrate the delineation recommended for use on various temporary work sites.

Regulatory Speed Limit (km/h)	Minimum Tangent Between Tapers
90 or greater	240
80	150
60 to 70	100
50 or less	50

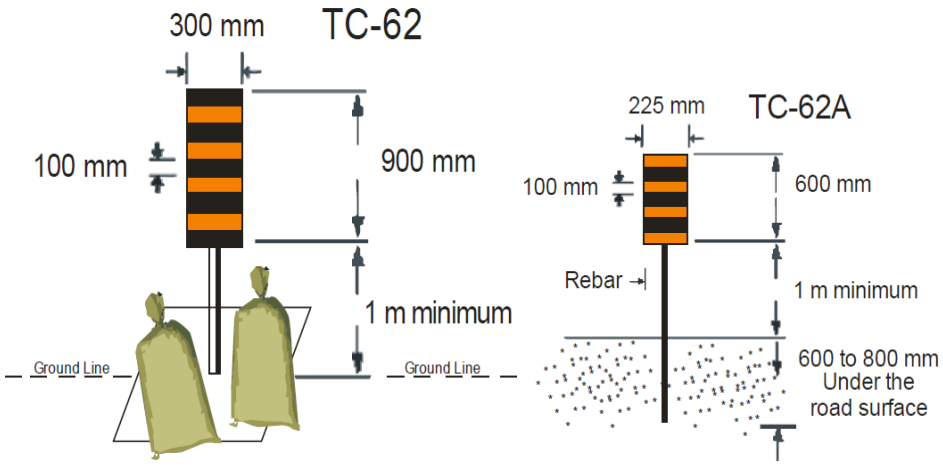
2.4 DESIGN AND COLOUR

.1 Delineators, with the exception of traffic cones, shall be designed with alternating striped orange and black colour placed in horizontal position. Traffic cones shall be solid orange in colour.

2.5 FORMS OF DELINEATORS

.1 A number of forms of delineation may be used, as outlined in the following:

.1 Construction markers shall be of the dimension indicated. They shall be reflectorized using high intensity grade orange reflective sheeting to indicate the same colour and shape by night as by day.



.2 Where Construction Markers are required for a distance greater than 300 metres, the use of the 225 mm x 600 mm marker is permissible (TC-62A).

.3 Drums are to be flexible and typically 200 litres in capacity, set on end and used as delineators. Drums shall be reflectorized to indicate the same colour and shape by night as by day. The drums are to be predominately orange, not fluorescent, but a minimum of two (2) white strips (100 mm width minimum) per drum is required.

.4 Flexible drums may be used as an alternative method to channelize or delineate flow and shall be approximately 1000 mm in height and a minimum of 550 mm in diameter at the base. The markings on the flexible drums shall be horizontal, circumferential alternating black and reflectorized orange strips. Drums frequently require weighted bases to prevent movement.

.5 The required height of traffic cones is related to the related to the normal maximum posted speed of the roadway and shall comply with the following minimum requirements.

Maximum Speed (km/h)	Minimum Heights (mm)
50 or less	450
More than 50	700

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 All costs associated with temporary condition signing of standards as outlined in this specification shall be the responsibility of the Contractor. Cost of the signs, handling, installation, materials, and labour shall be paid by the Contractor and no payment shall be considered by the Owner.

This specification outlines the requirements for the location, placement, supply and installation of barricades relative to Work Sites.

PART 1 REFERENCES

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure

TI Traffic Control Manual

PART 2 GENERAL

2.1 FUNCTION AND LOCATION OF BARRICADES

.1 For reasons of traffic safety and for the protection of workers, barricades shall be used to define the Work Area. Such protection is considered a part of the temporary signing arrangement. Barricades shall also be used to close streets or roads in the area where the work is being carried out.

.2 Barricades are always placed immediately preceding the work area on the approach side and act as a physical barrier between the road user and the obstruction or activity.

.3 These barricades shall be reflectorized or illuminated to indicate the same color and shape by night as by day. **The use of fluorescent paint on barricades shall not be considered for use after dark.**

.4 All barricades shall have a retro-reflective high intensity grade orange background and black print meeting the approval of the Owner.

2.2 LIGHT BARRICADES:

.1 Light barricades shall be used for works of short duration to provide the closure of a traffic lane or roadway or blocking road excavation sites or other work site hazards.

.2 Light barricades shall not be used as a channelizing device.

.3 TC-64A of the Traffic Control Manual is required on each light barricade.

2.3 HEAVY BARRICADES

.1 Heavy barricades shall be used to provide a complete closure of a road or lane for an extended period of longer than 5 (five) days.

.2 Their supports may consist of posts set in the ground or of weighted bases with two (2) heavy barricade faces attached as shown in TC-64C of the Traffic Control Manual.

.3 Where no direction is required barricade TC-64B of the Traffic Control Manual shall be used.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 All costs associated with temporary condition signing to standards as outlined in this specification shall be the responsibility of the Contractor. Cost of the signs, handling, installation, removal, asphalt reinstatement and / or repair, materials, and labour shall be paid by the Contractor and no payment shall be considered by the Owner.

This specification outlines the requirements for the location, placement, supply and installation of miscellaneous warning devices relative to work sites.

PART 1 REFERENCES

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure

TI Traffic Control Manual

PART 2 GENERAL

2.1 APPLICATION

.1 Under certain conditions, as outlined in the following sections, a number of other warning devices, including the following, may be used to augment the standard devices outlined in Sections 01571, 01572, 01573 and 01574.

2.2 HIGH LEVEL WARNING DEVICES

.1 High level warning devices may be used where sight lines are such that normal devices cannot be seen because of obstacles or vehicles. Such devices shall be placed inside the area protected by the delineators or barricades.

2.3 TRUCKS WITH FLASHERS

.1 Trucks with flashers may be used as a replacement for normal signing, in some cases, where the work site is of a very temporary nature and its location changes on a continuing basis. In such instances, the truck shall be equipped with a rotating amber flasher mounted on its roof and standard four-way flashers. This vehicle shall display a bumper, a minimum of 250 mm wide, with alternate orange and black stripes at 45 degrees, and shall be equipped with the appropriate sign to properly guide vehicles approaching from the rear. The bumper and the sign shall be reflectorized to indicate the same shape and colour by night as by day. Examples of the use of this vehicle can be found in the Traffic Control Manual.

2.4 MISCELLANEOUS

.1 Other miscellaneous traffic control devices, such as flares, flashlights, floodlights, lanterns, etc., may be used, as required, to supplement the signs and other devices described in this part.

2.5 PORTABLE LANE CONTROL SIGNALS

.1 Portable lane controls signals may be used to alternate traffic past a work area, in lieu of flag persons. The Owner shall be advised, in each case, of the intent to use this device, at least ten (10) business days before application. The intent to use must also include a review of the flag persons hours for a credit change in the work.

.2 Traffic light timings are calculated using the table shown in Traffic Control Manual drawing 791-1. The user will be required to adjust the timing to the approval of the Owner.

.3 Portable signals shall be used only under conditions where the lights are clearly visible to an approaching motorist such that the vehicle can be brought to a safe stop at any approach speed. Intensity of the signal lamps shall be maintained in such a manner that the lights are clearly visible for a distance of at least 500 metres.

.4 It is essential that these devices be removed immediately when conditions no longer require their use.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 All costs associated with temporary condition signing and equipment as outlined in this specification shall be the responsibility of the Contractor. Cost of the signs, handling, installation, materials, labour shall be paid by the Contractor and no payment shall be considered by the Owner.

This specification outlines the requirements for the installation of a project sign in location on or near the site of the work.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 TIMING

.1 The location of the sign is to be determined by the Owner and is to be installed in the first week that the Contractor's personnel mobilizes to site prior to any other work being performed.

.2 A photo is to be submitted to the Owner immediately.

.3 Sign to remain in place until 30 days after construction is complete and the project is ready for intended use.

2.2 PROJECT SIGN & SIGN SUPPORTS

.1 Materials:

.1 Timber posts shall be Eastern Spruce or Fir.
.2 All nails shall be galvanized.
.3 Project sign is to be supplied by the Contractor. Project sign to be 1.22 m x 2.44 m and made of Dibond or 13 mm plywood or as otherwise approved by the Regional Engineer..

.2 Construction:

.1 Refer to Drawing Index for standard drawing for the size of sign and lettering.
.2 Refer to Drawing Index for standard drawings for the size and type of sign supports required.
.3 Fasten panels to 100 mm by 100 mm posts as indicated, using 180 mm by 10 mm galvanized carriage bolts.
.4 Each 100 mm by 100 mm post shall be in one length, set vertically in the ground a minimum of 900 mm.
.5 Each 50 mm by 100 mm brace will be fastened to the post with a 180 mm by 10 mm galvanized carriage bolt.
.6 After installation, backfill to the existing ground elevation and compact thoroughly.
.7 Remove any debris from the Work Area.
.8 Top of the sign to be 2.4 m above the ground.

.9 Remove sign and make good the area 30 days after Total Performance.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted in the MERX Schedule of Quantities and Prices. The Owner will not approve any progress claims until the Project Sign and sign supports have been erected. Maintenance of the signs shall be considered part of the lump sum amount

This specification outlines the requirements for the supply and installation of various types of wooden signposts and the placing of signs on these signposts. This specification shall be read in conjunction with applicable Sign and Signpost Installation Details standard drawings as outlined in the TI, Highway Specifications Book.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications.

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure (TI), Highway Design and Construction Division, Highway Specifications Book

580 Sign and Signpost Installations

Standard Drawings

Canadian General Standard Board (CGSB)

CAN/CGSB-1.189	Exterior Alkyd Primer for Wood
CAN/CGSB-1.61	Exterior and Interior Marine Alkyd Enamel

CSA Group (CSA)

CSA 080	Wood Preservation

PART 2 GENERAL

2.1 CLASSIFICATION OF SIGNPOST INSTALLATIONS

.1 There are four basic types of signpost installation namely: Type A, Type B, Type C and Type D (see TI, Highway Specifications Book, Standard Drawings Table of Contents for appropriate Sign and Signpost Installation drawings).

.2 Type A and Type B are of various dimensions, but are intended to support smaller size signs that require only one vertical member to support the sign.

.3 For Type A and Type B signpost installations, the number following the letter denotes the required height of the sign to be placed on the post, measured in millimetres.

.4 Type C and Type D signpost installations are of various dimensions, but all are intended to support the larger size signs that require two vertical members to support the sign. Type C installations are intended for large

signs of width less than 2400 mm and a height less than 1200 mm. Type D installations are intended for signs wider than 2400 mm and/or higher than 1200 mm.

.5 For Type C and Type D signpost installations, the upper number following the letter denotes the required height of the sign board in millimetre and the lower number denotes the width of the sign board in millimetres (see TI, Highway Specifications Book, Standard Drawings Table of Contents for appropriate Sign and Signpost Installation drawings).

2.2 MEASUREMENT FOR PAYMENT

.1 Measurement for payment will be by means of the number of each type of signpost installation place at the specified locations.

.2 Signs not included in these documents shall be paid for by the each.

PART 3 PRODUCTS

3.1 GENERAL

.1 The Contractor shall supply all materials required to complete sign and signpost installations in accordance with these specifications.

.2 Nails shall be galvanized nails of length 100 mm.

.3 Wood preservative to be in compliance with CAN/CSA – 080

.4 Primer paint shall be one coat of white exterior alkaloid primer in accordance with AN/CGSB-1.189, or equivalent.

.5 Finish paint shall be one coat of white marine enamel paint in accordance with CAN/CGSB-1.61, or equivalent.

.6 Lag bolts shall be galvanized lag bolts of length 800 mm and diameter 10 mm with Hex or Square Head only (Carriage Type Head are not to be used on signs).

.7 Washers shall be galvanized flat washers that fit 10 mm diameter lag bolts.

3.2 ADDITIONAL MATERIALS TYPE A INSTALLATIONS

.1 Vertical members shall be 114 mm by 114 mm lumber of length not less than that as calculated for the appropriate Sign and Signpost Installation drawings as listed in the TI, Highway Specifications Book, Standard Drawings Table of Contents.

.2 Footings for each post shall consist of six pieces of 38 mm by 89 mm lumber of length not less than 450 mm.

3.3 ADDITIONAL MATERIALS TYPE B INSTALLATIONS

.1 Vertical members shall be 140 mm by 140 mm lumber of length not less than that as calculated by the appropriate Sign and Signpost Installation drawings as listed in the TI, Highway Specifications Book, Standard Drawings Table of Contents.

.2 Footings for each post shall consist of six pieces of 38 mm by 89 mm lumber of length not less than 450 mm.

3.4 ADDITIONAL MATERIALS TYPE C INSTALLATIONS

.1 Vertical members shall be 140 mm by 140 mm lumber.

.2 Footings for each installation shall consist of 2 pieces of 38 mm by 89 mm lumber.

.3 The length of vertical members and footings shall not be less than that as calculated for the appropriate Sign and Signpost Installation drawings as listed in the TI, Highway Specifications Book, Standard Drawings Table of Contents.

.4 Cross bracing shall consist of two pieces of 38 mm by 89 mm lumber of sufficient length to provide cross bracing for the installation of the required size.

3.5 ADDITIONAL MATERIALS TYPE D INSTALLATIONS

.1 Vertical members shall be 184 mm by 184 mm lumber.

.2 Footings for each installation shall consist of two pieces of 38 mm by 89 mm lumber.

.3 Cross members for each installation shall consist of two pieces of 89 mm by 89 mm lumber.

.4 The length of vertical members, footings and cross members shall not be less than that as calculated for the appropriate Sign and Signpost Installation drawings as listed in the TI, Highway Specifications Book, Standard Drawings Table of Contents.

.5 Cross bracing shall consist of two pieces of 38 mm by 89 mm lumber of sufficient length to provide cross bracing for the installation of the required size.

.6 Nuts, bolts and washers for connecting cross members shall be galvanized. The bolt shall be of length 150 mm and be of diameter not less than 15 mm or greater than 25 mm.

3.6 MATERIALS USED FOR THE INSTALLATION OF SIGNS ONTO SIGNPOSTS

.1 Signs will be placed on signposts with 80 mm by 10 mm lag bolts and washers in accordance with appropriate Sign and Signpost Installation drawings as listed in the TI, Highway Specifications Book, Standard Drawings Table of Contents.

PART 4 EXECUTION

4.1 GENERAL

.1 Should any piece of lumber become split or cracked during nailing or installing the sign, then the Contractor shall replace the damaged piece with sound lumber at their own expense.

4.2 ASSEMBLY OF TYPES A AND TYPES B

.1 The footings shall be secured to the vertical member at the spacing shown on the drawings.

.2 Each footing shall be nailed near its centre to the vertical member by means of two nails as shown on the drawings.

4.3 ASSEMBLY OF TYPES C

.1 The footings, cross bracing and vertical members shall be assembled and secured at the spacing shown on the drawings.

.2 Each piece of footing and cross bracing shall be secured to the vertical member with four nails, that is, two nails in each joint.

4.4 ASSEMBLY OF TYPES D

.1 The length of vertical members, footings and cross members shall not be less than that as calculated for the appropriate Sign and Signpost Installation drawings as listed in the TI, Highway Specifications Book, Standard Drawings Table of Contents.

.2 Cross bracing shall consist of two pieces of 38 mm by 89 mm lumber of sufficient length to provide cross bracing for the installation of the required size.

.3 Nuts, bolts and washers for connecting cross members shall be galvanized. The bolt shall be of length 150 mm and be of diameter not less than 15 mm or greater than 25 mm.

.4 Each joint shall be secured with a nut, bolt and washer. The head of the bolt shall be placed at the front of the installation. The head shall be counter sunk so that the top of the bolt is flush with the front of the installation.

.5 Each piece of footing and cross bracing shall be secured with four nails, that is, with two nails at each joint.

4.5 INSTALLATION

.1 The Owner will stake the locations where signpost installations are to be installed and designate the sign number of the signpost installation that is required for each location.

.2 The Contractor shall place signpost installations at these locations only of the required size and type for the sign as specified on the Contract drawings.

.3 The Contractor shall excavate holes for the footings, such that when installed the installation is at least the required minimum depth in the ground.

.4 Signpost installations shall be placed with the vertical axis plumb and with at least the required minimum depth in the ground. The vertical post edge nearest the road shall be 2500 mm from the edge of the shoulder as illustrated on the appropriate Sign and Signpost Installation drawings as listed in the TI, Highway Specifications Book, Standard Drawings Table of Contents.

.5 Footings shall be backfilled with material approved by the Owner. Backfill material shall not contain stones larger than 150 mm in any one dimension. .

.6 Backfill material shall be placed in layers not greater than 150 mm in thickness. Each layer shall be thoroughly compacted before the successive layer is placed. Dry granular backfill shall be moistened before tamping.

.7 Backfill material around the signpost installations shall be brought up level with the surrounding ground and surplus excavated material together with surplus backfill material shall be disposed of on the sides of fills or as directed by the Owner.

.8 The Contractor shall be responsible for placing each sign on the correct posts and at the location specified by the Owner, taking care to ensure

that each sign is placed undamaged, horizontally level and attached to the posts and cross members with 80 mm by 10 mm galvanized lag bolts and galvanized washers. Nails can not be substituted for this job.

.9 Sign board size, signpost type and the location of each will be specified on the Contract drawings by the Owner.

4.6 ADDITIONAL INSTALLATION REQUIREMENTS FOR TYPES A AND TYPES B

.1 Types A and Types B signpost installations shall be placed so that at least 1250 mm of the vertical member is in the ground. They shall be installed so that the face of the post that is to take the sign is perpendicular to the direction of traffic unless otherwise directed by the Owner.

4.7 ADDITIONAL INSTALLATION REQUIREMENTS FOR TYPES C AND TYPES D

.1 Types C and Types D signpost installations shall be placed so that both vertical members are at least 1500 mm in the ground.

.2 Special care should be taken with the placing of Types D and the larger Types C signpost installations so as to minimize specular glare.

.3 On straight stretches of roadway, Types C and Types D signpost installations shall be set with the horizontal axis at an angle of 93 degrees with the traffic lane that the proposed sign will serve, or as directed by the Owner.

.4 On horizontal curves, Types C and Types D installations shall be set with the horizontal axis at an angle of 93 degrees with a straight line between the sign and the point at which the sign is read, or as directed by the Owner.

4.8 ADDITIONAL INSTRUCTIONS FOR THE SIGN BOARD

.1 Types A and Types B signposts, the sign board will be mounted flush with the top of the signposts.

.2 On Types C and Types D signposts, the sign board will be mounted with the top of the sign board 100 mm above the top of the signpost.

.3 On Types A and Types B signposts, the top and bottom lag bolts must be placed 100 mm from the top and bottom edges of the sign board. Refer to appropriate Sign and Signpost Installation drawings as listed in the TI, Highway Specifications Book, Standard Drawings Table of Contents.

.4 On Types C and Types D signposts, lag bolts must be placed 250 mm down from the top edge of the sign board and follow down the sign board

at a maximum spacing of 600 mm apart with the lowest lag bolt placed approximately 100 mm above the bottom edge of the sign board (for each post). Refer to appropriate Sign and Signpost Installation drawings as listed in the TI, Highway Specifications Book, Standard Drawings Table of Contents.

.5 The Contractor is advised that care must be taken when installing the sign board to see that all lag bolts are seated into the frame and without the washers indenting the reflective sheeting of the sign. Care must be taken to see that damage to the sign while installing it to the post is minimal.

4.9 REMOVAL

.1 The sign and signpost shall be removed by the local area government.

PART 5 BASIS OF PAYMENT

.1 Payment at the contract price for sign and signpost installation of a particular type shall be compensation in full for all labour, handling, materials and equipment used, assembly and installation, painting, excavating and backfilling of a hole for the footing including compaction of the backfill, installing the sign board and the disposal of all surplus material in accordance with this specification, including the ongoing maintenance of signs.

This specification outlines the general requirements for Product quality, availability, storage, handling, protection, transportation, and installation. Requirements that are more specific may be outlined in other specifications.

PART 1 REFERENCES

.1 Within the text of each specification section, reference may be made to reference standards. Conform to these standards, in whole or in part, as specifically requested in each the specifications.

.2 Conform to latest date of issue of reference standards in effect on date of submission of bids.

.3 If there is question as to whether any Product or system is in conformance with applicable standards, the Owner reserves the right to have such Products or systems tested to prove or disprove conformance.

.1 The cost for such testing will be borne by the Owner in the event of conformance with the Contract Documents or by the Contractor in the event of non-conformance.

PART 2 GENERAL

2.1 QUALITY

.1 In accordance with the General Conditions, GC 34 - Labour and Products

.2 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.3 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

.4 Defective Products, whenever identified prior to the completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is a precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.

.5 Should any dispute arise as to the quality of fitness of Products, the decision rests strictly with the Owner based upon the requirements of the Contract Documents.

.6 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item throughout the building.

.7 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

2.2 AVAILABILITY

.1 Immediately upon signing the Contract, review Product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of Products are foreseeable, notify the Owner of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In the event of failure to notify the Owner at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Owner reserves the right to substitute more readily available Products of equal or better character, at no increase in Contract Price or Contract Time.

2.3 STORAGE, HANDLING AND PROTECTION

.1 Handle and store Products in a manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled Products in original and undamaged condition with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in the Work.

.3 Store Products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious Products clear of earth or concrete floors, away from walls and in a dry area.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in a heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged Products at own expense and to the satisfaction of the Owner.

.9 Touch-up damaged factory finished surfaces to the Owner's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

.10 Security of stored materials shall be the responsibility of the Contractor.

.11 Storage of Owner supplied Products shall be appropriate for the Product and adequately secured.

2.4 TRANSPORTATION

.1 Pay costs of transportation of Products required in the performance of Work.

.2 Transportation cost of Products supplied by the Owner will be paid for by the Owner. The Contractor shall unload, handle and store such Products as necessary.

2.5 MANUFACTURERS' INSTRUCTIONS

.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's latest printed instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify the Owner in writing of any conflict between these specifications and manufacturer’s instructions. Allow the Owner ten (10) business days to provide direction.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Owner to require removal and re-installation at no increase in Contract Price or Contract Time.

2.6 PERFORMANCE

.1 When material or equipment is specified by standard or performance specifications, upon request of the Owner, obtain from manufacturer an independent testing laboratory report, stating that material of equipment meets or exceeds specified requirements.

2.7 CONSTRUCTION EQUIPMENT

.1 On request, prove to the satisfaction of the Owner that the construction equipment and plant are adequate to manufacture, transport, place and finish Work to quality and production rates specified. If inadequate, replace or provide additional equipment or plant as directed.

.2 Maintain construction equipment and plant in good operating order.

2.8 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in the respective duties for which they are employed. Immediately notify the Owner if required Work is such as to make it impractical to produce required results.

.2 Do no employ any unfit person or anyone unskilled in their required duties. The Owner reserves the right to require the dismissal from the site, workers deemed incompetent, careless, insubordinate or otherwise objectionable.

.3 Decisions as to standard or fitness of the Work in cases of dispute rest solely with the Owner, whose decision is final.

2.9 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for co-ordination and placement of openings, sleeves and accessories.

.3 The Contractor shall be responsible for the co-ordination of work by their sub-contractors.

2.10 CONCEALMENT

.1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation inform the Owner if there is interference. Install as directed by the Owner.

2.11 CUTTING AND REMEDIAL WORK

.1 In accordance with the General Conditions, GC 38 - Cutting and Remedial Work.

.2 Perform cutting and remedial Work required to repair or replace parts of the Work identified as defective or unacceptable and make them come together properly. Co-ordinate adjacent affected Work as required.

.3 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

.4 Should Work performed outside this contract necessitate cutting and/or remedial Work to be performed, the cost of such Work will be valued by the Owner in accordance with the General Conditions, GC 19 - Valuation and Certification of Changes in the Work.

2.12 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform the Owner of conflicting installation. Install as directed.

2.13 FASTENINGS - GENERAL

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use noncorrosive hot dip galvanized steel fasteners, anchors and spacers for securing exterior Work, unless stainless steel or other material is specifically requested in the affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood or any other organic materials plugs are not acceptable.

.5 Keep exposed fastenings to a minimum space evenly and install neatly.

.6 Fastenings that cause spalling or cracking of material to which anchorage is made are not acceptable.

2.14 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

2.15 PROTECTION OF WORK IN PROGRESS

.1 Adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and

replaced, or repaired, as directed by the Owner, at no increase in Contract Price or Contract Time.

.2 Prevent overloading of any part of the structure. Do not cut drill or sleeve any load bearing structural member, unless specifically indicated, without written approval of the Owner.

2.16 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

2.17 SELECTION OF MATERIAL AND EQUIPMENT

.1 Material and equipment will be specified in the tender documents, and selected by Contractor, by one or more of the following methods:

.1 Specification by reference to a relevant Standard, such as CSA, ASTM, ULC, etc., select any material or equipment that meets or exceeds the specified.

.2 Specification by reference to an accepted product evaluation publication, such as the CGSB “Qualified Products List”, or CCMC Registry of Product Evaluations”, - select any manufacturer’s product so listed.

.3 Specification by Prescriptive or Performance specification – select any material or equipment meeting or exceeding specification.

.4 Specification by identification of one or more Manufacturer’s specific product(s) as an “Acceptable Product”, along with a listing of other manufacturers who may offer equivalent products – select any product so named, or select from equivalent product(s) of other listed manufacturers.

.2 “Acceptable Product” is deemed to be a complete and working commodity as described by a manufacturer’s name, catalogue number, trade name, or any combination thereof, and will constitute the minimum standard of acceptance.

.3 Owner will determine acceptability of Contractor’s selection of material and equipment at time of Shop Drawing review.

.4 When material or equipment is specified by a Standard, Prescriptive or Performance specification, upon request of the Owner, obtain from manufacturer an independent laboratory reporting, showing that material or equipment meets or exceeds the specified requirements.

2.18 SUBSTITUTION OF MATERIAL AND EQUIPMENT

.1 Substitution prior to Tender closing will be considered by Owner only if the conditions of Section 01330 are met.

.2 After Contract award substitutions of material or equipment, other than as selected by Contractor from those specified, will be considered by Owner only if the conditions of Section 01330 are met.

.3 Requests for substitutions after Contract award must be accompanied by sufficient information in the form of shop drawings, manufacturer's literature, samples or other data to permit proper investigation of the substitutes used. Requests must also include statements of respective costs of material or equipment originally specified and the proposed substitution.

.4 Should a proposed substitution be accepted after Contract award either in part or in whole, assume full responsibility and costs when substitution affects other work on Project. Contractor to pay for design or drawing changes required as a result of the substitution.

.5 Amounts of all credits arising from approval of substitutions after Contract award will be determined by Owner and the Contract amount will be reduced accordingly.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 No separate or direct payment will be made for the Work specified in this section. Costs of all Work are deemed to be included in the lump sum and unit prices quoted in the MERX Schedule of Quantities and Prices.

This specification outlines the requirement for payment for work for which no contract unit price exists or has not been previously agreed upon.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 GENERAL

.1 Work required, for which no contract unit price exists, or has not been subsequently agreed upon, will be paid for in accordance with the General Conditions, GC 19.1(c).

.2 Payroll Burden, calculated as 35 % of Labour Cost shall be considered as a component of Actual Cost in the General Conditions, GC 19.1(c).

.3 Accommodations at a licenced establishment, shall be approved in writing by the Owner before work commences. Board and Lodging expenses, including meals, are only for those workers currently in accommodations paid for by the Contractor and supported by invoices per Treasury Board guidelines. The Board and Lodging rates claimed will be on a prorated basis of the total work day.

.4 When the Contractor or Subcontractor does work with their own forces, including their own equipment, the rental rate for equipment, including overhead and profit, shall be as specified in the current Department of Transportation and Infrastructure, Municipal Infrastructure Division Equipment Rental Rate Schedule and the Equipment Rental Rate Schedule subsection of this section. Additional allowance for overhead and profit in accordance with the General Conditions, GC 19.1(c), and shall be calculated upon materials, labour and payroll burden only.

.5 When the Contractor or Subcontractor does work with their own forces, including their own equipment, and no rental rate for that equipment is included in the current Municipal Infrastructure Division Equipment Rental Rate Schedule, the rental rate allowed shall be approved, in writing, by the Owner before work commences.

.6 When pole relocation, shoring and/or bracing is performed by a utility company, the Contractor shall be allowed a markup of 5 % of the invoice submitted by the utility company.

.7 Contractors are required to submit the hourly rates of all employees on the project prior to work commencing in anticipation of Force Account work being required. Owner will verify these rates with payroll records.

.8 Pickup trucks are not to be included on Force Accounts unless they are critical to the work being performed.

.9 Superintendent/Foreperson hours are not to be included under Force Account, unless there is an extension in contract time or if an extra supervisor is required.

2.2 EQUIPMENT RENTAL RATE SCHEDULE

.1 Rental rates in this schedule include depreciation, interest, liability insurance, repairs, maintenance, supplies, fuels, lubricants, overhead and profit.

.2 Rates for equipment sizes not shown will be interpolated.

.3 The rental rates stated in this Schedule are Hourly Rates unless indicated otherwise. These rates do not include the operator's wages.

.4 When equipment is rented on an operated basis, the operator's wages will be added to the rental cost. Operator's wages shall be interpreted to mean the basic wage paid the operator plus 35 % burden.

.5 The cost of fuel and lubricants supplied by the Owner will be deducted from the rental charge at the commercial rate applying in the area.

.6 Rental rates in this Schedule are maximum hourly rates allowed. When equipment is rented for weekly or monthly periods, the Owner reserves the right to negotiate rates lower than the hourly rates shown.

.7 Rentals are to be paid for working time only. Lunch hour is not paid as working time. Down time of less than one hour in one shift will not be deducted.

.8 The rental period commences when the unit leaves the owner's premises and shall end on the date of the actual delivery of the unit at the owner's premises or at any other equidistant point, provided transportation conditions are equal and such delivery is requested by the owner. In the case of water transport, the owner will be required to negotiate a rate less than that shown for the period of transport.

.9 Insurance for the unit or units being rented will be the responsibility of the owner.

.10 Machines that may not be represented in this schedule will be subject to rate calculation by the Owner.

.11 All rates for equipment rented in Labrador will be increased by 5.8 %. This will recognize the different operating conditions associated with work in Labrador.

.12 Metric Conversion

Imperial unit	Conversion factor	Metric unit	Abbreviation
net flywheel horsepower	× 0.746	kilowatts	kW
weight (mass)	× 0.45	kilograms	kg
cubic yards	× 0.7646	cubic metres	m3
cubic feet	× 0.028	cubic metres	m3
cubic feet per minute (CFM)	× 28.31	litres/minute	L/min
foot pounds	× 1.355818	joule	J
feet	× 0.305	metres	m
inches	× 25.40	millimetres	mm
ton	× 0.907	tonne	t
inches	× 2.54	centimetres	cm
amperes	× NC	amperes	A
kilowatts (Electric 1,000 watts)	× NC	kilowatts	kW
gallons - imperial	× 4.546	litres	L

Note: Model and Specification References are located in the Appendix.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 Payment for Force Account work shall be made with each progress payment, based on Daily Force Account Reports complete with change order, detailed invoices and mark-up for overhead and profit in accordance with the General Conditions, GC18 - Changes in the Work and GC19 - Valuation and Certification of Changes in the Work, as approved by the Owner. All Daily Force Account Reports are to be signed daily by the Owner to ensure accuracy.

.2 The following items are not included in Force Account Work unless there is an extension in contract time:

.1 Superintendent/foreperson unless an extra supervisor is required
.2 Safety manager, management, and signage
.3 Project management
.4 Waste disposal and handling
.5 Insurance/bonding

This specification outlines the criteria for and requirements of the final portion of the contract, administrative, site and document requirements to close-out the Work.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 FINAL INSPECTION AND DECLARATION PROCEDURES

.1 Contractor's Inspection: The Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects; repair as required.

- .1 Notify the Owner in writing of satisfactory completion of the Contractor's Inspection and submit verification that corrections have been made.
- .2 Request an Owner’s Inspection.

.2 Owner’s Inspection: Owner and the Contractor will perform an inspection of the Work to identify obvious defects or deficiencies. The contractor shall correct Work accordingly.

.3 Completion: submit written certificate that the following have been performed:

- .1 Work has been completed and inspected for compliance with Contract Documents.
- .2 Defects have been corrected and deficiencies have been completed.
- .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
- .4 Certificates required by Fire Commissioner and Utility companies have been submitted.
- .5 Operation of systems have been demonstrated to Owner's personnel.
- .6 Commissioning of all electrical, mechanical, and controls system and copies of final Commissioning Report submitted to Owner.
- .7 Work is complete and ready for Final Inspection.

.4 Final Inspection: When items noted above are completed, request final inspection of Work by the Owner, representative of MI and the Contractor. If Work is deemed incomplete by the Owner, complete outstanding items and request a re-inspection.

.5 Declaration of Substantial Performance: When the Owner considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Certificate of Substantial Performance. Refer to General Conditions for specifics to application.

.6 Commencement of Lien and Warranty Periods: The date of Owner acceptance of the submitted declaration of Substantial Performance shall be the date for commencement for the warranty period and commencement of the lien period.

.7 Declaration of Total Performance: When the Owner considers final deficiencies and defects have been corrected and it appears requirements of the Contract have been totally performed, make application for certificate of Total Performance. Refer to General Conditions for specifics to application. If Work is deemed incomplete by the Consultant, complete the outstanding items and request a re-inspection.

.8 Final Payment: When the Owner considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.

2.2 RE-INSPECTION

.1 Should status of work require re-inspection by Owner due to failure of work to comply with Contractor’s claims for inspection, Owner will deduct amount of compensation for re-inspection services from payment to Contractor.

2.3 FINAL CLEANING

.1 In accordance with the General Conditions, GC 37 – Cleanup and Final Cleaning of Work.

.2 Clean in accordance with Section 01710 Reinstatement and Cleaning.

Remove surplus materials, excess materials, rubbish, tools, and equipment.

2.4 INSPECTION/TAKEOVER PROCEDURES

.1 In accordance with the General Conditions, GC 21 – Certificates and Payments for specifics to application.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICAPLE

PART 5 BASIS OF PAYMENT

.1 No separate or direct payment will be made for Work as outlined in this specification. Costs of all Work specified are deemed to be included in the lump sum and unit prices quoted in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for the reinstatement and cleaning all roads, ditches, other trenches, footpaths, sodded and other surfaces disturbed or damaged during the construction of the Work.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3))

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Fences to be removed, relocated and/or replaced, located within the theoretical trench pay width plus one (1) metre on either side of the trench will be measured by the metre. Fences replaced shall be of a quality equal to or greater than existing conditions.

.2 Ditches or other trenches to be removed, relocated and/or replaced, located within the theoretical trench pay width plus one (1) metre on either side of the trench, will be measured by the metre.

.3 Culverts and other structures to be removed, relocated and/or reinstalled, located within the theoretical trench pay width plus a maximum of one (1) metre on either side of the trench will be measured by the unit specified in the MERX Schedule of Quantities and Prices. Structures replaced shall be of a quality equal to or greater than existing conditions.

.4 Landscaping and topsoil reinstatement will be in accordance with Section 02104, with payment based on theoretical trench pay width plus one (1) metre on either side of the trench, will be measured by the square metre.

.5 Driveway reinstatement and patching, as designated in the contract documents or as directed by the Owner, shall be paid by the square metre including patch preparation such as asphalt cutting, asphalt removal, supply, placement, and compaction of Class A granular base, tack coat on existing asphalt faces, cutting, as well as placing of new asphalt. Asphalt thickness shall be 50 mm compacted and granular base thickness shall be 150 mm compacted.

2.2 PROJECT CLEANLINESS

.1 During the construction period and after Substantial and Total Performance:

.1 Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
.2 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by the Owner or other Contractors.
.3 Remove waste materials and debris from site at daily regularly scheduled times or dispose of as directed by the Owner. Do not burn waste materials on site.
.4 Clear snow and ice from access to the Work.
.5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
.6 Dispose of waste materials and debris off site.
.7 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
.8 Store volatile wastes in covered metal containers, and remove from premises daily.
.9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation is not permitted for this purpose.
.10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
.11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.
.12 On a daily basis maintain project site and adjacent public and private properties free from debris and waste material.
.13 Remove waste materials, noxious or offensive matter, and rubbish from site and provide legal disposal. Comply with any directions or precautions issued by the Owner.
.14 Permanently provide for and maintain the flow, where required, of all sewers, drains, house or inlet connections, and all water courses that may be met with during the progress of the Work. Prevent the contents of any sewer, drain, and house or inlet connection from flowing into the trench or sewers to be constructed under the Contract, except where written permission is given by the Owner.

2.3 GENERAL REINSTATEMENT

.1 Reinstate, restore and make good all roads, ditches, other trenches, footpaths, sodded and other surfaces disturbed or damaged during the construction of the Work, to the satisfaction of the Owner.

.2 Replace or repair with equivalent or better any pavement, trees, shrubbery, fences, retaining walls, poles or other property and surface structures that have been removed, damaged, or disturbed during the Work.

.3 Provide new materials for reconstruction of property and surface structures where original materials are not re-constructible as directed by Owner.

.4 Restore, unless otherwise stipulated, all pavement, granular base or surfacing materials, sidewalks, curbing, gutters, shrubbery, poles, sod or other property, and surface structures removed or disturbed as a part of the Work to a condition equal to that before the Work began, furnishing all labour and materials incidental thereto. No permanent pavement or new gravelling shall be placed unless instructed by the Owner, and then not until, in the opinion of the Owner, the condition of the backfill and subgrade is such as to properly support the pavement.

2.4 FINAL CLEANING

.1 Refer to General Conditions.

.2 When Work is Substantially Performed, remove all surplus materials, tools, equipment, and temporary structures not required for performance of remaining work.

.3 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.4 Remove all surplus usable materials furnished by the Owner from the site and deliver to locations designated by the Owner.

.5 When the Work is Totally Performed, remove surplus products, tools, construction machinery and equipment.

.6 Remove waste products and debris other than that caused by the Owner.

.7 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.8 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.9 Remove dirt and other disfiguration from exterior surfaces.

.10 Clean and sweep roofs, gutters, areaways, and sunken wells.

.11 Sweep and wash clean paved areas.

.12 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.

.13 Clean roofs, downspouts, and drainage systems.

.14 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.15 Remove snow and ice from access to the Work.

.16 Replace all temporary bulbs, alarms, and filters.

2.5 FINISHING OF PROJECT

.1 After all other work encompassed in the contract is completed, and before acceptance and final payment will be made, the entire project shall be neatly finished and trimmed to the lines, grades, and cross sections shown on the plans, or as directed by the Owner, to produce smooth surfaces and slopes and a uniform cross section. All construction operations related debris, fallen trees, boulders, bog, and surplus materials, shall be disposed of as provided by these specifications.

.2 All drainage ditches, waterways, and culverts shall be opened up and cleared out to restore to their full effectiveness.

.3 Should the surface of any structure or road be contaminated as a result of the Contractor's operations, then the Contractor shall clean off all such mud, or deleterious substances, and restore the surface to the satisfaction of the Owner’s Representative.

.4 All grubbed areas adjoining excavations or embankments shall be graded to conform to the general ground lines.

.5 Finishing of project will be considered as subsidiary work pertaining to the contract and no extra payment will be made.

2.6 MAINTENANCE

.1 Following the issuance of the Certificate of Substantial Performance, items requiring maintenance or repair will be corrected during the warranty period or specified maintenance period.

.2 Maintenance or reinstatement, partial reinstatement, repairs, replacement or restoration until the next construction season starts for the respective area of the Province for the area of the Work (spring start up) will be:

.1 at the Contractor's expense where the continuance of the Contract beyond Period of Work is under the Contractor's control;
.2 at the Owner's expense where completion of the contract beyond Period of Work is under the Owner's control. In this case, payment for maintenance shall be in accordance with Section 01610.

2.7 REINSTATEMENT OF ROADS

.1 Return all roads to their original or better condition and obtain Department of Transportation and Infrastructure, Highway Design and Construction division acceptance of the roads under their jurisdiction. (Refer Drawing Index for appropriate road restoration standard drawings and details).

.2 Comply with and accept responsibility for any requirements that the Department of Transportation and Infrastructure, Highway Divisions imposes on the Owner as a condition of carrying out the Works within the right-of-way of roads under the Department jurisdiction. These same requirements shall also apply to all other roads and streets affected by the Works. These requirements are, but not necessarily limited to, the following:

.1 The Work performed within the right-of-way of the highway will be subject to inspection and approval of authorized Department of Transportation and Infrastructure, Highway personnel.
.2 All structures placed in a roadway shall be bedded in a firm, well compacted foundation. Backfilling of these structures must be compacted in an approved manner in order to prevent undue settlement. Material for backfilling shall be that excavated or similar to that of which the subgrade is constructed. Compaction specified as:

.1 Subgrade: 95 % of the maximum standard proctor dry density (ASTM D698)
.2 Subbase: (granular) 100 % (ASTM D698)
.3 Asphalt: 100 % (ASTM D698)

.3 On gravelled surface roads or gravelled shoulders, backfilling with excavated or similar material must be carried on such that a minimum thickness of 150 mm of Class 'A' granular base course or other approved base course material can be placed below the surface grade.
.4 Repair any undue settlement occurring within the warranty period. Where in the Owner's opinion permanent repairs to the asphalt pavement or granular surface cannot be undertaken, an asphalt patch or granular surface will be placed by the Contractor and replaced at a convenient time (usually the following year). Both

installations shall be at the Contractor's expense and accepted by the Owner. Any maintenance of the patch or granular surface required by the Owner or the Department of Transportation and Infrastructure will also be made by the Contractor. Refer also to Section 02574.

.5 The Contractor is responsible for any damage that may be caused to the road or adjoining property during or as a result of this Work.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 Except as indicated in these Specifications or in the MERX Schedule of Quantities and Prices, no separate of direct payment will be made for reinstatement. To ensure reinstatement is carried out as the Work progresses, a sum equal to 5 % of the value of the Work completed will be retained in addition to all other specified allowances or holdbacks. This reinstatement allowances will be released progressively each month on the basis of the Owner's opinion of the percentage of reinstatement completed.

.2 With failure of the Contractor to carry out reinstatement within a reasonable period of time, the Owner may authorize to have the Work carried out by others at the expense of the Contractor. The Owner will give the Contractor written notice in accordance with the General Conditions, Section GC 9 – Owner's Right to do Work, before taking action.

.3 Class "A" (Granular Base) reinstatement for roads and shoulders of paved roads will be measured by the cubic metre (m^3) of compacted material incorporated into the Work, in accordance with Section 02233. The Contractor shall not be paid more than the calculated quantities based on 100 mm thickness times the width.

.4 Class "A" (Granular Base) and Class "B" (Granular Sub-Base) reinstatement for materials removed during trench excavation along gravel roads will be measured by the cubic metre (m^3) of compacted material incorporated in the Work in accordance with Section 02233, based on the theoretical trench width and 100 mm thickness.

.5 Payment for removal and replacement of existing asphalt pavement, except for driveways as noted in this Section, shall be to Section 02574.

This specification outlines the procedural requirements for submittal of maintenance and record documents, operation data, and warranties and bonds specified in individual specification sections.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 QUALITY ASSURANCE

.1 Prepare instructions and data by personnel experienced in maintenance and operation of described products.

2.2 SUBMISSION

.1 Collect reviewed submittals and assemble documents executed by Subcontractors, suppliers and manufacturers.

.2 Submit material prior to final Application for Payment.

.3 Submit operation and maintenance data, and record (as-built) drawings.

.4 Execute Performance, Labour and Materials Payment Bond to warranty period requirements.

.5 Owner will issue a final change order reflecting approved adjustments to Contract Price not previously made.

.6 Commissioning Manuals.

.7 Submit copy of completed volumes in draft form 15 business days prior to issuing of substantial performance.

.8 Copy will be returned after final inspection, with the Owner's comments.

.9 Revise content of documents as required prior to final submittal.

.10 Submit revised files in final form within ten (10) business days after final inspection.

.11 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

.12 If requested, furnish evidence as to type, source and quality of products provided.

.13 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.14 Pay costs of transportation.

2.3 FORMAT

.1 Organize data in the form of an instructional manual.

.2 Documents are to be in PDF format submitted by email to the Owner and MI.

.3 Correlate data into related consistent groupings.

.4 Identify each with the following title format "Project Record Documents"; list title of Project, MI Project Number, Owner, and identify subject matter of contents.

.5 Arrange content by systems, under Section numbers and sequence of Table of Contents.

.6 Provide CAD files in DWG format and PDF format.

2.4 CONTENTS OF EACH VOLUME

.1 Table of Contents: provide title of project, MI project number, Owner, names, addresses, and telephone numbers of consultant and Contractor with name of responsible parties, schedule of products and systems, indexed to content of the volume.

.2 For Each Product or System:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.2 List manufacturer’s name, model number, serial number and contractor’s purchase order number.

.3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Type Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01600.

.6 Training: provide records of required training.

2.5 AS-BUILTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site for Owner one record copy of:

.1 Contract Drawings.
.2 Specifications.
.3 Amendments.
.4 Change Orders and other modifications to the Contract.
.5 Reviewed shop drawings, product data, and samples.
.6 Field test records.
.7 Inspection certificates.
.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.

.1 Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition.

.1 Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Owner.

2.6 RECORDING AS-BUILT CONDITIONS

.1 For projects where water and sewer systems or roads are the main components, the Contractor shall provide all horizontal and vertical data related to the layout of the Work before the Certificate of Substantial Performance is issued. Drawings shall show all differences, design changes, and deviations from the original Contract Drawings in red with references to the Contractor’s survey and quality control inspection records beside each entry. Contractor shall pay costs for uncovering and making good Work that is covered before required as-built information is recorded.

.2 In projects where a building or building systems is the a component, the Contractor shall provide the mechanical, electrical, and other related as-built information to the Owner’s Representative before Substantial Performance issued. The information may be provided on marked up contract drawings.

.3 Do not conceal Work until required information is recorded. Contractor shall pay costs for uncovering and making good Work that is covered before required as-built information is recorded.

.4 Shop Drawings: legibly mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each item actually installed, particularly optional items and substitute items.
.2 Changes made by Amendments and change orders.

.5 Other Documents: submit manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.

.6 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.7 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:

.1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
.2 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
.3 Field changes of dimension and detail.
.4 Changes made by change orders.
.5 Details not on original Contract Drawings.
.6 References to related shop drawings and modifications.

.8 At completion of project, provide all recorded information on print drawings. Transfer recorded information to AutoCAD files in DWG format. Submit DWG files, also with electronic files in PDF format as part of the Closeout Submittals.

2.7 FINAL SURVEY

.1 Submit final site survey certificate certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

2.8 EQUIPMENT AND SYSTEMS

.1 For each item of Equipment and each System: include description of unit or system, and component parts.

.1 Give function, normal operation characteristics, and limiting conditions.

.2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board Circuit Directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.

.1 Include regulation, control, stopping, shut-down, and emergency instructions.

.2 Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include test and balancing reports as specified in Section 01400 and 01600.

.15 Additional Requirements: As specified in individual specification sections.

2.9 MATERIALS AND FINISHES

.1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.

.1 Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods complete with WHMIS sheets, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommend schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications sections.

2.10 MAINTENANCE MATERIALS

.1 Spare Parts:

.1 Provide spare parts, in quantities specified in individual specification sections.
.2 Provide items of same manufacture and quality as items in Work.
.3 Deliver to site or location as directed; place and store.
.4 Receive and catalogue items.

.1 Submit inventory listing to the Owner.
.2 Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit before final payment.

.2 Extra Stock Materials:

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
.2 Provide items of same manufacture and quality as items in Work.
.3 Deliver to site or location as directed; place and store.
.4 Receive and catalogue items.

.1 Submit inventory listing to the Owner.
.2 Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit before to final payment.

.3 Special Tools:

.1 Provide special tools, in quantities specified in individual specification Section.
.2 Provide items with tags identifying their associated function and equipment.
.3 Deliver to site or location as directed; place and store.
.4 Receive and catalogue items.

.1 Submit inventory listing to the Owner.

.2 Include approved listings in Maintenance Manual.

2.11 DELIVERY, STORAGE, AND HANDLING

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to the satisfaction of the Owner.

2.12 PRE-WARRANTY MEETING

.1 Convene meeting with contractor's representative, Owner, Owner’s Representative and Departmental Representative, in accordance with Section 01200. Schedule meeting in conjunction with request for Substantial Performance or with review of deficiencies to:

.1 Verify Project requirements.
.2 Review manufacturer's installation instructions and warranty requirements.

.2 Owner to establish communication procedures for:

.1 Notifying of construction warranty defects.
.2 Determine priorities for type of defects.
.3 Determine reasonable response time.

.3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.

2.13 WARRANTIES AND BONDS

.1 Develop warranty management plan to contain information relevant to Warranties.

.2 Submit warranty management plan 10 business days before planned pre-warranty meeting, to the Owner for approval.

.3 Warranty management plan to include required actions and documents to assure that the Owner receives warranties to which it is entitled.

.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.5 Assemble approved information and submit upon acceptance of work, organized as follows:

.1 Separate each warranty or bond with index tab sheets keyed to the List of Contents listing.
.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) business days after completion of the applicable item of Work.
.4 Verify that documents are in proper form, contain full information, and are notarized.
.5 Co-execute submittal when required.
.6 Retain warranties and bonds until time specified for submittal.

.6 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 No separate or direct payment will be made for Work as outlined in this specification. Costs of all Work specified are deemed to be included in the lump sum and unit prices quoted in the MERX Schedule of Quantities and Prices.

DIVISION 2

02070 SITEWORK, DEMOLITION & REMOVAL OF STRUCTURES

PART 1 REFERENCES
PART 2 GENERAL
2.1 EXISTING CONDITIONS
2.2 COORDINATION
2.3 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 PREPARATION & DISCONNECTION
4.2 REMOVAL
4.3 DEMOLITION
4.4 SALVAGE
4.5 EXCAVATION
4.6 SEALING
4.7 DISPOSAL OF MATERIAL
4.8 BACKFILL
4.9 RESTORATION
4.10 SAFETY REQUIREMENTS
PART 5 BASIS OF PAYMENT

02104 LANDSCAPING, SEEDING, SODDING & TREE PRESERVATION

PART 1 REFERENCES
PART 2 GENERAL
2.1 SOURCE QUALITY CONTROL
2.2 DELIVERY AND STORAGE
2.3 SCHEDULING OF WORK
2.4 TERRASEEDING
2.5 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 MATERIALS
3.2 GRASS SEED MIXTURE
3.3 TERRASEEDING
PART 4 EXECUTION
4.1 FERTILIZING EXISTING TREES
4.2 RAISING GRADE AROUND EXISTING TREES
4.3 LOWERING GRADE AROUND EXISTING TREES
4.4 TOPSOIL
4.5 APPLICATION OF FERTILIZER
4.6 APPLICATION OF LIME
4.7 PREPARATION OF SURFACES
4.8 APPLICATION OF SEED
4.9 SEED PROTECTION ON SLOPES

4.10 SODDING
4.11 HYDROSEEDING
4.12 MAINTENANCE
4.13 PROTECTION AND REPAIR
4.14 ACCEPTANCE
4.15 TERRASEEDING
PART 5 BASIS OF PAYMENT

02111 CLEARING & GRUBBING

PART 1 REFERENCES
PART 2 GENERAL
2.1 REGULATORY AGENCIES
2.2 MEASUREMENT FOR PAYMENT
2.3 SAFETY REQUIREMENTS
2.4 STORAGE AND PROTECTION
2.5 ENVIRONMENTAL PROTECTION
PART 3 PRODUCTS
PART 4 EXECUTION
4.1 PROTECTION
4.2 PREPARATION
4.3 CLEARING
4.4 GRUBBING
4.5 CLEARING AND GRUBBING
4.6 CLOSE CUT CLEARING
4.7 UNDERBRUSH CLEARING AND GRUBBING
4.8 ISOLATED TREES
4.9 REMOVAL AND DISPOSAL
4.10 FINISHED SURFACE
4.11 CLEANING
PART 5 BASIS OF PAYMENT

02202 ROCK REMOVAL

PART 1 REFERENCES
PART 2 GENERAL
2.1 QUALIFICATIONS
2.2 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 ROCK REMOVAL
PART 5 BASIS OF PAYMENT

02215 SITE WORK & SITE GRADING

PART 1 REFERENCES
PART 2 GENERAL
2.1 EXAMINATION
2.2 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 MATERIALS
3.2 STOCKPILING
PART 4 EXECUTION
4.1 COMPACTION EQUIPMENT
4.2 WATER DISTRIBUTORS
4.3 EXCAVATION
4.4 EXCAVATION REQUIRED BY OTHERS
4.5 BACKFILLING
4.6 MAINTENANCE
4.7 PRESERVATION OF TOPSOIL
4.8 INSPECTION & TESTING
4.9 WASTE MATERIAL
PART 5 BASIS OF PAYMENT

02223 EXCAVATION, TRENCHING & BACKFILLING

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 SITE PREPARATION
4.2 COFFERDAMS, SHORING, BRACING AND UNDERPINNING
4.3 DEWATERING
4.4 EXCAVATION
4.5 TRENCH BOTTOM PREPARATION
4.6 PRE-INSTALLATION INSPECTION
4.7 BACKFILLING
4.8 RESTORATION
PART 5 BASIS OF PAYMENT

02224 ROADWAY EXCAVATION, EMBANKMENT & COMPACTION

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
2.2 TRAFFIC PROVISIONS
PART 3 PRODUCTS
3.1 MATERIALS

PART 4 EXECUTION
4.1 COMPACTION EQUIPMENT
4.2 WATER DISTRIBUTORS
4.3 EXCAVATING
4.4 DEWATERING AND HEAVE PREVENTION
4.5 EMBANKMENTS
4.6 FINISHING
4.7 MAINTENANCE
PART 5 BASIS OF PAYMENT

02226 AGGREGATES, GENERAL

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 SOURCE APPROVAL
2.2 PRODUCTION SAMPLING
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 DEVELOPMENT OF AGGREGATE SOURCE
4.2 PROCESSING
4.3 HANDLING
4.4 STOCKPILING
4.5 STOCKPILE CLEANUP
PART 5 BASIS OF PAYMENT

02231 SCARIFYING & RESHAPING

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 SCARIFYING AND RESHAPING
4.2 COMPACTING
4.3 MAINTENANCE
PART 5 BASIS OF PAYMENT

02232 RESHAPING ONLY (UP TO 100 MM)

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS

3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 RESHAPING
4.2 COMPACTING
4.3 MAINTENANCE
PART 5 BASIS OF PAYMENT

02233 SELECTED GRANULAR BASE & SUB BASE MATERIALS

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 INSPECTION OF UNDERLYING SUB-BASE OR SUB-GRADE
4.2 PLACING
4.3 SHOULDERING
4.4 COMPACTION
4.5 MAINTENANCE
PART 5 BASIS OF PAYMENT

02250 CALCIUM CHLORIDE

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 APPLICATION
PART 5 BASIS OF PAYMENT

02270 RIP-RAP PROTECTION

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 STONE
3.2 SOD
3.3 GROUT
PART 4 EXECUTION
4.1 EXCAVATION
4.2 PLACING

PART 5 BASIS OF PAYMENT

02271 ARMOUR STONE PROTECTION

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 STONE
PART 4 EXECUTION
4.1 PLACING
PART 5 BASIS OF PAYMENT

02272 GABIONS

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS.
3.1 MATERIALS
3.2 PRODUCTION
3.3 CERTIFICATION
3.4 INSPECTION AND TESTING
3.5 SHIPPING AND MARKING
PART 4 EXECUTION
4.1 SITE PREPARATION
4.2 INSTALLATION
4.3 FILLING BASKETS
4.4 PLACING OF CONNECTING WIRES
4.5 PLACING GABIONS
4.6 SECURING LIDS
PART 5 BASIS OF PAYMENT

02282 SUPPLY & INSTALLATION OF GUIDE RAIL

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
2.2 SUBMITTALS
2.3 ENVIRONMENTAL REQUIREMENTS
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 EXAMINATION
4.2 INSTALLATION

4.3 PAINTING AND TOUCH-UPS
4.4 CLEANING
PART 5 BASIS OF PAYMENT

02283 SALVAGE & REINSTALLATION OF GUIDE RAIL

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
2.2 ENVIRONMENTAL REQUIREMENTS
PART 3 –PRODUCTS
3.1 MATERIALS
PART 4 –
4.1 DISMANTLING OF EXISTING GUIDE RAILREMOVAL AND SALVAGE OF EXISTING POSTS
4.2 BACKFILLING POST HOLES
4.3 INSTALLATION
PART 5 BASIS OF PAYMENT

02284 HANDRAIL

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAMENT
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 INSTALLATION
PART 5 BASIS OF PAYMENT

02410 SUB-DRAINS

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 TRENCHING
4.2 BEDDING
4.3 INSTALLATION
PART 5 BASIS OF PAMENT

02434 PIPE CULVERTS

PART 1 REFERENCES
PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 ALUMINIZED STEEL PIPE
3.2 ALUMINIZED TYPE-2 PIPE
3.3 POLYMER LAMINATE PIPE
3.4 ALUMINUM PIPE
3.5 CONCRETE PIPE MATERIALS
3.6 PLASTIC PIPE MATERIALS
3.7 GRANULAR BEDDING AND BACKFILL
PART 4 EXECUTION
4.1 TRENCHING AND BACKFILL
4.2 DEWATERING
4.3 BEDDING
4.4 LAYYING ALUMINIZED STEEL PIPE
4.5 JOINING ALUMINZED STEEL CULVERTS
4.6 LAYING CONCRETE PIPE CULVERTS
4.7 JOINING CONCRETE PIPE CULVERTS
4.8 LAYING PLASTIC PIPPE CULVERTS
4.9 JOINING PLATIC PIPE CULVERTS
4.10 BACKFILLING
4.11 PROTECTION FROM TRAFFIC
PART 5 BASIS OF PAYMENT

02481 CHANNEL EXCAVATION, CLEARING AND DEEPENING

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 EXCAVATION
PART 5 BASIS OF PAYMENT

02496 TIMBER CRIBWORK

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAMENT
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 PREPPARATION
4.2 CRIB CONSTRUCTION

4.3 HHANDLING TREATED TIMBER
4.4 BALLAST
4.5 TOLERANCES
PART 5 BASIS OF PAYMENT

02501 CORRECTED MAXIMUM DRY DENSITY

PART 1 REFERENCES
PART 2 GENERAL
2.1 MAXIMUM DRY DENSITY
2.2 CORRECTED MAXIMUM DRY DENSITY
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

02528 CURBS, GUTTERS, AND SIDEWALKS

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 GRADE PREPARATION CONCRETE
4.2 GRANULAR BASE
4.3 CONCRETE
4.4 FORMING
4.5 EXPANSION AND CONTRACTION JOINTS
4.6 BACKFILL
4.7 CORROSION PREVENTION
PART 5 BASIS OF PAYMENT

02547 ASPHALT TACK COAT

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT OF PAYMENT
PART 3 PRODUCTS
PART 4 EXECUTION
PART 5 BASIS OF PAYMENT

02552 HOT MIX ASPHALTIC CONCRETE PAVEMENT

PART 1 REFERENCES
PART 2 GENERAL

2.1 EXCEPTIONS TO HIGHWAY SPECIFICATIONS BOOK
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 NOT APPLICABLE
PART 5 BASIS OF PAYMENT

02574 RESHAPING & PATCHING ASPHALT PAVEMENT

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 CONSTRUCTION
PART 5 BASIS OF PAYMENT

02575 COLD PLANING

PART 1 REFERENCES
1.1 NOT APPLICABLE
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 SCOPE
4.2 EQUIPMENT
4.3 OPERATIONS
4.4 USE OF MILLED MATERIAL FOR SOULDERING
4.5 USE OF MILLED MATERIAL FOR SOTCKPILING FOR OWNER
PART 5 BASIS OF PAYMENT

02576 PULVERIZE EXISTING ASPHALT

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 NOT APPLICABLE
PART 4 EXECUTION
4.1 SCOPE
4.2 PROCEDURE
PART 5 BASIS OF PAYMENT

02577 PAVEMENT CRACK CLEANING & FILLING

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
PART 4 EXECUTION
PART 5 BASIS OF PAYMENT

02580 PAVEMENT MARKINGS

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
2.2 SUBMITTALS
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 GENERAL
4.2 EQUIPMENT
PART 5 BASIS OF PAYMENT

02601 MAINTENANCE HOLES, CATCH BASINS & DITCH INLETS

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 EXCAVATING AND BACKFILL
4.2 CONCRETE WORK
4.3 INSTALLATION
4.4 ADJUSTING TOPS OF EXISTING UNITS
4.5 MAINTENANCE HOLE INFLOW PROTECTION COVER
4.6 INFILTRATION AND EXFILTRATION TEST
PART 5 BASIS OF PAYMENT

02650 SEWAGE PUMPING STATION

REFERENCES

PART 1 GENERAL
1.1 MEASUREMENT FOR PAYMENT
PART 2 PRODUCTS
2.1 WET WELL CHAMBER
2.2 PUMPS
2.3 PIPING
2.4 MISCELLANEOUS ITEMS
2.5 PORTABLE DIESEL GENERATOR
2.6 MOTOR
2.7 ACCESS FRAME AND COVER
2.8 LIQUID LEVEL CONTROL
2.9 PUMP CONTROL PANEL
2.10 ELECTRICAL WIRING
2.11 INSPECTION, TESTING AND SHIPMENT
2.12 LABELS
2.13 DRAWINGS AND DATA
PART 3 MAINTENANCE AND OPERATIONS MANUALS
PART 4 INSTALLATION SUPERVISION
PART 5 PROVISION FOR POWER
PART 6 BASIS OF PAYMENT

02702 SEWER MAINS

PART 1 REFERENCES
PART 2 GENERAL
2.1 AS-BUILT DRAWINGS
2.2 MEASUREMENT FOR PAYMENT
2.3 SCHEDULING OF WORK
PART 3 PRODUCTS
3.1 CONCRETE PIPE
3.2 HYPRESCON PIPE
3.3 STEEL PIPE
3.4 ALUMINIZED TPE-2 AND POLYMER LAMINATE
3.5 ALUMINUM PIPE
3.6 PLASTIC PIPE
3.7 HIGH DENSITY POLYETHYLENE PIPE
3.8 CEMENT MORTAR
3.9 CORRUGATED ALUMINUM PIPE
PART 4 EXECUTION
4.1 PREPARATION
4.2 TRENCHING AND BACKFILLING
4.3 CONCRETE BEDDING AND ENCASEMENT
4.4 GRANULAR BEDDING
4.5 INSTALLATION

4.6 SERVICE CONNECTIONS
4.7 FIELD TESTING
4.8 CCTV INSPECTION OF PIPELINES
4.9 QUALITY ASSURANCE
PART 5 BASIS OF PAYMENT

02704 SANITARY SEWER OUTFALL PIPE

PART 1 REFERENCES
PART 2 GENERAL
2.1 RELATED WORK SPECIFIED ELSEWHERE
2.2 SAMPLES
2.3 MATERIAL CERTIFICATION
2.4 AS BUILT DRAWINGS
2.5 SCHEDULING OF WORK
2.6 MANUFACTURER'S INSTRUCTIONS
2.7 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 PIPE AND FITTINGS
3.2 PIPE BEDDING MATERIALS
PART 4 EXECUTION
4.1 PREPARATION
4.2 TRENCHING AND BACKFILLING
4.3 CONCRETE BEDDING AND ENCASEMENT
4.4 PIPE INSTALLATION
4.5 UNDERWATER VIDEO AND/OR PHOTO INSPECTION
PART 5 BASIS OF PAYMENT

02710 FOUNDATION & UNDERSLAB DRAINAGE

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 INSPECTION
4.2 INSTALLATION
PART 5 BASIS OF PAYMENT

02713 WATER MAINS

PART 1 REFERENCES
PART 2 GENERAL
2.1 LOCATION OF CURB STOPS
2.2 SUBMITTALS

2.3 CLOSEOUT SUBMITTALS
2.4 SCHEDULING OF WORK
2.5 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 PIPE AND FITTINGS
3.2 VALVES AND VALVE BOXES
3.3 VALVE CHAMBERS
3.4 SERVICE CONNECTIONS
3.5 HYDRANTS
3.6 PIPE BEDDING MATERIALS
3.7 PIPE DISINFECTION
3.8 TOOLS AND EQUIPMENT
PART 4 EXECUTION
4.1 PREPARATION
4.2 TRENCHING AND BACKFILL
4.3 CONCRETE BEDDING, CUT-OFF WALLS AND/OR ENCASEMENT
4.4 GRANULAR BEDDING
4.5 PIPE INSTALLATION
4.6 VALVE INSTALLATION
4.7 VALVE CHAMBERS
4.8 SERVICE CONNECTIONS
4.9 HYDRANTS
4.10 THRUST BLOCKS
4.11 PRESSURE TEST
4.12 LEAKAGE TEST
4.13 FLUSHING AND DISINFECTING
4.14 SWABBING
PART 5 BASIS OF PAYMENT

02724 SEWAGE FORCE MAINS

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 MATERIALS
3.2 PIPE BEDDING MATERIALS
PART 4 EXECUTION
4.1 PREPARATION
4.2 TRENCHING AND BACKFILL
4.3 BEDDING
4.4 CONCRETE BEDDING AND ENCASEMENT
4.5 INSTALLATION
4.6 THRUST BLOCKS

4.7 FIELD TESTING OF FORCE MAIN
4.8 SWABBING
PART 5 BASIS OF PAYMENT

02726 FACTORY PRE-INSULATED PIPING SYSTEMS

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
2.2 SHHOHP DRAWINGS
PART 3 PRODUCTS
3.1 CARRIER CORE PIPE AND FITTINGS
3.2 FACTORY APPLIED INSULATION
3.3 OUTER JACKET FOR BURIED APPLICATIONS
3.4 OUTER JACKET FOR ABOVE GROUND APPLICATIONS
3.5 INSULATED PIPE JOINTS FOR BURIED APPLICATIONS
3.6 INSULATED PIPE JOINTS FOR ABOVE GROUND APPLICATIONS
3.7 INSULATIONS KITS FOR FITTINGS
3.8 INSULATION FOAMED IN PLACE
3.9 INSULATION ACCESSORIES
3.10 ELECTRIC HEAT TRACING
PART 4 EXECUTION
4.1 UNLOADING AND HANDLING OF PRE-INSULATED PIPE
4.2 REPAIRING DAMAGED PRE-INSULATED PIPE
4.3 TRENCHING AND BACKFILLING
4.4 GRANULAR BEDDING AND SURROUND
4.5 PIPE INSTALLATION
4.6 INSULATION OF PIPE JOINTS
4.7 INSULATION OF FITTINGS
4.8 ELECTRIC TRACING
4.9 TESTING
PART 5 BASIS OF PAYMENT

02729 WATER WELLS

PART 1 REFERENCES
PART 2 GENERAL
2.1 REPORTS
2.2 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 PERMANENT WELL CASING
3.2 SCREEN
3.3 WELL SEAL
PART 4 EXECUTION
4.1 DRILLING

4.2 SCREEN INSTALLATION
4.3 PERMANENT CASING INSTALLATION
4.4 GRAVEL PACKING
4.5 GROUTING
4.6 DISINFECTION
4.7 TEST PUMPING
4.8 WELL DEVELOPMENT
4.9 AQUIFER TEST
4.10 SEALING WELLS
PART 5 BASIS OF PAYMENT

02831 CHAIN LINK FENCES & GATES

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 MATERIALS
3.2 FINISHES
PART 4 EXECUTION
4.1 GRADING
4.2 ERECTION OF FENCE
4.3 INSTALLATION OF GATES
4.4 TOUCH UP
4.5 CLEANING
PART 5 BASIS OF PAYMENT

02832 WILDLIFE WIRE FENCES

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 GRADING
4.2 ERECTION OF FENCE
4.3 INSTALLATION OF GATES
4.4 GROUNDING
4.5 TOUCH UP
4.6 CLEANING
PART 5 BASIS OF PAYMENT

02897 FILTER FABRIC (GEOTEXTILE)

PART 1 REFERENCES

PART 2 GENERAL
2.1 APPROVAL
2.2 SHIPPING AND STORAGE
2.3 MEASUREMENT FOR PAYMENT
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 INSTALLATION
PART 5 BASIS OF PAYMENT

This specification outlines the requirements for demolishing, salvaging, recycling and removing in whole or in part, various items designated to be removed or partially removed and for backfilling resulting trenches, holes and pits and the disposal of resulting materials.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Government of Newfoundland and Labrador, Department of Environment and Climate Change

Pollution Prevention Division, Asbestos Waste Disposal Guidance Document

Other

Province of Newfoundland and Labrador, Occupational Health and Safety Act, Amended

Province of Newfoundland and Labrador, Regulation 5/12, Occupational Health and Safety Regulations

National Building Code of Canada

PART 2 GENERAL

2.1 EXISTING CONDITIONS

.1 Take over structures to be demolished based on their condition on date that bid is accepted.

2.2 COORDINATION

.1 Coordinate with the Owner for the material ownership including the following:

.1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from Project site.

.2 Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner that may be encountered during demolition remain the Owner's property:

.1 Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.

.2 Coordinate with the Owner, who will establish special procedures for removal and salvage operations.

2.3 MEASUREMENT FOR PAYMENT

.1 Payment at the contract price for the items covered in this Section shall be full compensation for all labour, equipment and materials required.

.2 The removal of water lines, sanitary sewers, storm sewers and culverts where specified or directed by the Owner will be measured along the surface in meters. There will be no deduction in length for the spaces occupied for intermediate maintenance holes, catch basins, ditch inlets or valve chambers.

.3 The excavated material will be paid separately under Section 02223 as appropriate to the existing depth and minimal trench width. The excavated volume is to be deducted from the installed trench volume where new pipe is to be installed in the same location.

.4 Removal of concrete base to thickness indicated in the contract documents, will be measured in square metres in place. No deductions will be made from computed areas for the spaces occupied by maintenance hole and catch basin castings.

.5 The removal of concrete pavement, asphalt covered concrete pavement and concrete base will be measured for payment whether on the roadway surface or within an excavation. The removal of asphalt pavement will be measured in accordance with Section 02574.

.6 The removal of concrete sidewalks will be measured in square metres in place. Measurements shall be made before removal and shall be the superficial area calculated as the product of the width of sidewalk times its length.

.7 Measurement for removal of curb and gutter will be made horizontally in metres along the faces adjacent to the pavement. Payment will be made for the removal of either concrete curb, concrete curb and gutter or asphalt curb and gutter without further separation into types. No deductions will be made from the measured lengths for the spaces occupied by maintenance holes and catch basin castings.

.8 Where maintenance holes, catch basins, valve chambers, and ditch inlets are to be removed in their entirety, payment will be made without separation into types for each unit removed.

.9 Removal of fences and/or guide rails where indicated on the contract documents and outside of the trench right-of-way will be measured in metres unless otherwise specified. The trench right-of-way equals the theoretical trench width plus one (1) metre on either side of the trench.

.10 The removal of bridges and other items not previously referred to but indicated on the contract documents will be paid by the unit unless otherwise specified.

.11 Removal of mass concrete will be measured in cubic metres in place.

.12 Where payment for the item to be removed is on a volume basis, excavation shall be carried out to such an extent as to permit the measurement by the Owner of the volume of concrete or masonry to be removed.

.13 Removal of Asbestos Cement pipe will be by the meter in accordance with the Newfoundland and Labrador Regulation 5/12 Occupational Health and Safety Regulation and the Department of Environment and Climate Control, Pollution Prevention Division, Asbestos Waste Disposal Guidance Document.

.14 Broken concrete, masonry or asphalt is acceptable for use for rip-rap construction. In accordance with subsection 4.7.3 of this specification, the placing of the rip-rap will be paid for separately under the appropriate bid item and will not be part of the work to be carried out under this section of the specification

.15 Imported backfill, when required, will be paid for separately in accordance with the specification for the material required and used.

PART 3 PRODUCTS

3.1 NOT APPLICABLE.

PART 4 EXECUTION

4.1 PREPARATION & DISCONNECTION

.1 Inspect site and verify with the Owner items designated for removal and items to be preserved.

.2 Locate and protect utility lines. Preserve in operating condition active utilities traversing site. Notify utility companies before starting demolition.

.3 Disconnect electrical and telephone service lines entering buildings to be demolished in accordance with rules and regulations of authorities having

jurisdiction. Post warning signs on electrical lines and equipment that must remain energized to serve other properties during period of demolition.

.4 Disconnect and cap mechanical services in accordance with requirements of local authority having jurisdiction.

.1 Remove sewer and water lines to main line and cap to prevent leakage.
.2 Remove, cap and dispose of other underground services.

4.2 REMOVAL

.1 Remove items indicated in contract documents

.2 In removal of pavements, curbs and gutters.

.3 Square up adjacent surfaces to remain in place by saw cutting or other approved method.

.4 Protect adjacent joints and load transfer devices.

.5 Protect underlying granular materials.

4.3 DEMOLITION

.1 Demolish structures as indicated in the contract documents. Demolish parts of building to permit construction of additional and remedial work as indicated. Demolish basement foundations walls to minimum of 600 mm below finished grade. Demolish foundation walls and footings, and concrete floors below or on grade within areas of new construction.

.2 Break one 200 mm diameter hole per 500 m^2 area in concrete slabs below grade that are not to be removed, to prevent accumulation of water. Keep building drains open if permanent drainage still connected.

.3 At end of each day's work, leave work in safe conditions so that no part is in danger of toppling or falling. Protect interiors of parts not to be demolished from exterior elements at all times.

.4 Demolish masonry and concrete walls in small sections. Carefully remove and lower structural framing and other heavy or large objects.

.5 Remove contaminated or dangerous materials from site and dispose of in safe manner in accordance with regulatory agencies.

4.4 SALVAGE

.1 Carefully dismantle items containing materials indicated for salvage. Stockpile salvaged materials at locations directed or indicated.

.2 Where maintenance holes, catch basins, valve chambers, and ditch inlets are to be demolished, castings and riveted gratings conforming to this specification shall be removed and stockpiled for use elsewhere on the contract or delivered to the yard designated in the contract, when surplus to the contract requirements.

.3 Other materials when designated in the contract to be salvaged, shall be dismantled, stockpiled or otherwise handled as set out elsewhere within the contract.

4.5 EXCAVATION

.1 Excavation required for the work to be carried out under this section shall be performed in such a manner as:

.1 to leave undisturbed adjacent structures or other work to be left in place and,
.2 to save where necessary for purposes of backfill, the acceptable excavated materials.

.2 Excavated material that is not required for the backfilling of the void resulting from the structure removal, shall be used for embankment construction or disposed of as set out elsewhere in the contract document.

4.6 SEALING

.1 Seal pipe ends and walls of maintenance holes or catch basins where indicated or directed by the Owner. Securely plug to form a watertight seal.

4.7 DISPOSAL OF MATERIAL

.1 Dispose of materials not designated for salvage or re-use in work, off-site, in accordance with Section 01005.

.2 Trim disposal areas to condition satisfactory to the Owner.

.3 Except as otherwise specified, concrete and masonry may be used for rip-rap or embankment construction within the limits of the contract as directed by the Owner. It shall be disposed of outside the right-of-way at locations arranged for by the Contractor when unsuitable or surplus to construction requirements.

.4 Timber, steel and materials other than concrete or masonry, that are not designated for salvage, shall become the property of the Contractor and shall be removed from the work.

.5 Asbestos Cement pipe removed shall be disposed of in accordance with the Newfoundland and Labrador Regulation 5/12 Occupational Health and

Safety Regulations and the Department of Environment and Climate Change, Asbestos Waste Disposal Guidance Document.

4.8 BACKFILL

.1 Backfill in accordance with Section 02223.

4.9 RESTORATION

.1 Clean and reinstate in accordance with Section 01710.

.2 Upon completion of work, remove debris, trim surfaces and leave work site clean. Reinstate areas and existing works outside areas of demolition to adjacent, undisturbed areas.

4.10 SAFETY REQUIREMENTS

.1 The Contractor shall provide protection by way of barricades, signs, etc. to safeguard adequately site personnel and the public from injury resulting from demolition activities.

.2 In all cases, the Contractor shall be in accordance with Part 8 – Safety Measures at Construction and Demolition Sites of the National Building Code of Canada.

.3 The Contractor shall not close off or demolish any existing stairs or exit doors until such time as new exit stairs or temporary arrangements have been provided to replace same.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices. When it is necessary to remove a section of pavement, concrete, sidewalk, curb and gutter or similar item in order to remove a culvert, sewer, or other structure lying beneath, payment will be made for each item removed in accordance with the specification for its removal

This specification outlines the requirements for fertilizing and preserving root systems of trees and plants affected by changing grades or excavation. This specification also outlines the requirements for supplying and placing topsoil and appropriate finished grading, and the application of seed and mulch for permanent cover. This specification also outlines the requirements for the supply, site preparation, weed control, application and maintenance of a Filtrexx Erosion Control Compost Blanket (includes Filtrexx Growing Media™, a permanent native seed mixture, and a nurse crop seed mixture) over all areas to be re-vegetated following site clean-up and fine grading.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft·lbf/ft3 (600 kN·m/m3))

Canadian Standards Associations

A23.1/A23.2	Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure (TI), Highway Design and Construction Division, Specifications Book

Section 631 Seeding	Sub-section 02.01 Topsoil

US Composting Council (USCC) Test Method for the Examination of Composting and Compost (TMECC) guidelines

TMECC 04.11-A	Electronic pH Determinations for Compost
TMECC 02.02-B	Sample Sieving for Aggregate Size Classification

Other

Canada Seeds Act (R.S.C., 1985, c. S-8)

Canada Seeds Regulations (C.R.C., c. 1400)

PART 2 GENERAL

2.1 SOURCE QUALITY CONTROL

.1 Inform the Owner of proposed source of topsoil to be supplied and provide access for sampling. Acceptance of topsoil subject to inspection and/or soil analysis test results. Do not commence work until topsoil is accepted by the Owner.

.2 The Contractor shall notify the Owner not less than three (3) days before the cutting of sod begins. Sod will be approved by the Owner in its original position before cutting and delivery to the project.

2.2 DELIVERY AND STORAGE

.1 Deliver and store grass seed in original containers showing:

.1 Analysis of seed mix.
.2 Percentage of pure seed
.3 Year of production
.4 Net mass
.5 Date when tagged and location.
.6 Percentage germination.
.7 Name and address of distributor.

.2 Deliver wood fibre mulch and erosion control agent in moisture-proof containers indicating manufacturer, content and net air-dry mass.

2.3 SCHEDULING OF WORK

.1 Schedule placing of topsoil and finish grading to permit sodding or seeding operations under optimum conditions. Seeds planted, sods and hydroseeding placed in the autumn will not be accepted until the following growing season.

2.4 TERRASEEDING

.1 The placement of materials shall be carried out by a certified Filtrexx installer.

.2 The Contractor shall be responsible for all labour, materials and equipment necessary to Terraseed the specified compost material and seed mixtures.

.3 Re-seeding and preparation of soil surface for unacceptable areas is part of the scope of work under this specification at no increase cost to the contract amount.

.4 The preparation of the final grades ready for Terraseeding shall be in accordance with Section 02215.

.5 A minimum of 21 calendar days prior to Terraseeding, the Contractor shall submit the following to the Owner:

.1 A legible, valid Seed Analysis Report, from a Certified Seed Testing Laboratory for all single species within the Native Seed Mixtures and the nurse grass species, including seed germination, hard seed and purity expressed as percentages. Seed germination tests or tetrazolium test shall have been completed within 6 months of the seeding operation.

.2 The final bulk seed rate of application for the Native Seed Mixture.

.3 The Contractor shall provide a copy of the order to the Owner showing the appropriate final bulk seed rate and amount required. Refer to subsection Terraseeding below

.6 Schedule Terraseeding works following site clean-up, installation of tree and shrub plantings, and the Owner's site inspection and authorization to proceed with this operation.

2.5 MEASUREMENT FOR PAYMENT

.1 Manual seeding and seed protection will be measured in square metres of actual area covered.

.2 Temporary cover measurement shall be in square metres following the contours of the ground of the areas designated for temporary cover.

.3 Measurement for hydraulic seeding and mulching shall be the area actually hydroseeded, from within the limits identified in the Contract Documents, and measured in square metres, rounded to the nearest whole number.

.4 Shrub and tree preservation will be measured by the each and as detailed on the contract documents.

.5 Preparation of sub-grade for placing of topsoil will not be measured.

.6 Placing of topsoil will be measured in square metres to thickness specified.

.7 Supply and application of agricultural limestone will be measured in square metres of area treated.

.8 Supply and application of fertilizer will be measured in square metres of area treated.

.9 Measurement for sodding will be by actual area of sod placed by the square metre.

.10 Plan Quantity measurement – Terraseeding: When measurement is by Plan Quantity, such measurement shall be based on the units shown on the Contract Drawings and listed in the Seed Mixture Table.

.11 Actual measurement - Terraseeding: Measurement shall be in square meters, following the contours of the ground with no allowance for overlap, as measured on-site by the Contractor and verified by the Owner.

PART 3 PRODUCTS

3.1 MATERIALS

.1 The topsoil shall be obtained from approved areas off the site. The soil shall be reasonably free from subsoil, clay lumps, brush, objectionable weeds and other litter, and shall be free from stones, stumps and other objects larger than 50 mm in diameter, from roots, toxic substances and from any other material or substances that might harm growth or be a hindrance to grading, planting, or maintenance operation.

.2 Asphalted felt in accordance with CSA A23.1/A23.2.

.3 Fertilizer shall be 6-12-12 grade, uniform in composition, free flowing and suitable for application with approved equipment delivered to the site in bags or other convenient containers, each fully labelled, conforming to the applicable local government laws, and bearing the name, trademark or tradename and warranty of the producer.

.4 Wound dressing: horticulturally accepted, non-toxic, non-hardening emulsion.

.5 Lime shall be ground limestone containing not less than 85 % of total carbonates and shall be ground to such fineness that at least 50 % will pass through a 100 mesh sieve and at least 90 % will pass through a 20 mesh sieve. Coarser materials will be acceptable, provided the specified rates of application are increased proportionally on the basis of quantities passing the 100 mesh sieve, but no additional payment will be made for the increased quantity.

.6 Grass seed: Certified Canada No. 1 Grade in accordance with the Canada Seeds Act and Regulations, and having minimum germination of 75 % and minimum purity of 97 %.

.7 Turf establishment blanket: uniform, open weave jute matting, wood excelsior covered biodegradable extruded plastic mesh as indicated in contract drawings.

.8 Staples: 25 mm wide by 300 mm deep by 3 mm thick steel wire.

.9 Mulch shall be of natural sun dried plant fibers (straw, cotton and paper specially treated) processed in lengths of 20 mm – 40 mm.

.10 Water: potable, free of impurities that would inhibit germination or otherwise adversely affect growth.

.11 Binder shall be capable of joining seeds mulch and soil particles together on slopes and erodible surfaces until plant growth has been established. The binder must not form an impervious seal which would prevent the penetration of moisture to the underlying soil. The binder shall be supplied as a water-soluble powder composed of polymerised and organic substances and must be absolutely non-toxic.

3.2 GRASS SEED MIXTURE

.1 Grass seed mixture to comprise

50 % Creeping Red Fescue

30 % Kentucky Bluegrass

15 % Colonial Bent

5 % Dwarf Timothy

.2 The Contractor may provide an alternate mix design provided it is prepared by a qualified agricultural expert.

3.3 TERRASEEDING

.1 Seed

.1 The seed mixture of this specification is available directly from approved Vendor.

.2 The Native Seed Mix shall be packaged by the supplier in parcels suitable for the full or partial tank loads of the blower truck. Completed Import Declaration Forms shall be required for the direct importation of the seeds.

.3 Grade Standards

.1 All seed, supplied either as single seed species, or as a seed mix shall be in accordance with the Canada Seeds Act and Regulations and the grade standards for that particular seed kind.

.4 Pure Live Seed

.1 The quantities of the Floodplain and Upland Seed Mixtures in the table are given in terms of pure live seed (kg or lb PLS). Pure Live Seed (PLS) is a unit of measure used to define the amount of viable seed in a seed lot taking the

purity and germination of the seed lot into account. Bulk quantity received will be greater, based on the purity and germination of available seed lots.

.5 Seed Quality

.1 All specified seeds shall be in accordance with the Canada Seeds Act and Regulations for minimum acceptable levels of noxious weed seed content. All seeds shall meet or exceed the minimum acceptable germination (MAG) level of 60 %. All seed shall meet or exceed the minimum acceptable purity (MAP) level of 50 %.

.6 Seed Analysis Report

.1 A legible, valid Seed Analysis Report, from a Certified Seed Testing Laboratory by the Canadian Food Inspection Agency (CFIA) for all single species within the Native Floodplain and Upland Seed Mixtures, including seed germination, hard seed and purity expressed as percentages and Pure Live Seed (PLS) content of the specified species.

.2 Seed germination percentage shall be the result of a germination test or a tetrazolium test within six months of the seeding operation. If hard seed is present, the percent hard seed is to be added to the percent seed germination test.

.3 The grass seed for the nurse crop shall be Certified Canada No. 1 Grade in accordance with the Canada Seeds Act and Regulations.

.7 Packaging, Labelling and Storage

.1 All seed mixtures shall be in the original sealed package with a legible label securely attached. Labelling shall be in accordance with the Canada Seeds Act and Regulations. Each package shall be labelled to show:

.1 The name and address of the seed supplier and date bagged.

.2 The seed species or the name of the seed mix and the various individual seed species that comprise the seed mix and the percentage by mass.

.3 The grade of the seed or seed mix.

.4 The supplier’s lot designation number, corresponding to the Seed Analysis Report.

.5 Mass in kilograms.

.6 Prior to using all seeds shall be stored in dry cool

locations. Seeds shall not be subject to temperatures less than 0 °C or greater than 25 °C.

.7 All seed and inoculants shall be stored in cool, dry location until use.

.8 Critical Timing for Ordering Seed Mixture

.1 The Contractor shall order the Floodplain and Upland Seed Mixtures as soon as the Project is awarded in order to secure the seed mixtures and to allow for a minimum period of 21 calendar days between the time of ordering until the date of delivery. These delays are due to time required for preparation of the seed mixture and shipping time across the border.

.2 Native Seed Mixture

Scientific Name	Common Name	Seeding rate (PLS kg per 10,000 sq. m.)	Proportion of seed mix (%)
Forbs (broad-leaved species)			
Desmodium canadense	Hoary (Canada) tick-trefoil	0.9	2.0
Helianthus divaricatus	Woodland sunflower	0.9	2.0
Onoclea sensibilis	Sensitive fern	1.35	3.0
Rudbeckia hirta	Black eyed Susan	2.70	6.0
Thalictrum pubescens	Tall meadowrue	0.9	2.0
Total native species			15
Grasses			
Agrostis stolonifera	Creeping bent grass	3.6	8.0
Calamagrostis canadensis	Canada bluejoint	4.5	10.0
Elymus canadensis	Canada wild rye	9.0	20.0
Elymus hystrix	Bottlebrush Grass	9.0	20.0
Elymus virginicus	Virginia wild rye	9.0	20.0

Scientific Name	Common Name	Seeding rate (PLS kg per 10,000 sq. m.)	Proportion of seed mix (%)
Glyceria striata	Fowl manna grass	3.15	7.0
Total native grass species			85.0 %
	Total	45.0	100.0 %

.3 Nurse Crop Seed Mixture Required for Floodplain Seed Mixture Application

Species	Common Name	Seeding rate (PLS kg per 10,000 sq. m.)	PLS Required (kg/3,347 sq. m.)
Lolium multiflorum	annual rye grass	25	8.0
Lolium perrene	perrenial rye grass	30	10.0
Elymus canadensis	Canada wild rye	15	5.0
Total nurse grasses		70	23.0

.4 Filtrexx Growing MediaTM

.1 Filtrexx Growing Media™ shall be weed free and derived from a well-decomposed source of organic matter. The Growing Media™ shall be produced using an aerobic composting process meeting, or exceeding CCME Type “A” and Type “AA” regulation and the Compost Quality Alliance (CQA) program, including time and temperature data indicating effective weed seed, pathogen and insect larvae kill. The Growth Media™ shall be free of any refuse, contaminants or other materials toxic to plant growth. Non-composted products will not be accepted. Test methods for the items below shall be in accordance with USCC TMECC guidelines for laboratory procedures:

.1 pH of 5.0–8.0 in accordance with TMECC 04.11-A
.2 Moisture content of less than 60 % in accordance with standardized test methods for moisture determination.
.3 The Growing Media™ shall incorporate the specified Floodplain Seed mixture at the specified seeding rate and required bulk seed amount at the time of application. The following Particle Sizes shall be followed: 100 % passing a

50 mm sieve, 99 % passing a 25 mm sieve, minimum of 60 % passing a 12.5 mm sieve in accordance with TMECC 02.02-B.

.4 Non seeded option: Particle size-100 % passing a 50 mm sieve, 99% passing a 25 mm sieve, minimum of 30 % passing a 18.25 mm sieve. All other testing parameters remain the same.

.5 Material shall be relatively free (<1 % by dry weight) of inert or foreign man made materials.

.6 A sample of the compost shall be submitted to the Owner for approval prior to being used and must comply with all local, provincial and federal regulations.

.7 Copies of the purchase order / receipt from Filtrexx Canada™ for the Growing Media™ must also be submitted to the Owner for verification and approval prior to the site delivery and installation of the Filtrexx.

.5 Pneumatic Blower Truck

.1 The pneumatic blower truck shall be a custom manufactured, fully integrated, truck-mounted unit. The blower truck shall be equipped with a computer-calibrated seed injection system and shall be capable of uniformly applying composted topsoil and seed at a rate greater than 0.25 m3 of material per minute. The blower truck shall also be equipped with an application hose capable of extended 100 m from the blower truck unit.

.6 Filtrexx LockDown Netting

.1 Filtrexx LockDown Netting is a single net rolled erosion control product that is designed to increase the slope stabilization and erosion control capabilities of the Compost Erosion Control Blanket. This netting is used to increase soil surface roughness and stability of disturbed soil on slopes. The tensile strength selection of the netting is to be reviewed and approved by the project Landscape Architect. The functional longevity shall be up to 4 years.

PART 4 EXECUTION

4.1 FERTILIZING EXISTING TREES

.1 Apply fertilizer at rate of 50 g/mm of calliper to existing trees to be retained. Take calliper measurement 0.3 m above grade. Apply once early in growing season except where specified or otherwise shown on the drawings.

.2 Distribute fertilizer equally into holes drilled 200-250 mm deep, spaced 600 to 750 mm apart and located in circular pattern between 2/3 and limit of each tree's branch spread. Water thoroughly after fertilizer applied.

.3 Water retained trees three (3) times during summer. Soak area immediately below tree crown sufficiently deep to reach feeder roots.

4.2 RAISING GRADE AROUND EXISTING TREES

.1 Apply fertilizer before revising grade.

.2 Protect bark of buried portion of tree from abrasion by surrounding trunk with water impervious material. Leave minimum 50 mm space between protective material and bark. Fill space with washed stones.

.3 Use approved topsoil to raise grade to required level, making allowance for topsoil in accordance with TI, Highway Specifications Book, Section 631.02.01.

.4 Compact fill without disturbing or damaging roots. Use frost-free materials over frost-free ground conditions. Compact fill to 80 % Standard Proctor density in accordance with ASTM D698.

4.3 LOWERING GRADE AROUND EXISTING TREES

.1 Cut slope from edge of branch spread to new grade level or retaining wall at degree indicated. Build dike of topsail for each tree at periphery of branch spread to hold water where required.

.2 If excavation through roots is required, excavate by hand and cut roots with sharp axe, tree lopper or saw. Seal cut edges 10 mm in diameter and larger with wound dressing.

.3 Apply fertilizer after excavation is backfilled and grading is completed. Do not permit root system to dry out at any time.

4.4 TOPSOIL

.1 The topsoil shall be uniformly distributed on the designated areas and evenly spread to an average thickness of 100 mm with a minimum thickness of 75 mm. The spreading shall be performed in such a manner that planting can proceed requiring little additional soil preparation or tillage. Irregularities in the surface resulting from top soiling or other operations shall be corrected so as to prevent the formation of depressions where water will stand. Topsoil shall not be placed where the subgrade is frozen, excessively wet, extremely dry or in a condition otherwise detrimental to the proposed planting or to proper grading.

.2 After the topsoil has been spread and graded as required, the surface shall be cleared of stone, stumps or other objects larger than 50 mm in thickness or diameter, and or root, brush, wire or other objects that might be a hindrance to planting or maintenance operations.

4.5 APPLICATION OF FERTILIZER

.1 Fertilizer shall be distributed uniformly at a rate of 1,125 kg/ha over the areas indicated on the drawings to be seeded, and shall be incorporated into the soil to a depth of at least 100 mm by disking, harrowing, or other acceptable methods. The incorporation of fertilizer may be a part of the tillage operation specified in other parts of this specification. Distribution by means of an approved seed drill equipped to sow seeds and distribute fertilizer at the same time will be acceptable.

4.6 APPLICATION OF LIME

.1 Immediately following the incorporation of the fertilizer, lime shall be applied in such quantities to obtain a pH value of 6.5 for the topsoil and shall be incorporated into the soil to a depth of at least 25 mm by disking, harrowing, or other acceptable methods.

.2 No area shall be limed until surface preparation has been completed to the satisfaction of the Owner.

4.7 PREPARATION OF SURFACES

.1 Undulation or irregularities in the surface resulting from tillage, fertilizing, limning or other operations shall be levelled before seeding operations are begun. The grassed area when completed and settled shall be on such a grade necessary to facilitate drainage.

4.8 APPLICATION OF SEED

.1 Sow during calm weather (winds less than 10 km/h) using equipment suitable for area involved to the approval of the Owner. Seed shall be applied at the rate of 175 kg/ha.

.2 Sow half of required amount of seeds in one direction and remainder at right angles to first seeding pattern. Incorporate seed into soil to a minimum depth of 5 mm simultaneously or within one hour after seeding operation. Mix carefully with light chain harrow or wire rakes and roll area immediately afterward with water ballast type lawn or agricultural type roller.

.3 Water with fine spray, avoiding washing out of seed. Apply enough water to ensure penetration of minimum 50 mm.

.4 Add erosion control agent, into seeder and mix thoroughly to complete seeding slurry when indicated in the contract documents.

.5 Complete slurry to be applied per hectare:

.1 Seed (mixture as specified)
.2 Mulch 1000 kg
.3 Erosion Control Agent 300 kg
.4 Water, minimum 10000 litres

4.9 SEED PROTECTION ON SLOPES

.1 Cover seeded slopes (where slope is 3:1 or steeper) with turf establishment blanket. Roll blanket down over slopes without stretching or pulling.

.2 Lay blanket smoothly on soil surface, burying top end of each section in narrow 150 mm trench. Leave 300 mm overlap from top roll over bottom roll. Leave 100 mm overlap adjacent section.

.3 In ditches, unroll blanket in direction of flow. Overlap ends of strips 300 mm with upstream section on top.

.4 Staple outside edges and overlaps at 1000 mm intervals and at intermediate points to ensure close contact between blanket and soil.

4.10 SODDING

.1 Before sodding, the surface is to be raked smooth to provide uniform slopes. Topsoil with a uniform organic content will be placed to a thickness of 100 mm or as directed on site by the Owner, and raked smooth to conform to the preparation slopes. Lime will be added to the topsoil at the rate of 1,125 kg/ha. The lime may be placed up to 21 calendar days ahead of placing of sod. Fertilizer will be spread evenly over the top 50 mm of the soil.

.2 Fertilizer cannot be added at the same time as the lime. The fertilizer shall be applied at the rate of 1,125 kg/ha, and will have a plant food ratio of 10 nitrogen to 20 phosphorous to 20 potash plus 2 % Fritted Trace Elements (FTE). The fertilizer must be placed not more than 7 calendar days ahead of sodding. After adding fertilizer, the surface shall be fine graded.

.3 Sod shall be laid on the prepared sod bed within 24 hrs after cutting, except that sod may be stored in stacks or piles, grass to grass and roots to roots for not more than five (5) calendar days. Sod shall be protected against drying from sun or wind and from freezing as necessary. The moving and laying of sod shall, as far as possible, be done when weather conditions and soil moisture are favourable. On slopes, stakes shall be

driven flush with the top of the sod, spacing stakes shall not exceed 600 mm across the face of slopes.

.4 If rainfall is insufficient during the period of sodding and initial grass growth, then water shall be applied immediately before and after sodding and subsequently thereafter until the grass is established, as directed by the Owner. Cost will be included in the unit price for laying sods.

4.11 HYDROSEEDING

.1 Before hydroseeding the surface is to be raked smooth to provide uniform slopes. Topsoil with a uniform organic content will be placed to a thickness of 100 mm, and raked smooth to conform with the prepared slopes.

.2 Lime will be added to the topsoil at a rate of 1,125 kg/ha. The lime may be placed up to 21 calendar days ahead of the placing of hydroseeding.

.3 Areas to be treated with hydroseeding and mulching shall be staked out by the Owner in the field. Operations will not commence until the Contractor has the approval of the Owner and the lime applied.

.4 Two operations shall be employed in the hydroseeding of designated areas.

.1 The first operation shall consist of the distribution of a slurry composed of grass seed, fertilizer, lime and binder. The rate of application of these ingredients shall be as follows:

Grass seed mixture	150 kg/ha
Fertilizer	600 kg/ha
Binder	20 kg/ha

(75% straw, 15% cotton, 10% cellulose)

.2 The second operation shall consist of the distribution of a slurry composed of mulch, plus binder. The rate of application of these ingredients shall be as follows:

Mulch	2,250 kg/ha
Binder	25 kg/ha

(45% straw, 45% cotton, 10% cellulose)

.5 The contractor shall measure the quantities of each of the materials to be charged into the seeder, either by mass or by a system of mass-calibrated

volume measurements approved by the Owner. The Contractor shall provide all equipment required for this purpose.

.6 Both operations require that the ingredients be thoroughly mixed with water in a hydroseeding tank. The mix must be continuously agitated during the hydroseeding operation to ensure that a homogenous slurry is produced.

.7 The distribution of the slurry shall be by means of an approved hydroseeder and shall be applied uniformly and in such a manner as to prevent puddling and movement of the soil surface.

.8 Work shall proceed only in calm weather and on ground free of frost, snow, ice or standing water and when, in the opinion of the Owner, weather and seasonal conditions are suitable. Hydroseeding shall not be carried out during periods of rainfall.

4.12 MAINTENANCE

.1 Ensure maintenance equipment suitable to the Owner.

.2 Keep soil moist during germination period and adequately water grassed areas until accepted by the Owner.

.3 Apply water to ensure moisture penetration of 75 to 100 mm. Control watering to prevent washouts.

.4 The Contractor shall be responsible for maintaining seeded areas to ensure proper and adequate growth of the grass during a period of two months following sowing.

.5 Should the treated area require watering in the Owners Representative’s opinion, then the Contractor shall thoroughly water the seeded area taking care not to cause any erosion.

.6 During the maintenance period, any defect caused by defects in materials, workmanship or damages caused by watering or the weather shall be re-seeded with grass seed at the Contractor's expense.

.7 The Contractor shall be responsible for maintaining hydroseeded areas to ensure proper and adequate growth of the vegetation during the warranty period. The Contractor shall also be responsible for an additional application of fertilizer the following spring. This application shall be by a method approved by the Department. The fertilizer shall be 5- 10-30 and shall be applied at a rate of 300 kilograms per hectare. No additional payment will be made for maintenance or the extra application of fertilizer.

.8 The Contractor shall be responsible for the care of all completed sodding for a period of one month following the completion of placing.

.9 During this period any break, which may occur through slipping of sod, shall be repaired and any sod which is dead shall be removed and replaced by the Contractor, with fresh, live sod, without charge. Should the sodding become wilted during the maintenance period, the Contractor shall thoroughly water the sodding taking care not to cause any erosion.

4.13 PROTECTION AND REPAIR

.1 The area shall be protected against traffic or other use by erecting barricades immediately after seeding is completed and by placing warning signs of an approved type on the various areas.

.2 If at any time before completion and acceptance of the entire work covered by this contract any portion of the surface becomes gullied or otherwise damaged following seeding, or the seedings have been winter-killed or otherwise destroyed the affected portion shall be repaired to re-establish the condition and grade of the soil prior to seeding and shall then be re-seeded as specified in previous sections.

4.14 ACCEPTANCE

.1 Areas will be accepted by the Owner provided that:

.1 Seeded areas are properly established.
.2 Turf is free of eroded, bare or dead spots and 98 % free of weeds.
.3 No surface soil is visible when grass has been cut to height of 40 mm.

.2 Areas seeded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

4.15 TERRASEEDING

.1 Operational Constraints

.1 Ordering of the seed shall not commence until the Owner is in receipt of the seed analysis report and has approved any changes in the seed mix composition in writing.
.2 Terraseeding operations shall not commence until the Owner is in receipt of the Certificates of Seed Analysis for the seed being applied and has approved the seed test results of the Certificates of Seed Analysis.
.3 Terraseeding operations shall not commence until the Owner has reviewed and approved the surface preparation; and the layout of the different permanent seed mixes locations and different cover types.

.4 Seed and cover application or re-application shall not be carried out under adverse field conditions such as high wind; heavy rain or when field conditions are not conducive to seed germination such as frozen soil or soil covered with snow, ice, or standing water.

.5 The site and erosion control shall be maintained until final acceptance of the seed and cover.

.6 No seed or cover shall come in contact with the foliage of any trees, shrubs, or other vegetation. Seed or cover shall not come in contact with waterbodies.

.7 Terraseeding of the permanent Native Seed Mixtures shall be done between September 15 and freeze up, or between spring start up and May 31.

.2 Surface Preparation

.1 The surface to be seeded shall be prepared not more than seven (7) calendar days before the seeding operation.

.2 Before Terraseeding, areas designated for this operation shall have been top soiled, graded, and approved by the Owner as specified in other sections of this contract document.

.3 At the time of Terraseeding, all surface areas designated for this operation shall be free of erosion and shall be friable, loose and shall have a fine graded, to a relative uniform surface. The surface shall be uniformly cultivated to a minimum depth of 50 mm (2 inches) and a maximum depth of 100 mm (4 inches) and shall not have surface stones greater than 25 mm (1 inch) in diameter, foreign material, and weeds or other unwanted vegetation.

.4 LockDown Netting Installation shall be installed prior to the application of the Filtrexx Growing Media. LockDown Netting shall be anchored to the soil using 150 to 200 mm (6 to 8 inches) sod stable to be driven along entire perimeter of the net and netting area.

.5 Staples shall be spaced 600 mm (2 feet) apart on all sides. Where more than one roll of LockDown Netting is required for slope width or slope length, netting edges shall be overlapped by a minimum of 150 mm (6 inches). LockDown netting shall be installed from top to bottom on the slope under the entire area of the Filtrexx Growth Media blanket.

.3 Terraseeding Application

.1 The Contractor shall ensure that the terraseeding equipment is calibrated to provide the coverage of Pure Live Seed as specified or as amended by the Owner based on the final composition of the Native Seed Mixtures. The Contractor shall ensure that there is a uniform dispersal of the mixed material over the entire area

designated for Terraseeding and that the spray does not dislodge soil or cause erosion.

.2 Seed and fertilizer may also be applied separately by a cyclone spreader. Seeding shall overlap the adjoining ground cover by 300 mm.

.3 For this Erosion Control Living Compost Blanket, the seeds must be injected at the time of application in the top 25 mm (1 inch) layer of the compost blanket, at the specified PLS rates per square metre. All other testing parameters remain the same.

.4 The Erosion Control Living Compost Blanket will be placed at locations and respective thickness in accordance with the Contract drawings.

.4 Application Rates

.1 The Native Seed Mixture shall be applied at the appropriate bulk seed rate to provide the specified PLS rate of 45 kg/10,000 m2 for the 75 mm thick blanket.

.2 Seeding Rate for a 50 mm thick Blanket shall also be 45 kg per 10,000 m2.

.3 The Nurse Crop Seed shall be applied at a rate of 70 kg per 10,000 m2.

.5 Quality Assurance

.1 The Certificate of Seed Analysis must be reviewed and approved by the Owner prior to ordering the seed to ensure that seed germination, seed purity, weed seed content and the various seed species components meet the values in accordance with the Native Seed Mixture Table in subsection Terraseeding of this specification.

.2 The Contractor must certify in writing that the seed mixtures and application rates have been done in accordance with the specifications. No substitutions within the seed mixtures shall be permitted without prior written approval of the Owner. Do not proceed if there is any uncertainty. Contact the Owner for directions.

.3 All seeded areas will be visually inspected by the Owner to ensure compliance with this specification at 30, 60, and 90 calendar day periods following the Terraseeding operations and at the end of the second growing season.

.4 Terraseeded areas will be accepted by the Owner provided that soil surface has not been eroded or otherwise degraded since completion of Terraseeding.

.5 At the 30 calendar Day inspection within the seeded earth area:

.1 The applied cover shall be visually intact and shall form a uniform, cohesive mat.

.2 Germination of the nurse crop shall be visually evident.

.6 At the 60 calendar Day inspection within the seeded earth area:

.1 The nurse crop shall be evident at mature height in an evenly dispersed, uniform cover.
.2 Germination of some of the permanent seed species may be visually evident in an evenly dispersed uniform cover.
.3 There shall not be any significant bare areas, both in terms of quantity and size.
.4 Non-seeded, non-specified vegetation shall not exceed 3 % of the seeded earth area.

.7 At the 90 calendar Day inspection within the seeded earth area:

.1 The specified permanent seed species shall be at an average height of 50 mm in an evenly dispersed, uniform cover.
.2 There shall not be any significant bare areas, both in terms of quantity and size.
.3 Non-seeded, non-specified vegetation shall not exceed 3 % of the seeded earth area.

.8 At the second full growing season inspection (end of August), and within the seeded earth areas of the Native Seed Mixtures:

.1 A survivability percentage shall be required in excess of 90 % of sown species.
.2 An average of 90 % combined cover of all sown species and 30 % cover of native species shall be required for successful completion. This shall be based on sampling of 10 random 1 metre squared plots taken during the second year in late August by the Owner. Bare soil shall constitute less than 3 % of the total area with individual bare areas not to be larger than 1 m2.
.3 No inspections will be made during the winter dormant period or when site conditions prohibit a visual field inspection. The timing intervals between inspections will be suspended during the winter dormant period.

.6 Failure to Meet Performance Measure

.1 If the values in the Certificate of Seed Analysis do not meet the values for seed germination, seed purity and weed seed content as specified, the seed lot will not be approved for use on the Contract and the Contractor shall supply a new seed lot and a new Certificate of Seed Analysis for approval prior to seeding.

.2 If the values in the Certificate of Seed Analysis do not meet the specified values for seed species composition, the Contractor shall supply a legible, valid copy of the Seed Mixing Sheet from the seed supplier for approval by the Owner prior to seeding.

.3 If the completed work does not meet the performance measures of the 30 Calendar Day inspection, the Owner shall document the failed areas, notify the Contractor of those areas, and re-inspect at the 60 Calendar Day inspection.

.4 If the completed work does not meet the performance measures of the 60 Calendar Day inspection, and during the following growing season, the Owner shall notify the Contractor in writing of the failed areas. The Contractor shall re-apply the specified material according to the specification within 14 calendar days of receiving the notification. The Owner shall re-inspect the Terraseeded area at the 90 Calendar Day inspection.

.5 If the completed work does not meet the performance measures of the 90 Calendar Day inspection, the Owner will notify the Contractor in writing of the failed areas. The Contractor shall re-apply the specified seed mixtures and compost materials according to this specification within 14 calendar days of receiving the notification. The Owner will re-inspect the Terraseeded earth area 30 calendar days after re-application.

.6 Inspections and re-application of material shall continue, as outlined in the 90 Calendar Day and Second Growing Season Inspection paragraphs above, until the seeded earth area has been accepted.

.7 The Contractor shall maintain the site and control erosion until conditions permit application or re-application of seed and cover.

.8 Terraseeded areas will be accepted by the Owner provided that soil surface has not been eroded or otherwise degraded since completion of Terraseeding.

.9 All replaced seed and cover shall be subject to the Quality Assurance section of this specification.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

.2 Unit price relating to Installation of Terraseeding shall include all labour, equipment and materials needed to undertake the all of the Terraseeding and maintenance works (including any watering required) during the

establishment and warranty period, including any re-seeding required under warranty. Supply of Terraseeding shall include all shipping, duties, currency exchange, permits, and brokerage fees. The basis of payment shall be per Plan Quantity Measurement.

.3 Payment at the contract price for seeding shall be compensation for all labour, materials and equipment use for: the preparation of the ground to be treated with seeding, the supply and placing of topsoil, lime, fertilizer and grass seed and the raking of the freshly seeded ground, together with such watering and maintenance as may be required over the two month maintenance period.

.4 Payment of the contract price for hydroseeding shall be compensation in full for all labour, materials and equipment use for: supplying the inoculated seed mixture as specified; supplying the fertilizer, binder and mulch; carrying-out the hydroseeding operation; and supplying and placing the fertilizer in the following spring; together with a one year warranty period, during which time the Contractor shall be responsible for making good any defect to the growth of the vegetation.

.5 Full payment shall not be made until the final acceptance of the work on satisfactory completion at the end of the warranty period. A holdback in the amount of 25 % of the total payment for hydroseeding shall be retained for the warranty period and until additional application of fertilizer the following spring, as per Section 632.05.

.6 Payment at the Contract price for sodding shall be compensation for all labour, materials and equipment use for: the preparation of the ground to be treated with sodding, the supply and placing of topsoil, sod and pegs, together with any necessary maintenance work, materials, and watering required during the one month maintenance period.

This specification outlines the requirements for removing and disposing of trees, brush, logs, surface boulders, rock fragments, stumps, roots, matted roots, other vegetation, and surface litter, as indicated on the drawings or as designated by the Owner.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure (TI), Highway Design and Construction Division, Highway Specifications Book

Division 12 Standard Drawings

Other

Canada Labour Code, Part 2, Canada Occupational Health and Safety

Canadian Environmental Protection Act, 1999 (CEPA 1999)

Canadian Pest Control Products Act (S.C. 2002, c. 28)

PART 2 GENERAL

2.1 REGULATORY AGENCIES

.1 Obtain necessary cutting permits from Regulatory Agencies. Comply with all municipal, provincial and federal laws and regulation.

.2 Provide copies of all permits to the Owner’s prior to commencing the Work.

2.2 MEASUREMENT FOR PAYMENT

.1 Following items will be measured in hectares by horizontal area within limits indicated or as directed by the Owner:

- .1 Clearing
- .2 Grubbing
- .3 Clearing and Grubbing
- .4 Close Cut Clearing
- .5 Underbrush Clearing and Grubbing

.2 Measure clearing and grubbing isolated trees, to a depth of 150 mm, as number of isolated trees cleared and number of isolated tree stumps grubbed as detailed on the contract documents.

.3 Clearing and grubbing beyond the limits detailed on the contract documents will not be measured for payment.

.4 Payment for grubbing shall include the cost of removal, from the area to be grubbed, of boulders that are less than 0.5 m^3.

.5 Earth excavated as part of any of the above operations and within the theoretical paylines for each excavation, will be paid as earth excavation.

.6 Removal of individual boulders 0.5 m^3 and greater in volume will be paid under Section 2215.

2.3 SAFETY REQUIREMENTS

.1 Safety Requirements: worker protection.

.2 Ensure workers are wearing gloves, dust masks, safety boots, protective clothing, eye protection, safety vests and any other protection required in the SSSP while performing clearing and grubbing activities.

.3 Ensure workers are wearing gloves, dust masks, eye protection, protective clothing, and any other protection required in the SSSP while applying herbicide materials.

.4 Ensure that workers are not allowed to eat, drink or smoke while applying herbicide material.

.5 Smoking is not permitted within 15 metres of pest control area.

.1 Provide and post “No Smoking” signs at certain locations as directed by the Owner.

2.4 STORAGE AND PROTECTION

.1 Prevent damage to fencing, trees, shrubs, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses, and root systems of trees which are to remain.

.1 Repair any damaged items to approval of Owner.
.2 Replace any damaged trees designated to remain as directed by Owner.

.2 No timber, brush or logs shall, in any event, be piled upon adjacent lands unless authority is first obtained from the Owner.

2.5 ENVIRONMENTAL PROTECTION

.1 Complete all protective measures noted in 1560 Environmental Requirements.

.2 Clean up spills of preservative materials immediately with absorbent material and safely discard to landfill.

.3 Do not dispose of unused preservative materials into sewer systems, into streams, lakes, onto ground or in other locations where they will pose health or environmental hazards.

.4 Ensure safe use and disposal of wood preservatives compiles with all Federal, Provincial, and Municipal regulations, particularly the Canadian Environmental Assessment Act (CEAA), the Canadian Environmental Protection Act, and the Pest Control Products Act.

.1 For information and procedures on pest control products, call the Pest Management Information Service at 1-800-267-6315. Ensure that the use and disposal of wood preservatives complies with all departmental regulations, particularly the Environmental Assessment Review Process.

.5 Where clearing or grubbing operations are required near a watercourse or water body, the Contractor shall ensure that a minimum 15 metre “No Grub” zone is left between the watercourse or water body and adjacent work area. Where possible, ditch waters shall be directed to existing vegetation at least 30 metres from watercourse crossing locations rather than directly discharging to the watercourse.

.6 The Contractor shall take all necessary precautions to guard against damage to surrounding timber and shall assume all liability for claims that may arise from any such damage.

PART 3 PRODUCTS

.1 Ensure that wood preservatives and other pesticides delivered to the Site are registered by Health Canada as part of the Pest Control Products Act.

.2 Bituminous based paint of standard manufacture specially formulated for tree wounds.

.3 Herbicide: effective for killing annual and perennial weeds, and bamboo grass, by being absorbed through roots and foliage.

.1 Spray applied on non-crop land areas.
.2 Type as indicated.

.4 Soil Material for Fill:

.1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.

PART 4 EXECUTION

4.1 PROTECTION

.1 Erosion and Sediment Control Measures

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the requirements of the Authorities Having Jurisdiction.

.2 Silt fences are to be installed as per the Standard Drawing Form 1238 of the TI, Highway Specifications Book.

.3 Inspect, repair, and maintain temporary erosion and sedimentation control measures during construction until permanent vegetation has been established.

.4 Remove temporary erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

4.2 PREPARATION

.1 Inspect site and verify with Owner any items designated to remain.

.2 Locate and protect utility lines: preserve in operation condition active utilities traversing the Site.

.1 Notify the Owner immediately of damage to or when unknown existing utility lines are encountered.

.2 When utility lines which are to be removed are encountered within area of operations, notify the Owner in ample time to minimize interruption of services.

.3 Notify utility authorities before staring clearing and grubbing activities.

.4 Keep roads and walks free of dirt and debris.

4.3 CLEARING

.1 Clear trees, shrubs, uprooted stumps and surface debris not designated to remain.

.2 Cut off trees, brush, and scrub as indicated or as directed by the Owner at a height of not more than 150 mm above ground.

.3 Cut off unsound branches on trees designated to remain

.4 Cut down dangerous trees overhanging area cleared.

.5 Apply herbicide at the rate indicated or in accordance with manufacturer’s instructions to top surface of stumps designated not to be removed.

.6 All tree branches extending into the area cleared, which hang within six metres of the ground, shall be cut off close to the trunk in a neat and competent manner.

.7 No trees shall be cut down outside the limits except any trees considered unsafe by the Owner or noted for Isolated Trees Clearing and Grubbing.

.8 If so ordered by the Owner, certain trees within the area to be cleared shall be preserved. Underbrush, down timber, snags, and roots shall be removed from the vicinity of such preserved trees and disposed.

4.4 GRUBBING

.1 Excavate and dispose of stumps, roots, surface boulders, rock fragments, embedded logs, debris, matted roots, and other vegetation to a depth of 150 mm below original ground surface.

.2 Cross sectioning for purposes of payment for excavated quantities for other items appearing in the contract documents will not be done until grubbing or clearing and grubbing operations in the designated area(s) are completed.

.3 Where a significant quantity of topsoil exists and as directed by the Owner, the Contractor shall stockpile topsoil separately from other material for possible rehabilitation work.

.4 Edge of grubbing debris shall be trimmed to slightly proportions.

4.5 CLEARING AND GRUBBING

.1 Clearing activities indicated or directed by the Owner at a height of not more than 150 mm above ground and grubbing activities to a depth of 150 mm below original ground surface.

4.6 CLOSE CUT CLEARING

.1 Cut off trees, shrubs, stumps and other vegetation to original ground surface.

.2 Perform close cut clearing in such a manner that existing insulation of fibrous material is not damaged.

.3 Cut off unsound branches and cut down dangerous trees overhanging area cleared.

.4 All tree branches extending into the area cleared, which hang within six metres of the ground, shall be cut off close to the trunk in a neat and competent manner.

4.7 UNDERBRUSH CLEARING AND GRUBBING

.1 Clear underbrush from areas indicated at ground level and grub out stumps and roots to a depth of 150 mm below original ground surface.

4.8 ISOLATED TREES

.1 Cut off isolated trees indicated or directed by the Owner at a height of 150 mm above ground and grub out isolated tree stumps.

.2 Prune individual trees as indicated.

.3 Trim trees designated to be left standing within cleared areas of dead branches 4.0 cm or more in diameter; and trim branches to heights as indicated.

.4 Cut limbs and branches to be trimmed close to bole of tree or main branches.

.5 Paint cuts more than 3 cm in diameter with approved tree wound paint.

4.9 REMOVAL AND DISPOSAL

.1 Remove cleared and grubbed materials to disposal area indicated and/or as approved by the Owner. The Contractor shall dispose of all brush and logs not suitable for salvage. Dispose of cleared and grubbed materials by burying or in an approved waste disposal area provided by the Contractor at their own expense.

.2 Timber cleared or grubbed from land belonging or leased to private individuals, crown corporations or companies, does not become the property of the Contractor. The Contractor must make prior arrangements with landowners or lessee(s) for the disposal of the timber.

.3 Bury by consolidating to highest degree practicable and covering with a minimum 500 mm of mineral soil. Finish to present a neat levelled appearance.

.4 The Contractor shall dispose of all brush and logs not suitable for salvage.

4.10 FINISHED SURFACE

.1 Leave ground surface in a condition suitable for immediate grading operations and stripping of topsoil.

4.11 CLEANING

.1 Cleaning as per Section 01710.

.2 Clean and remove debris and sediment from work area drainage devices and dispose of to an approved landfill site as directed by the Owner.

.3 Maintain Work in tidy condition, free form accumulation of waste products and debris.

.4 Do not clean equipment in the waterbody or where the wash-water can enter the waterbody.

.5 Maintain tidy Work area, free from accumulation of waste products and debris.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

.2 Payment at the contract price for Clearing and Grubbing shall be compensation in full for all labour, materials and equipment use to carry out the work indicated in this specification or in any way connected with these operations.

.3 No payment, other than that provided for in the contract price for Clearing and Grubbing, will be made for topsoil and surface boulders removed by clearing and grubbing operations, or for any haulage involved in clearing and grubbing debris disposal. The cost to acquire an approved waste disposal area, as required, is deemed incidental to the work.

This specification outlines the requirements for the removal of rock or boulders classified as rock in grading operations or excavations.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Canadian Construction Safety Code

Canadian Blasting Association Standards

Government of Newfoundland and Labrador, Occupational Health and Safety Act, Chapter O-3

Government of Newfoundland and Labrador, Regulation 5/12, Occupational Health and Safety Regulations

PART 2 GENERAL

2.1 QUALIFICATIONS

.1 Blasting operations shall be conducted in accordance with the requirements of the Canadian Construction Safety Code, Canadian Blasting Association Standards, and the Newfoundland and Labrador Regulation 5/12 Occupational Health and Safety Regulation.

.2 Blasting shall only be performed by an experienced blaster licensed in the Province of Newfoundland and Labrador to use explosives.

.3 Prevent damage to persons and property from flying rocks, by covering the site of the blasting with blasting mats or other suitable devices. Post guards, sound warnings and display signs when blasting is to take place.

.4 Carry out trial blasting at the commencement of the blasting work in order to determine the amount of charge required to keep vibrations within safe limits, to the satisfaction of the Owner. Take seismograph recordings during such trial blasting and at any other time while blasting is continued, as considered necessary by the Contractor for their own protection, or as may be directed by the Owner. Maximum acceleration during blasting must not exceed 50 mm/s^2.

.5 No increase in charges will be permitted without further trial blasting and seismograph recordings, as described above.

.6 Repair any damage caused by blasting. Blasting may not be permitted, or may be limited to such an extent as to ensure the safety of structures, if considered necessary by the Owner. For their own protection, the Contractor is advised to engage a qualified inspection company to carry

out a pre-blasting survey of buildings in the vicinity of their blasting operation in order to record pre-blasting conditions.

2.2 MEASUREMENT FOR PAYMENT

.1 Measurement of rock excavation is by plan quantity of the volumes in cubic metres below the existing rock surface and within theoretical paylines, except that the minimum depth of excavation for measurement purposes shall not be less than 300 mm.

.2 The volume of excavated boulders and rock fragments in excess of 0.5 m^3 will be determined by measuring three maximum mutually perpendicular dimensions.

.3 Rock removal shall be measured and paid in accordance with the applicable rock excavation Sections of 02215, 02223, or 02224.

PART 3 PRODUCTS

3.1 NOT APPLICABLE.

PART 4 EXECUTION

4.1 ROCK REMOVAL

.1 Remove rock to alignments, profiles, and cross sections as indicated.

.2 Correct unauthorized rock removal at no extra cost, in accordance with backfilling requirements specified in Section 02223.

.3 Remove boulders and fragments that may slide or roll into excavated areas.

.4 Excavate trenches to lines and grades to minimum of 150 mm below pipe invert indicated. Provide recesses for bell and spigot pipe to ensure bearing will occur along barrel of pipe.

.5 Cut trenches to widths specified.

PART 5 BASIS OF PAYMENT

.1 No separate or direct payment will be made for work as outlined in this specification. All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for excavation and backfilling for site grading.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft·lbf/ft^3 (600 kN·m/m^3))

PART 2 GENERAL

2.1 EXAMINATION

.1 Examine all drawings and specifications to ascertain the extent of the work. Visit the site to ascertain special conditions which might affect the work of this specification.

2.2 MEASUREMENT FOR PAYMENT

.1 Excavated materials will be measured in cubic metres from cross sections taken in areas of excavation.

.2 Mass Rock Excavation

.1 When depth indicated on the Drawings or directed by the Owner is less than 300 mm below original rock surface, depth excavated for measurement purposes will be taken as 300 mm.

.2 Volume of excavated boulders and rock fragments in excess of 0.5 m^3 will be determined by measuring three maximum mutually perpendicular dimensions.

.3 Mass Common excavation:

.1 In areas of excavation provided by the Owner, initial cross

.2 Topsoil and waste material will be measured for payment as common excavation in its original location.

.4 No measurement will be made for:

.1 Unnecessary excavation beyond lines established.

.2 Extra handling of windrowed materials blended on embankment slopes.

.3 Stockpiling of topsoil or protection of stockpiles.

.5 Payment for excavation includes placing of excavated material at another location on site or disposal of waste material off site.

.6 Mass Imported Common Backfill including compaction to be measured in cubic metres in place to specified paylines.

.7 Excavation, trenching and backfilling for all service utilities will be measured in accordance with Section 02223, unless otherwise specified.

.8 When benching is required to key new fill slopes to existing slopes, no measurement or payment shall be made with respect to quantities excavated during this operation.

.9 Clearing and grubbing will be measured in accordance with Section 02111.

.10 Placing and Spreading of on site and/or imported topsoil will be paid by the square metre to the specified depth.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Embankment materials require approval by the Owner.

.2 Material used for embankment not to contain organic matter, frozen lumps, weeds, sod, roots, logs, stumps or any objectionable matter and have not more than 10 % passing 0.075 mm sieve nor particles larger than 250 mm or 150 mm within 300 mm of sub-grade.

.3 Common Material to be obtained from sources indicated or approved by the Owner.

3.2 STOCKPILING

.1 Stockpile fill materials in areas designated by the Owner. Stockpile granular material in manner to prevent segregation. Protect stockpiled fill material from freezing.

.2 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

PART 4 EXECUTION

4.1 COMPACTION EQUIPMENT

.1 Compaction equipment must be capable of obtaining required densities in materials on project.

4.2 WATER DISTRIBUTORS

.1 Apply water with equipment capable of uniform distribution. Water used for this purpose shall be fresh water.

4.3 EXCAVATION

.1 Excavate areas designated on drawings to design lines, grades and cross-sections. The excavation tolerance in OM shall be ± 30 mm and in rock - 150 mm.

.2 Remove materials that are unsuitable to the lines and grades as designated by the Owner and dispose of as directed.

.3 Suitable material not used immediately in the work shall be stockpiled in areas designated by the Owner at no additional cost to the Owner for subsequent use in the work.

.4 Maintain crowns and cross slopes to provide good surface drainage.

.5 Excavate to elevations and dimensions indicated or required for construction of work plus space required to erect forms.

.6 Make excavation to clean lines to minimize quantity of fill material required.

.7 Earth bottoms or excavations to be dry undisturbed soil, level, free from loose or organic matter.

.8 Excavation must not interfere with normal 45 degree splay of bearing from bottom of any footing.

.9 When complete, have the Owner inspect excavations to verify soil bearing capacity, depths and dimensions.

.10 Correct unauthorized excavation at no extra cost as follows:

.1 Fill under bearing surfaces and footings with concrete as specified for footings.

.2 Fill under other areas with fill compacted to 95 % density in accordance with ASTM D698.

.11 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw. Seal cuts with approved tree wound dressing.

4.4 EXCAVATION REQUIRED BY OTHERS

.1 Excavation for mechanical and electrical work is included in this Section and shall be carried out in accordance with provisions specified herein and indicated.

.2 Excavate trenches to lines and grades shown to a minimum of 75 mm below pipe invert. Provide recesses for bell and spigot pipe to ensure bearing will occur along barrel of pipe.

.3 Cut trenches 300 mm wider than maximum pipe diameter. Trim and shape trench bottoms and leave free of irregularities, lumps or projections.

4.5 BACKFILLING

.1 Do not commence backfilling until areas of work to be backfilled have been inspected and approved by the Owner.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Prior to placing fill under slabs on grade, compact existing sub-grade to obtain same compaction as specified for fill. Remove "soft" material and fill with approved material until specified compaction can be obtained.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures, erect bracing or shoring to counteract unbalance and leave in place until removal is approved by the Owner.

.5 Backfill simultaneously each side of walls and other structures to equalize soil pressures.

.6 Place and compact fill materials in continuous horizontal layers not exceeding 300 mm loose depth. Use methods to prevent disturbing or damaging buried services. Make good any damage.

.7 Maintain optimum moisture content to enable compaction to attain specified density.

.8 In roads, parking lot and under concrete structures place fill materials in 500 mm lifts and compact to 95 % corrected maximum dry density.

.9 In other areas of site compact to density of existing soil.

4.6 MAINTENANCE

.1 Maintain roadway surface until next course of material is placed or until project or that portion thereof is accepted.

4.7 PRESERVATION OF TOPSOIL

.1 At the direction of the Owner:

.1 Remove topsoil before any construction procedures commence to avoid compaction of topsoil.

.2 Handle topsoil only when it is dry and warm.

.3 Remove vegetation and brush from targeted areas by non-chemical means and dispose of stripped vegetation in accordance with Section 02111.
.4 Strip topsoil to depths as directed by the Owner. Avoid mixing topsoil with subsoil.
.5 Pile topsoil by mechanical hoe in berms in locations as directed by the Owner. Stockpile height shall not exceed 2.0 m.
.6 Protect stockpiles from contamination, compaction, and erosion.
.7 Topsoil that has been piled for long term storage will be covered with trefoil or grass to maintain agricultural potential of soil.

4.8 INSPECTION AND TESTING

.1 Sieve Analysis: proposed fill materials will be tested to confirm suitability for intended use and conformity with specifications.

.2 Density Test will be conducted on compacted fill to ASTM D698 for Standard Proctor Density.

4.9 WASTE MATERIAL

.1 Dispose of waste material not required for backfill, grading or landscaping, at an approved dump site.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

.2 Payment for excavation and borrow material will include placing and compacting in embankments elsewhere on the project, as well as legal disposal of all waste material.

This specification outlines the requirements for trench excavation and backfill for the installation of pipe lines, conduits and appurtenances together with the requirements for backfilling and compacting material in trenches after the removal of pipe or after the placing of pipe and bedding.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

C117	Standard Test Method for Materials Finer than 75-µm (No.200) Sieve in Mineral Aggregates by Washing
C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3))

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Trench excavation to be measured in cubic metres in their original position and based on theoretical trench conditions. Payment for excavation shall include backfill with excavated trench material, compaction, disposal of waste material off site, placing of excavated material at another location on site and all other items as outlined in this section.

.2 Before commencing any excavation, take levels and cross-sections of the original ground surface and agree upon them with the Owner.

.3 Mass excavation and/or mass backfill will be measured in accordance with Section 02215.

.4 Trench length for measurement purposes will be measured continuously through maintenance holes and other appurtenances except in the case of sewage lift stations and any extra excavation required for their construction outside the specified measurement trench width will be deemed to be included in the contract unit price for these structures and appurtenances.

.5 Excavation and backfill of sewage lift stations will be paid for under this section in accordance with the measurement limits defined under Section 02650.

.6 Excavated quantities measured to be theoretical volume removed within the following limits unless otherwise detailed in this specification:

.1 Depth: Measured from original ground, less a deduction of 150 mm when grubbing required, to installed grade at bottom of trench as shown on the drawings. In areas of specified mass excavation, trench depth will be measured from the new ground elevation established after mass excavation.

.2 Width: Subject to subsection 2.1.6.3 of this specification, the width of main trench allowed for measuring purposes shall be the sum of the nominal diameters of the pipe in the trench plus pipe insulation plus 600 mm. In the case of service pipes the width of trench allowed shall be 1000 mm. In the case of combined gravity sanitary sewer and storm sewer the width of trench allowed for measuring purposes shall be the sum of the nominal diameters of the pipes plus 1050 mm. When concrete pipe is used the outside diameter of the pipe rather than the nominal diameter shall be used to determine the trench width.

.3 The minimum width of main trench shall be: 1500 mm where the average depth is 0 to 4 m; 2000 mm where the average depth is greater than 4 m to 6 m; 2500 mm where the average depth is greater than 6 m. The average depth shall be calculated between maintenance holes on sewer line or at 100 m intervals along water main only trench. The width of service trench shall increase by 500 mm where the average depth is greater than 4 m and by an additional 500 mm where the average depth is greater than 6 m.

.7 Extra excavation required for maintenance holes and/or the deflection of water mains and/or storm sewer pipes at maintenance holes or other structures will be deemed to be included in the Contract Unit Price for trench excavation and backfill as detailed above. Trench width for measurement purposes will be that required for the number and size of pipes as specified, and assumed as one trench passing continuously through the maintenance hole or other structures. Deflected pipes at or around structures will not be considered as separate trenches for measurement and payment purposes.

.8 When rock is exposed by stripping the common material, the rock surface will be profiled. When rock is to be excavated by drilling from ground level, then rock will be measured by inspection of the sides of the excavation by measuring the height of the over burden on top of the rock.

.9 Imported common backfill including compaction to be measured in cubic metres based on theoretical paylines for trenching.

.10 Excavation and disposal of waste material to be paid under common excavation.

.11 Sheeting and bracing left in place on direction of the Owner will be measured in square metres of surface area of plane surface of sheeting.

.12 Shoring, bracing, trench boxes, cofferdams, underpinning and de-watering of excavation will be incidental to work and will not be measured separately.

.13 When separate payment is specified or indicated in the MERX Schedule of Quantities and Prices for granular materials for pipe bedding and backfill, measurement widths shall be the theoretical trench width and lengths shall be as specified for trench excavation, bedding and backfill. Measurement depth shall be actual depth installed up to limits shown on the contract drawings or as specified in this specification. Bedding volumes shall be adjusted in accordance with Section 02702, and Section 02713. ,

.14 Rock underbedding will be measured compacted in place according to theoretical paylines specified and depth required. Payment includes all additional costs associated with type of materials and greater excavation depths required.

.15 Supply and placement of marking tape will be paid for by the metre.

.16 Supply and placement of filter fabric will be measured in accordance with Section 02897.

.17 Trucking, handling, stockpiling, filling and conditioning at the direction of the Owner of otherwise competent material that is too wet for immediate reuse when removed from the trench shall be measured in accordance with subsection 2.1.6 of this specification.

.18 Where the Owner requires excavation or borrow materials be hauled in excess of two (2) kilometres, additional payment for overhaul will be made in accordance with Section 1005.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Marking Tape:

.1 Heavy gauge polyethylene, 150 mm wide indicating the service buried.

.2 Detectable metallic underground tape, indicating the service buried, not less than 75 mm wide.

.2 Type 1 bedding: clean, hard durable crushed gravel or stone, free from shale, clay, friable materials, organic matter and other deleterious substances and graded within the following limits when tested in

accordance with ASTM C136 and ASTM C117 and giving a smooth curve without sharp breaks when plotted on a semi-log chart:

ASTM sieve designation	% passing
25.000 mm	100
19.000 mm	75–100
12.500 mm	–
9.500 mm	50–100
4.750 mm	30–70
2.000 mm	20–45
0.425 mm	10–25
0.180 mm	–
0.075 mm	3 - 8

.3 Type 2 bedding: clean, hard, durable sand, gravel or crushed stone, free from shale, clay, friable materials, organic matter and other deleterious substances when tested to ASTM C136 and ASTM C117 and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart:

ASTM sieve designation	% passing
9.5 mm	100
4.75 mm	50–100
2.00 mm	30–90
0.075	0–10

.4 Type 3 bedding: uniformly graded, clean granular material free from mud lumps, cinders, sods, refuse of other deleterious substances. The maximum particle size shall be 25 mm and the gradation and fines content shall be such that the material can be well compacted and will not become unstable and lose its pipe bearing ability upon exposure to water or ground water movement. Type 3 bedding shall be selected, whenever possible, from excavated material at the same point of trench excavation or from other points of trench excavation where suitable material is available. The bedding shall be approved by the Owner. No payment will be made for the direct reuse of the approved trench material if screening is not required by the Owner. When the excavated trench material is screened as directed by the Owner and used for bedding, payment will be made at the unit price bid for Type 3 bedding in the MERX Schedule of Quantities and Prices. When the excavated trench material is deemed insufficient for bedding as directed by the Owner and imported material

from outside the limits of the contract is required, payment will be made at the unit price bid for Type 3 imported bedding in the MERX Schedule of Quantities and Prices".

.5 Backfill Material: selected material from excavation or other sources, approved by the Owner for use intended, unfrozen and free from rocks larger than 200 mm, cinders, ashes, sods, refuse or other deleterious materials.

.6 Granular bedding shall be the type #1, #2, or #3 material as specified in the MERX Schedule of Quantities and Prices.

.7 Rock underbedding: Crushed stone consisting of durable crushed rock approximately 100 mm maximum size and consisting of angular fragments obtained by breaking and crushing solid or natural rock, reasonably free from thin, flat elongated or other objectionable pieces and fines. Material not to contain any organic soil or objectionable matter with not more than 10 % by mass passing the #63 Canadian Metric sieve, including parties adhering to larger stone particles.

PART 4 EXECUTION

4.1 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Strip topsoil from within limits of excavation and stockpile as directed by the Owner, for re-spreading after backfilling or for reinstatement in other parts of the work.

.3 Cut pavement or sidewalk neatly along limits of proposed excavation or as specified in order that surface may break evenly and cleanly.

4.2 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

.1 Obtain permit from Authority Having Jurisdiction for diversion of water course.

.2 Construct temporary works to depths, heights and locations as indicated or directed by the Owner.

.3 During backfill operation:

.1 Unless otherwise indicated or directed by the Owner, remove sheeting and shoring from excavation.

.2 Do not remove bracing until backfilling has reached respective levels of such bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above toe of sheeting.

.4 When sheeting is required to remain in place, cut off tops at elevations indicated or directed by the Owner.

.5 Upon completion of substructure construction:

.1 Remove cofferdams, shoring and bracing.
.2 Remove excess materials from site and restore water courses to conditions indicated or as directed by the Owner.

4.3 DEWATERING

.1 Keep excavations free of water while work is in progress.

.2 Protect open excavations against flooding and damage due to surface run-off.

.3 Dispose of water in a manner not detrimental to public and private property, or any portion of work completed or under construction. Comply with all requirements of the Department of Environment and Conservation and other regulatory agencies having jurisdiction regarding disposal of water from excavations.

.4 Submit for the Owner's review, details of proposed dewatering methods, such as dikes or well points.

.5 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas.

.6 Do not dewater during placing of concrete, or for a period of at least 24 hours thereafter, unless from a pump separated from concrete work by a watertight wall or other effective means.

.7 Construct all sub-drains, sump holes, wells or the like required for dewatering the excavations so as not to endanger in any way the stability of the Works, and on completion of the work completely backfill and consolidate these excavations.

4.4 EXCAVATION

.1 Advise the Owner ten (10) business day prior to excavation operations to enable original cross sections to be taken.

.2 Excavate to lines, grades, elevations and dimensions indicated.

.3 Cut pavement or side walk neatly in a line along limits of proposed excavation or as specified in order that surface may break evenly and cleanly. The width removed along the normal trench for the installation of

the pipe shall not exceed the width of the trench specified by more than 500 mm on each side of the trench. The width and length of the area removed for the installation of gate valves, specials, maintenance holes, or other structures shall not exceed the maximum linear dimensions of such structures by more than 500 mm on each side. Wherever, in the opinion of the Owner, existing conditions make it necessary or advisable, remove additional pavement, as directed by the Owner and approved by the Regional Engineer, and receive extra compensation provided such additional work is not shown in the drawings or specified. Removal or damage to pavement or surfaces beyond these limits, shall be replaced or repaired at the expense of the Contractor.

.4 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation.

.5 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw. Seal cuts with approved tree wound dressing.

.6 Unless otherwise authorized by the Owner in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.7 Dispose of waste material in accordance with Section 01005. The Owner shall define waste material.

.8 Do not obstruct flow of surface drainage or natural watercourses.

.9 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.10 Obtain Owner approval of completed excavation.

.11 Remove unsuitable material from trench bottom to extent and depth directed by the Owner.

.12 Where required due to unauthorized over-excavation, correct as follows:

- .1 Fill under bearing surfaces and footings with concrete specified for footings.
- .2 Fill under other areas with approved fill compacted to minimum of 95 % corrected maximum dry density, maximum dry density to ASTM D698, Method D.

.13 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.14 No extra payment shall be made for measures ordered by the Owner to correct problems caused by unauthorized over-excavation.

.15 No extra payment shall be made for construction methods required to keep the trench stable, free from disturbance, or dry, nor for crushed stone or other granular material used to facilitate drainage or dewatering during construction of the pipeline or for any extra excavation related thereto.

.16 The use of mechanical excavators will be permitted except where their use, in the opinion of the Owner, will cause damage to property or structures above or below ground where property or structures must be preserved in accordance with the contract. The costs for hand excavation when the proximity of existing structures or other considerations render this necessary are deemed to be included in the Unit Price for trench excavation and backfill in the MERX Schedule of Quantities and Prices.

.17 Keep all surface materials that, in the opinion of the Owner, are suitable for re-use in restoring the surface separate from the general excavation material.

.18 Stockpile suitable material excavated, including rock excavation, required for trench backfill in approved location.

4.5 TRENCH BOTTOM PREPARATION

.1 Draw the attention of the Owner to the nature and condition of the excavated surfaces that are to receive the foundations of the works. If in the opinion of the Owner, the foundation is unsuitable to receive the structure as shown on the Drawings, the Owner will issue written instructions for extra excavation, special filling or other extra work required to secure a proper foundation.

.2 Where required due to removal of unsuitable material and/or unauthorized over excavation, bring bottom of excavation to design grade with approved granular material or rock underbedding as directed by the Owner.

4.6 PRE-INSTALLATION INSPECTION

.1 Excavations require inspection and approval prior to commencement of installation of pipe bedding and operations.

4.7 BACKFILLING

.1 Do not proceed with backfilling operations until the Owner has inspected and approved installations.

.2 Areas to be backfilled and/or backfill material shall be free from debris, snow, ice, water or frozen ground. Do not use backfill material that is frozen or contains ice, snow or debris.

.3 Backfilling around installations:

.1 Place bedding as specified and as detailed on the contract drawings.

.2 Do not backfill around or over cast-in-place concrete within 24 hours after placing.

.3 Place layers simultaneously on both sides of installed work to equalize loading.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures.

.1 Permit concrete to cure for minimum of 7 calendar days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from the Owner or:

.2 If approved by the Owner, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by the Owner.

.5 Place material by hand under, around and over installations until 600 mm of cover is provided. Dumping material directly on installations will not be permitted.

.4 Place backfill material in uniform layers not exceeding 300 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Do not place backfill in freezing weather without written permission of the Owner.

.6 The foundation or underside of all structures and installations, including pipe bedding for pipes in trench shall bear on undisturbed ground or prepared surfaces as reinstated and approved by the Owner.

.7 Granular backfill materials:

.1 Beneath paved highways or within 1.5 metres of the edge of pavement and beneath paved areas, curbs, driveways or sidewalks use granular backfill materials compacted to 95 percent of the maximum density as determined by ASTM D698 Method D. Compact using approved mechanical tamping devices.

4.8 RESTORATION

.1 Remove waste materials and debris, trim slopes, and correct defects noted by the Owner.

.2 Replace topsoil as indicated or directed by the Owner.

.3 Reinstate pavement, sidewalks and lawns to condition and elevation that existed before excavation.

.4 Clean and reinstate areas affected by work as directed by the Owner.

.5 Reinstate areas affected by equipment outside of planned area to condition that existed prior to commencement of work and leave site in rake-clean condition as directed.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification, including labour, materials, and equipment use to carry out the work shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for roadway excavation, borrow excavation, embankment construction and disposal of material conforming to lines, grades, dimensions and typical cross-sections shown on plans or established by the Owner.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft·lbf/ft^3 (600 kN·m/m^3))

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Excavated materials will be measured in cubic metres from cross sections taken in areas of excavation.

.2 Mass Rock Excavation:

.1 Where depth indicated on the Drawings or directed by the Owner is less than 300 mm below original rock surface, depth excavated for measurement purposes will be taken as 300 mm.

.2 Volume of excavated boulders and rock fragments in excess of 0.5 m^3 will be determined by measuring three maximum mutually perpendicular dimensions.

.3 Mass Common Excavation:

.1 In areas of excavation provided by the Owner, initial cross-sections will be taken prior to clearing and grubbing and prior to stripping of topsoil.

.2 Topsoil and Unsuitable material to be paid under common excavation will be measured for payment as common excavation in its original location.

.4 Imported rock and common backfill including compaction to be measured in cubic metres in place to specified paylines unless otherwise specified by the Owner.

.5 Placing and spreading of topsoil on site and/or imported topsoil will be paid by the square metre to the specified depth.

.6 No measurement will be made for:

.1 Unnecessary excavation beyond lines established.
.2 Extra handling of windrowed materials blended on embankment slopes.
.3 Placing of excavated material at another location on site or disposal of waste material off site.
.4 Ripping and/or drilling and blasting of material.
.5 Scarifying or benching existing slopes or existing road surfaces.
.6 Removing and disposing of roots, stumps and other materials excavated during waste operation.
.7 Burying existing culverts from old road.
.8 Removing unsuitable material from embankment attributable to negligence.
.9 Shattering rock to 300 mm below subgrade elevation.
.10 Scaling and removing loose rock from rock face.
.11 Watering, drying and compacting.
.12 Finishing.

.7 Supply and placement of filter fabric will be paid in accordance with Section 02897.

2.2 TRAFFIC PROVISIONS

.1 Provide and maintain roadways, walkways and detours, for vehicular and pedestrian traffic and access to fire hydrants.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Embankment materials require approval by the Owner.

.2 Material used for embankment not to contain organic matter, frozen lumps, weeds, sod, roots, logs, stumps or any other objectionable matter and have not more than 10 % passing 0.075 mm sieve nor particles larger than 250 mm. Within 300 mm of sub-grade the maximum particle size shall be 150 mm.

.3 Common Material shall be obtained from sources indicated or approved by the Owner.

PART 4 EXECUTION

4.1 COMPACTION EQUIPMENT

.1 Compaction equipment must be capable of obtaining required densities in materials on project.

.1 Demonstrate compaction equipment effectiveness on specified material and lift thickness by documented performance of test-strip before start of Work.
.2 Replace or supplement equipment that does not achieve specified densities.

.2 Operate compaction equipment continuously in each embankment when placing material.

4.2 WATER DISTRIBUTORS

.1 Apply water with equipment capable of uniform distribution.

.2 Water used for this purpose shall be fresh water.

4.3 EXCAVATING

.1 General:

.1 Advise the Owner sufficiently ten (10) business days prior to excavation operations for initial cross-sections to be taken.
.2 Maintain crowns and cross slopes to provide good surface drainage.
.3 Notify the Owner whenever unsuitable materials are encountered in cut sections and remove unsuitable materials to depth and extent directed.
.4 Where subgrade is on transition from excavation to embankment treat ground slopes at grade points as indicated or as directed by the Owner.

.2 Stripping:

.1 Strip topsoil from areas and to depths indicated or directed by the Owner prior to beginning of excavation and embankment work. Avoid contamination to topsoil and underlying soil.
.2 Remove materials unsuitable for embankments to lateral limits and depths directed and dispose of as directed.

.3 Rock Excavation:

.1 If during excavation, material appearing to conform to classification for rock is encountered, notify the Owner in sufficient time to enable measurements to be made to determine volume of rock.
.2 Remove rock to 300 mm below sub-grade elevation indicated.
.3 Provide effective drainage to ditches, leaving no undrained pockets in foundation.
.4 Scale down rock slopes and remove rock fragments that are liable to slide or roll down slopes.

.4 Borrow:

.1 Completely use in embankments, suitable materials removed from excavations before taking material from borrow areas.

.2 Obtain from borrow areas additional suitable embankment material.

.1 Owner to approve location and extent of borrow areas, and allowable depth of cutting.

.2 Shape edges of borrow areas on slopes of 2:1 and provide drainage as directed by the Owner.

.3 Trim and leave borrow pits in a condition to permit accurate measurement of material removed.

.4 Leave borrow pits in safe condition suitable for rehabilitation.

.5 Side Ditches:

.1 Construct side ditches to depths and widths indicated or directed by the Owner, to permit ready flow of surface water.

.2 Maintain and keep ditches open and free from debris until final acceptance of work.

4.4 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations and embankments dry while Work is in progress by draining and pumping as required.

.2 Provide for Owner’s review all details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.

.1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.4 Protect open excavations against flooding and damage due to surface run-off.

.5 Dispose of water in a manner not detrimental to public health, environment, public and private property, or any portion of the work completed or under construction. Comply with all requirements of the Department of Environment and Climate Change and other regulatory Agencies Having Jurisdiction regarding disposal of water from excavation.

.1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

.6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

4.5 EMBANKMENTS

.1 When directed by the Owner, scarify or bench existing slopes in side hill or sloping sections to ensure a proper bond between new materials and existing surfaces. Obtain prior approval of method to be used.

.2 Do not place material that is frozen or place material on frozen surfaces.

.3 Maintain a crowned surface during construction to ensure ready run-off of surface water. Do not place material in free standing water. Drain low areas before placing.

.4 With material containing less than 25 % by volume of stone or rock fragments larger than 100 mm:

- .1 Place and compact to full width in uniform layers not exceeding 500 mm loose thickness. The Owner may authorize thicker lifts if specified compaction can be achieved.
- .2 Compact to a density of not less than 95 % corrected maximum dry density, maximum dry density in accordance with ASTM D698 except last 150 mm up to sub-grade elevation. Compact last 150 mm to 100 % corrected maximum dry density, maximum dry density in accordance with ASTM D698.

.5 Where material consists principally of rock:

- .1 Place to full width in layers of sufficient depth to contain maximum sized rocks but in no case is layer thickness to exceed 500 mm.
- .2 Carefully distribute rock material to fill voids with smaller fragments to form a compact mass.
- .3 Fill surface voids at subgrade level with rock spalls or selected material to form an earth-tight surface.
- .4 Do not place boulders and rock fragments with dimensions exceeding 150 mm within 300 mm of subgrade elevation.

.6 Upon completion of embankment construction, if so directed, place stock piled and windrowed topsoil and unsuitable material against embankment and trim to maintain embankment slope.

.7 Place topsoil taken from stockpile or other sources, at locations and to depths directed. Remove surface stones, roots and other debris and leave surface in uniform condition.

4.6 FINISHING

.1 Remove soft or other material that will not compact properly and fill resulting depressions with approved material.

.2 Shape and compact entire roadbed to within 30 mm of design elevations but not uniformly high or low.

.3 Do scarifying, blading, compacting or other methods of work as necessary to provide a thoroughly compacted roadbed shaped to grades and cross sections indicated or directed.

.4 Finish back and side slopes of common material to a neat condition, suitable for seeding, true to line and grade.

.1 Remove boulders encountered in cut slopes and fill resulting cavities.

.2 Hand finish slopes that cannot be finished satisfactorily by machine.

.5 Finish back and side slopes of rock material to a neat and safe condition, true to line and grade. For rock slopes greater than 1:1, scale slope by removing loose fragments.

.6 Grade and leave all disposal areas or dump sites in a condition acceptable to the Owner and do not obstruct flow of surface drainage or natural watercourses. Ensure that approved disposal sites are available so that the Work shall not be delayed.

4.7 MAINTENANCE

.1 Maintain finished surfaces in a condition conforming to this section until acceptable.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices. Payment for excavation and borrow material will include placing and compacting in embankments elsewhere on the project, as well as disposal of all waste material at approved dump sites.

This specification outlines the requirements for supplying and processing of aggregates to be stockpiled or incorporated into work. Specific requirements for physical properties of aggregate properties are given in the related work sections.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 SOURCE APPROVAL

.1 Source of materials to be incorporated into work or stockpiled requires approval of the Owner ten (10) business days prior to commencing work. Provide gradation analysis and other laboratory testing results as directed by the Owner.

.2 If, in opinion of the Owner, materials from the proposed source do not meet, or cannot reasonably be processed to meet specified requirements, procure an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

.3 Should a change of material source be proposed during work, advise the Owner ten (10) business days sufficiently in advance of such change to allow sampling and testing.

.4 Acceptance of a material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

2.2 PRODUCTION SAMPLING

.1 Aggregate will be subject to continual sampling during production. Provide the Owner with ready access to source and processed material for purpose of sampling and testing.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material or other deleterious substances.

.2 Flat and elongated particles are those whose greatest dimension exceeds five times their least dimension.

.3 Particles having at least one freshly fractured face are considered as crushed material.

.4 Fine aggregates satisfying requirements of applicable section shall be one, or a blend of following:

.1 Natural sand.
.2 Manufactured sand.
.3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

.5 Coarse aggregates satisfying requirements of applicable section shall be one of following:

.1 Crushed rock or slag.
.2 Gravel composed of naturally formed particles of stone.

PART 4 EXECUTION

4.1 DEVELOPMENT OF AGGREGATE SOURCE

.1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as directed by the Owner.

.2 Where clearing is required, leave a screen of trees between area and roadways as directed.

.3 Clear, grub and strip an area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.

.4 When excavation is completed, dress sides of excavation to a nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.

.5 Trim off and dress slopes of waste material piles and leave site in a neat condition.

.6 Provide silt fence or other means to prevent contamination of existing watercourse or natural wetland features.

4.2 PROCESSING

.1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

.2 Blend aggregates, if required, to obtain gradation requirements specified. Use methods and equipment approved by the Owner.

.3 Blending to increase percentage of crushed particles or decrease percentage of flat and elongated particles is permitted.

.4 Wash aggregates, if required to meet specifications. Use only equipment approved by the Owner.

4.3 HANDLING

.1 Handle and transport aggregates to avoid segregation, contamination and degradation.

4.4 STOCKPILING

.1 Unless otherwise authorized in writing by the Owner, stockpile aggregate on site in locations shown on drawings or designated by the Owner.

.2 Stockpile aggregates in sufficient quantities to meet project schedules.

.3 Stockpiling sites shall be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.4 Except where stockpiled on acceptably stabilized areas, provide a compacted sand base not less than 300 mm in depth to prevent contamination of the aggregate or, if permitted, stockpile aggregate on ground but do not incorporate bottom 300 mm of pile into work.

.5 Separate aggregates by substantial dividers or stockpile far enough apart to prevent intermixing.

.6 Reject intermixed or contaminated materials. Remove and dispose of rejected materials as directed by the Owner within 48 hours of rejection.

.7 Stockpile materials in uniform layers of thickness as follows:

.1 Max 1 m for coarse aggregate and base course materials.
.2 Max 2 m for fine aggregate and sub-base materials.
.3 Max 1.5 m for other materials.

.8 Complete each layer over entire stockpile area before beginning next layer.

.9 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.10 Coning of piles or spilling of material over edges of pile will not be permitted.

.11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

4.5 STOCKPILE CLEANUP

.1 Leave stockpile site in a tidy, well drained condition, free of standing surface water.

.2 Leave any unused aggregates in neat compact stockpiles as directed by the Owner.

PART 5 BASIS OF PAYMENT

.1 No separate or direct payment will be made for work specified in this section. Costs of all work specified in this section are deemed to be included in lump sum or unit prices quoted in MERX Schedule of Quantities and Prices.

This specification outlines the requirements for scarifying and reshaping of a road surface prior to the application of Selected Granular Base Course or asphaltic pavement.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft·lbf/ft^3 (600 kN·m/m^3))

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Scarifying and reshaping existing roadbed including compaction will be measured in square metres.

.2 Repair of soft areas will be measured in accordance with Section 02224.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 SCARIFYING AND RESHAPING

.1 Where directed by the Owner the Contractor shall scarify and reshape a road surface prior to the application of Selected Granular Base Course or Asphaltic Pavement. The scarifying and reshaping shall be carried out within the lengths designated by the Owner, and within the width to be covered by the proposed pavement plus 0.3 m on each side, or to such other widths as the Owner may designate.

.2 Where the road surface consists of Selected Granular Base Course of a particular type, then the scarifying shall be to the full depth of the base course of that type, or to a depth of 300 mm, whichever is less.

.3 Where the road surface consists of subgrade then the scarifying shall be to a depth of not less than 300 mm.

.4 Unsuitable roadbed materials as determined by the Owner, that are encountered during the scarifying operation shall be excavated to the lateral limits and depth directed by the Owner and shall be disposed of as directed.

.5 No boulders greater than 150 mm in diameter shall be left within 300 mm of the top of the subgrade composed of other material. Such boulders over 150 mm in diameter that cannot be removed by the scarifying operation shall be removed by hand excavation, blasting or any other suitable method. All excavated boulders shall be removed from the subgrade and ditches and then disposed of.

.6 Excavations resulting from removal of boulders or Unsuitable Material shall be backfilled with approval material to the specified grades.

.7 Whenever the materials incorporated in the existing subgrade are insufficient to provide the required profile and cross-section, the Contractor shall add additional approved material as directed by the Owner.

.8 The maximum variation from the specified profile and cross-section of the compacted scarified and reshaped road surface shall be 30 mm, except in those instances where paving is to take place directly on top of the scarified and reshaped material, in which case the finished surface shall not deviate at any place on a 3 metre straight edge by more than 10 mm.

.9 Where due to traffic use, or for whatever other reason, the scarified and reshaped road surface no longer lies within the required tolerance, then, before placing the next materials, the Contractor shall scarify and reshape the affected area again, at their own expense.

4.2 COMPACTING

.1 Road material disturbed by the scarifying and reshaping shall be compacted.

.2 Where subgrade is scarified and reshaped, the disturbed materials shall be compacted to not less than 95 % maximum Standard Proctor Dry Density in accordance with ASTM D698, Method D.

.3 Where select granular base course is scarified and reshaped the disturbed materials shall be compacted to not less than 100 % of the Maximum Standard Proctor Dry Density in accordance with ASTM D698.

4.3 MAINTENANCE

.1 Maintain finished surfaces to degree of compaction and within tolerance specified until surfaces are covered with required granular or pavement course or until project is accepted by Owner.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for reshaping of a road surface up to a depth of 100 mm prior to the application of Selected Granular Base Course or asphaltic pavement.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft·lbf/ft^3 (600 kN·m/m^3))

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Reshaping of existing roadbed (up to a depth of 100 mm) including compaction will be measured in square metres.

.2 Repair of soft areas will be measured in accordance with Section 02224.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 RESHAPING

.1 Where directed by the Owner the Contractor shall scarify and reshape a road surface prior to the application of Selected Granular Base Course or Asphaltic Pavement. The scarifying and reshaping shall be carried out within the lengths designated by the Owner, and within the width to be covered by the proposed pavement plus 0.3 m on each side, or to such other widths as the Owner may designate.

.2 Unsuitable roadbed materials as determined by the Owner, which are encountered during the reshaping operation shall be excavated to the lateral limits and depth directed by the Owner and shall be disposed of as directed.

.3 The maximum variation from the specified profile and cross-section of the compacted reshaped road surface shall be 30 mm, except in those

instances where paving is to take place directly on top of the scarified and reshaped material, in which case the finished surface shall not deviate at any place on a 3 metre straight edge by more than 10 mm.

.4 Where due to traffic use, or for whatever other reason, reshaped road surface no longer lies within the required tolerance, then, before placing the next materials, the Contractor shall reshape the affected area again, at their own expense.

4.2 COMPACTING

.1 Road material disturbed by reshaping shall be compacted.

.2 Subgrade:

.1 Where subgrade is reshaped, the disturbed materials shall be compacted to not less than 95 % maximum Standard Proctor Dry Density in accordance with ASTM D698, Method D.

.2 Shape and roll alternately to obtain smooth, even and uniformly compacted subgrade surface.

.3 Apply water as necessary during compaction to obtain specified density.

.4 If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected to value not greater than % moisture above optimum value for compaction to ASTM D 698.

.3 Select granular base:

.1 Where select granular base course is reshaped, the disturbed materials shall be compacted to not less than 100 % of the Maximum Standard Proctor Dry Density in accordance with ASTM D698.

.2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.3 Apply water as necessary during compaction to obtain specified density.

.4 Use mechanical tampers to compact areas not accessible to rolling equipment to specified density.

.4 Asphalt pavement:

.1 Compact to density not less than % in accordance with ASTM D 698.

.2 Compact reshaped material in accordance with written approval of the Owner.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.4 Apply water as necessary during compacting.
.5 In areas not accessible to compaction equipment, compact to specified density, with mechanical tampers.

4.3 MAINTENANCE

.1 Maintain finished surfaces to degree of compaction and within tolerance specified until surfaces are covered with required granular or pavement course or until project is accepted by Owner.

.2 Subgrade and select granular base:

.1 Reshaped compacted surface within plus or minus 10 mm of elevation as indicated.

.3 Asphalt pavement:

.1 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in theMeasurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for the supply and the placing of Selected Granular Base Course Class "A", Granular Sub-Base Class "B", and Maintenance Grade No. 3.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure (TI), Highway Design and Construction Division, Highway Specifications Book

ASTM International

C117	Standard Test Method for Materials Finer than 75-µm (No.200) Sieve in Mineral Aggregates by Washing
C131/C131M	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3))
D4318	Standard Tests Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
D4718	Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
E11	Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

American Association of State Highway and Transportation Officials (AASHTO)

T180	Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in) Drop
T193	Standard Method of Test for the California Bearing Ratio

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Measurement for Payment will only be made for those materials accepted for use under this specification and then only when incorporated into the work at the required locations and thicknesses as indicated on the plans. The contractor shall not be paid more than 110 % of the calculated quantities based on theoretical limits and approved tickets. This additional quantity is included in the MERX Schedule of Quantities and Prices.

.2 Selected Granular Base and Sub-Base Materials will be measured in cubic metres (m^3) of compacted material incorporated into the work within the areas and to the thicknesses indicated on the Contract Drawings unless otherwise specified. Owner shall indicate in the 01000 Project Specific Specifications if tickets are required.

.3 Weigh Scales shall be provided by the Contractor and in accordance with Section 01155. The Contractor will supply scale tickets, and the Owner will issue tickets. Only loads certified by the Owner as being placed in the works at the required locations shall be included in measurement for payment. The weight shall be computed in tonnes, rounded to one decimal place.

.4 Excavation of base, sub-base and sub-grade materials to correct deficiencies in sub-grade discovered during placing of base or sub base will be measured for payment as common excavation in accordance with Section 02224. Imported backfill of sub-grade with suitable materials will be measured for payment as imported backfill in accordance with Section 02224. Replacement of base and sub-base material will be measured for payment under this section.

.5 The theoretical quantities will be based on 2.1 tonne/m^3 for Class “A”, Class “B”, and Maintenance Grade regardless of the actual density.

PART 3 PRODUCTS

3.1 MATERIALS

.1 The granular materials shall be composed of clean, hard, uncoated particles and shall be free from organic matter, clay lumps, and deleterious materials such as shale, slate, ochre and schists.

.2 Materials from deposits acceptable as to the quality of the particles, but deficient in sizes to provide the required gradation, may be accepted if the Contractor furnishes and satisfactorily incorporates into the product supplementary sizes from other sources to produce the required grading.

If the deficiencies occur in Class "A" or Class "B" materials, corrections may be attempted by crushing to a smaller maximum particle size. In that event, the Owner will furnish special grading limits on the actual maximum particle size.

.3 Materials shall be considered unsuitable, even though particle sizes are within the specified gradation limits, if particle shape or any other characteristic precludes satisfactory compaction or fails to provide a roadway suitable for traffic. If, in the opinion of the Owner, an improved particle shape can be achieved by using a different crushing unit from that proposed by the Contractor, then the Contractor shall supply and use a crushing unit of the type directed by the Owner.

.4 Class "A", Class "B", and Maintenance Grade No. 3 shall be processed by crushing and, when necessary to eliminate surplus fines passing the 4.76 mm sieve, shall be screened and washed.

.5 Granular base material (Class "A") to following requirements:

.1 The gradation will be within the limits indicated for Granular “A” in Table 1 Gradation Requirements in TI, Highway Specifications Book Section 315 Selected Granular Base Course when tested to ASTM C136 and ASTM C117. The gradings shall not show marked fluctuations from opposite extremes of the limiting sizes, and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11.

.2 Other properties as follows:

.1 Liquid Limit ASTM D4318 Maximum 25.

.2 Plasticity Index ASTM D4318 Maximum 0.

.3 Los Angeles Abrasion ASTM C131/C131M maximum 35 % loss by weight.

.4 Crushed Fragments: 50 %. The percent of crushed particles will be determined by examining the fraction retained on the 4.76 mm sieve and dividing the weight of the crushed particles by the total weight retained on the 4.76 mm sieve.

.5 CBR: AASHTO T193 minimum 100 when compacted to 100 % of AASHTO T180, Method D.

.6 Granular sub-base material (Class "B") to following requirements:

.1 The gradation will be within the limits indicated for Granular “B” in Table 1 Gradation Requirements in TI, Highway Specifications Book Section 315 Selected Granular Base Course when tested to ASTM C136 and ASTM C117. The gradings shall not show marked fluctuations from opposite extremes of the limiting sizes, having a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11.

.2 Other Properties as follows:

.1 Liquid Limit ASTM D4318 Maximum 25
.2 Plasticity Index ASTM D4318 Maximum 0
.3 Los Angeles Abrasion ASTM C131/C131M Max 35 % Loss by Weight.
.4 Crushed fragments: 50 %. The percent of crushed particles will be determined by examining the fraction retained on the 4.76 mm sieve and dividing the weight of the crushed particles by the total weight retained on the 4.76 mm sieve.
.5 CBR: AASHTO T193 minimum 100 when compacted to 100 % of AASHTO T180 Method D.

.7 Granular sub-base material (Maintenance Grade 3) to following requirements:

.1 The gradation will be within the limits indicated for Maintenance Grades No. 3 in Table 1 Gradation Requirements in TI, Highway Specifications Book Section 315 Selected Granular Base Course when tested to ASTM C136 and ASTM C117. The gradings shall not show marked fluctuations from opposite extremes of the limiting sizes, and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11.
.2 Other properties as follows:

.1 Liquid Limit ASTM D4318 Maximum 25.
.2 Plasticity Index ASTM D4318 Maximum 0.
.3 Los Angeles Abrasion ASTM C131/C131M maximum 35 % loss by weight.
.4 Crushed Fragments: 50 %. The percent of crushed particles will be determined by examining the fraction retained on the 4.76 mm sieve and dividing the weight of the crushed particles by the total weight retained on the 4.76 mm sieve.
.5 CBR: AASHTO T193 minimum 100 when compacted to 100 % of AASHTO T180, Method D.

PART 4 EXECUTION

4.1 INSPECTION OF UNDERLYING SUB-BASE OR SUB-GRADE

.1 The Contractor shall prepare the road surface in accordance with Section 02231 to the satisfaction of the Owner before commencing placement of any selected granular base course materials.

4.2 PLACING

.1 The Contractor shall place all granular bases in such a manner as to prevent contamination by other materials and to prevent segregation. If, in the opinion of the Owner, the methods and techniques used by the Contractor cannot overcome contamination or segregation, then the Owner may direct a modification in these methods, which may require the use of an approved spreader box or other acceptable device.

.2 All granular bases shall be placed in uniform layers such that the thickness of the compacted layer does not exceed 150 mm.

.3 Prior to closing down operations for each business day, all granular materials shall be bladed and compacted to the specified density.

.4 The materials shall be sprayed with water when and as directed by the Owner, either to aid compaction or reduce dust nuisance or both. When water is added to aid compaction, it shall be applied immediately ahead of the compacting unit.

.5 Each layer of granular base shall be bladed shaped and compacted as necessary to produce the required profile and cross-section. The finished surface shall not deviate at any place on a 3 m straight edge by more than 20 mm for Class "B" and 10 mm for Class "A". The upper layer shall be maintained to these tolerances and to the specified density until completion of the contract, or until the surface is paved. This may require keeping the moisture content at the appropriate value during periods of dry weather in addition to regrading and recompacting as frequently as may be deemed necessary by the Owner.

.6 Calcium chloride shall be applied uniformly by mechanical means when, and as directed by the Owner.

4.3 SHOULDERING

.1 Unless otherwise directed by the Owner the placing of granular materials for shoulder construction shall be carried out by means of an approved spreader. Spreader shall consist of a box to hold shouldering material and a suitable mechanism to control the width and rate of application and to prevent material getting onto the pavement.

.2 Granular materials for shoulder construction shall be placed directly on the shoulder and any spillage and materials dragged onto the pavement surface shall be immediately removed, without damage to the pavement, and the area so affected shall be thoroughly cleaned by the use of a power broom or other suitable method.

.3 The shoulders shall be sloped to the specified lines, grades and cross-section.

.4 Shouldering operations shall not commence along any section of pavement until 24 hours have elapsed from the time of completion of the final pavement course in that section, but the shouldering operations shall be completed within the next 24 hours on sections that are open to traffic.

4.4 COMPACTION

.1 All Class "A", Class "B", and Maintenance Grade 3 materials placed on the roadway, or placed on shoulders, shall be compacted to not less than 100 % of the maximum Standard Proctor Dry Density ASTM D698, Method D.

.2 Compaction operations shall be carried out as closely as possible behind the placing and spreading operation. At the end of each business day, all materials placed shall have been compacted to the specified density.

.3 Each layer of material shall be graded and compacted as specified before the next layer is placed.

.4 Where necessary to obtain the required compaction, the Contractor shall apply sufficient water by means of an approved distributor.

.5 Material must be handled and compacted without segregating or adversely breaking down (such that its gradation falls outside the specified grading limits, as determine by sieve analysis on random samples of the compacted in place material). Frozen material shall not be incorporated into the work and material shall not be placed on a frozen roadbed.

.6 Water shall be applied as necessary to facilitate compaction in order to achieve the degree of compaction required. However, it shall not be added in such quantities that it seeps into the underlying subgrade or exceeds the optimum moisture content (as determine by ASTM D698 and ASTM D4718, as applicable) by 1.0 %

4.5 MAINTENANCE

.1 Maintain finished base in a condition conforming to this section until succeeding material is applied or until acceptance.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

.2 Payment at the appropriate contract price for the particular type of Selected Granular Base Course shall be full compensation for all labour, materials, equipment use and any other expenses. This may include expenses to provide a pit or quarry, obtain all required permits and approval, provide and transport pit or quarry samples to the Owner, clear, grub and strip the pit or quarry, process pit or quarry materials to the gradation and physical requirements for the required type of material, provide and maintain a field laboratory, provide scales if required and construct and maintain access road to the source of the material

.3 Reconditioning of the surface on which the selected granular base course is to be applied and which is required in accordance with Section 2231, but which is not a pay item under that section is incidental to the work.

.4 Incidental to the work is all haulage of the material from the source to where the material is to be placed, placing, spreading, grading, and compacting the material.

.5 Also incidental to the work is the cost of any royalties for the material, cleaning up and providing such other restoration to the pit or quarry and the stockpile site as may be required, and any other work necessary to complete the contract item.

This specification covers the requirements for the supply and application of a solution of calcium chloride in water to such areas of gravel roads that the Owner may designate.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Measurement for payment shall be of the number of tonnes, rounded to two decimal places, of the calcium chloride flakes made into solution and applied within the required limits. This measurement will be made by computing the net weights of the sacks used.

.2 Measure supply and application of water for dust control in litres.

.3 No extra compensation will be paid for ordered and applied on Saturdays, Sundays or holidays.

PART 3 PRODUCTS

3.1 MATERIALS

.1 The calcium chloride shall be delivered to the site in the form of crystal flakes. Only calcium chloride flakes acceptable to the Owner shall be used. Water for forming the solution with the calcium chloride shall be clean water free of impurities.

.2 The Contractor shall supply the calcium chloride and the water.

PART 4 EXECUTION

4.1 APPLICATION

.1 The Owner will designate the limits between which the calcium chloride treatment is to be applied to the road.

.2 The Contractor shall grade up the road to be treated to obtain a smooth grade prior to application of the calcium chloride.

.3 The Contractor shall form a solution of calcium chloride and water of known proportions, so that the rate of application of calcium chloride is known and can be controlled by manipulation of the spreader.

.4 The rate of application of the solution shall be such that the required weight of dissolved flakes is applied to each square metre of road surface. The rate of application shall be 0.9 kilograms of dissolved flakes per square metre, or such other rate of application of calcium chloride as the Owner may designate.

.5 The calcium chloride shall be applied uniformly by the approved spreader.

.6 The Contractor shall compact the treated gravel surface to 100 % of Standard Proctor Dry Density.

.7 Any spill of calcium chloride such as arising from broken bags or otherwise must be immediately cleaned up. Any quantity of calcium chloride that is recovered from a spill and cannot be utilized in the normal manner must be disposed of at an approved waste disposal site at the Contractor's expense. Information on these sites can be obtained from the provincial Newfoundland and Labrador Government Service Centre. See the procedure for reporting spills as per the requirement of the Newfoundland and Labrador Government Service Centre.

.8 Contractors are reminded that the Dust Control subsection of Section 01560, applies.

PART 5 BASIS OF PAYMENT

.1 All costs associated with work as outlined in this specification shall be deemed to be included in the unit price as outlined above in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for the placing of rip-rap for erosion protection at locations and to details indicated or directed by the Owner.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

C88/C88M	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
C131/C131M	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Rip-rap will be measured in cubic metres to measurement specified or directed by the Owner.

.2 Transportation of material to placement site, access to placement site, and excavation for and preparation of foundation base not to be measured for payment but considered incidental to work and included in the MERX Schedule of Quantities and Prices.

.3 Filter Fabric will be paid in accordance with Section 02897.

PART 3 PRODUCTS

3.1 STONE

.1 Rip-rap shall consist of clean, hard, durable rock, having a density not less than 2.6 tonnes/m^3. The rock material, if subjected to the Los Angeles Abrasion Test (ASTM C131/C131M), shall have a loss not greater than 35 %. When tested for soundness, five cycles of magnesium sulphate (ASTM C88/C88M), the rock material shall have a loss of not greater than 15 %.

.2 Stones for use in rip-rap shall consist of clean, hard, durable rock, free of cracks. Rock subject to marked deterioration by water or weather will not be accepted. Only those stones approved by the Owner shall be used.

.3 The largest rocks procurable shall be supplied and in no case shall any fragment measure less than 0.0035 m^3 in volume. In hand laid dry wall rip-rap, spalls shall be supplied to fill open joints. Field stones or boulders or other materials may be used when approved by the Owner.

3.2 SOD

.1 Sod shall consist of a dense well rooted growth of permanent and desirable grasses. When sod is lifted, it shall be covered with grass recently mowed to a length not more than 75 mm. Sod shall be in widths not less than 300 mm nor more than 450 mm, in thickness not less than the depth of the fibrous roots and in no case less than 25 mm.

.2 All sod shall be taken from good loamy soil. It shall be well permeated with roots; be uniform in texture and free from weeds; be in good healthy condition with no sign of decay, and contain sufficient moisture to maintain its vitality during transportation and placing.

3.3 GROUT

.1 Grout shall consist of a cement mortar composed of one part Portland Cement and three parts fine aggregate.

PART 4 EXECUTION

4.1 EXCAVATION

.1 Should the Owner require that excavation be carried out to prepare a foundation for the rip-rap, then the work shall be carried out in accordance with Section 02224.

.2 Rip-rap - Hand Laid Dry Wall; Hand Laid with Sod; Grouted;

.1 On slopes to be rip-rapped the slopes shall be fine graded to a uniform surface. Depressions shall be filled and thoroughly compacted.

.3 Rip-rap Random;

.1 Where directed by the Owner, excavation for foundation shall be performed to provide a shelf or ledge to retain the rock so dumped.

4.2 PLACING

.1 Rip-rap - Hand Laid Dry Wall;

.1 Unless laid to form a flat apron, the rip-rap shall commence in a trench below the toe of the slope. Stones shall be placed by derrick

or by hand. Stones shall be set normal to the slope, and placed so that the largest dimension is perpendicular to the face of the wall, unless such dimensions is greater than specified thickness of the wall.

.2 The largest stones shall be placed in the bottom courses and for use as headers through subsequent course. No shaping of stones will be required; but the Contractor shall build to reasonable semblance of courses with stones laid closely and voids chinked with spalls.

.3 Stones shall be placed in the wall in such a way that the rear of each stone shall be embedded into the slope of the embankment.

.4 On the completion of laying of rip-rap operations any open foundation trenches bordering the rip-rap shall be backfilled and tamped.

.5 The required thickness of rip rap is dependent on the proposed height and slope of the rip rap and on the expected force of the stream flow.

.6 The Contractor shall construct the rip rap to the thickness stipulated in the contract documents or as directed by the Owner's Representative.

.2 Rip-rap Hand Laid with Sod;

.1 The placing of stones and the backfilling and tamping of trenches shall in accordance with subsection 4.2.1 of this specification.

.2 However, as the placing of stones proceeds sod shall be placed so that sod separates the stones from each other, both horizontally and vertically. The sod shall be placed so that there are no voids between stones.

.3 Sod shall not be placed upside-down.

.4 The sodding shall be trimmed so that the exposed edges of sods are flush with the exposed face of the rip-rap.

.3 Rip-rap - Grouted;

.1 The placing of stones shall be in accordance with subsection 4.2.1 of this specification. Before applying mortar the surfaces of the stones shall be amply wetted. The spaces between the stones shall be filled with mortar, starting from the bottom and working to the top. The mortar shall be worked with suitable tools to completely fill all voids except that the outer faces of the stones shall be exposed. Excess mortar shall be removed with a stiff brush. Grouted rip-rap shall be cured in accordance with the requirements for curing concrete sidewalk.

.2 After mortar has set any foundation trenches bordering, the rip-rap shall be backfilled and tamped.

.4 Rip-rap - Random;

.1 Rock material may be placed by dumping it into position over the surface to be rip-rapped.

.2 The Owner will indicate whether the larger stones should be placed near the bottom of the slope, or near the top of the treated area to protect against scour. The Contractor shall make a reasonable endeavour to dump the larger stones where required. Placing shall be done in such a manner that the surface of the finished rip-rap shall have a uniform appearance.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for the placing of armour stone for erosion protection at locations and to details indicated or directed by the Owner.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

C88/C88M	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
C131/C131M	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Payment for supply and installation of armour stone will be measured in cubic metres unless otherwise specified.

.2 Transportation of material to placement site, access to placement site, and excavation for and preparation of foundation base not to be measured for payment but considered incidental to work and included in the MERX Schedule of Quantities and Prices.

.3 Filter Fabric will be paid in accordance with Section 02897.

.4 Armour Stone will be paid based on the size (weight) range in the MERX Schedule of Quantities and Prices with 50 % more than the average unless otherwise specified on the drawings.

PART 3 PRODUCTS

3.1 STONE

.1 Armour stone shall consist of clean, hard, sound, durable rock, resistant to weathering and degradation in water, free of overburden, spoil, shale and organic material and having a density not less than 2.6 tonne/m^3. The rock material is subject to the Los Angeles Abrasion Test (ASTM C131/C131M) shall have a loss not greater than 35 %. When tested for soundness, five cycles of magnesium sulphate, ASTM C88/C88M, the rock material shall have a loss not greater than 15 %.

.2 Armour stones shall be of an angular shape, and be of a uniform gradation. The least dimension of any stone shall not be less than one-quarter of the greatest dimension.

.3 Individual armour stones shall be of a volume that is not less than that specified in the contract item in the MERX Schedule of Quantities and Prices.

PART 4 EXECUTION

4.1 PLACING

.1 Armour stones shall be placed within the limits required by the Owner.

.2 The Contractor shall prepare a foundation for the armour stone by excavating a seat in the existing ground.

.3 Excavation shall be by means of a backhoe, or a clam bucket as required, to carry out the excavation for the seat at the required location and to sufficient depth to provide a proper footing for the armour stone.

.4 Stones shall be placed by a crane, or similar equipment, starting at the bottom of the slope and working upwards.

.5 No pushing or dumping of the stones by bulldozers or other equipment will be allowed.

.6 The Contractor shall choose the stones and place them in such a way that the whole structure will be bound and consolidated to as great an extent as the nature of the rock will allow. Placing shall be done in such a manner that the surface of the armour stone treated slope shall have a uniform appearance. The thickness of the treated slope shall not be less than that specified in the item in the Contract Documents.

.7 Care shall be taken by the Contractor to ensure that no stones are placed outside of the specified limits.

.8 If any armour stones are placed outside of the area to be treated or are washed out of place during construction, then they shall be removed or replaced by the Contractor at their own expense.

.9 The Contractor shall complete any and all work required to provide access to all areas of the work site necessary to complete the preparation of foundation and placement of armour stone.

.10 Excavation shall include any additional excavation required at the toe of slope to adequately prepare the armour stone footing.

.11 The Contractor shall maintain the grades and slopes of the underlying material to ensure that the work area is cleared of all driftwood, debris, snow, ice and all other objectionable materials in the area of work.

.12 The Contractor shall be responsible for any Work or materials required to repair damage that is a result of water level variations, waves or weather conditions.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for supply and installation of baskets fabricated from wire mesh and filled with stone. A gabion structure consists of a number of baskets placed and wired together so that joints between baskets are as strong as the wire mesh, making a monolithic structure.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Gabions of the size and type specified will be measured in cubic metres of stone filled wire mesh baskets incorporated into the work based on the nominal dimensions of the gabion units used.

.2 Measurement for volume of the gabion structure shall be the sum of the volumes of the individual rows of gabions. The volume of a row of gabions shall be calculated as the product of: the mean length of a row, times the mean height of the row measured along the face of the row, times the mean depth of the row measured perpendicularly to the exposed face.

.3 Only gabions placed within specified lines and grades will be measured for payment.

.4 Where excavation required for gabions overlaps excavation required for other work, then payment for excavation will be made in accordance with the specification for the other work as though no excavation were required for gabions.

.5 Mass excavation and backfill, if required, shall be paid in accordance with Section 02224.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Gabion baskets:

.1 Fabricated so that sides, ends, lid and internal diaphragms readily assemble at site into rectangular baskets of sizes indicated.

.2 Single unit construction or with joints having strength and flexibility equal to that of mesh.

.3 When the length exceeds horizontal width, provide diaphragms of same mesh as gabion walls to divide basket into equal cells of a length not in excess of horizontal width.

.4 Wire mesh to be uniform hexagonal pattern wire woven in a triple twist pattern or welded wire with openings of approximately not greater than 80 x 100 mm and fabricated to be non-ravelling. Perimeter edges of mesh to be securely selvedged so that joints formed by tying selvedges are as strong as body of mesh.

.5 Wire to have following mechanical properties:

.1 Wire for mesh: 3.0 mm diameter
.2 Wire for selvedges: 3.8 mm diameter
.3 Wire for binding: 2.2 mm diameter
.4 Minimum tensile: 400 mPa strength
.5 Minimum elongation: 10 %
.6 Wire: hot dipped galvanized with a minimum of 250 g/m^2 and/or covered with a 0.5 mm thick polyvinyl chloride coating as specified in the MERX Schedule of Quantities and Prices.

.2 Stone fill:

.1 Stone to be hard, durable and abrasion resistant and such that it will not disintegrate from action of wetting and drying, wave action, freezing and thawing cycles.

.2 Stone to be minimum 100 mm to maximum 200 mm dimension unless otherwise specified.

3.2 PRODUCTION

.1 Gabions shall be so fabricated that the sides, ends, lid, base and diaphragms can be readily assembled at the construction site into rectangular baskets of the specified sizes. Gabions shall have all components interconnected in such a manner that the strength and flexibility at the point of connection is at least equal to that of the mesh.

.2 Where the length of the gabion exceeds its horizontal width, the gabion shall be divided by diaphragms, of the same mesh and thickness of steel wire as the body of the gabion, into equal cells whose length does not exceed the horizontal width. Diaphragms shall be secured in the proper position on the base section such that no additional tying will be required at this juncture.

.3 Gabions and gabion mats shall be supplied in the sizes and to dimensions indicated in the contract documents.

3.3 CERTIFICATION

.1 Gabions shall be accompanied by a certified report of tests showing that the products to be supplied meet the requirements of this specification, and by a statement of the system to be used in identifying the various sizes of gabions to be supplied.

.2 These requirements may be waived for subsequent supply, provided the supplier certifies that the gabions to be furnished are of the same specific material and manufactured as that covered by a certified report of the tests previously submitted and approved.

3.4 INSPECTION AND TESTING

.1 Notwithstanding the acceptance of certification, the Owner reserves the right to make inspections and tests, and at such times as the Owner may consider necessary to ensure that the materials supplied are in accordance with this specification.

.2 All materials failing to comply with the requirements of this specification shall be rejected.

.3 Rejection shall constitute automatic withdrawal of the Owner's approval. Applications for re-approval shall be substantiated by an up-to-date test report as required for certification.

3.5 SHIPPING AND MARKING

.1 Gabions shall be shipped folded flat in bundles each containing a uniform number of one size only, except as necessary to complete an order, and weighing not more than 230 kg.

.2 Bundles shall be clearly marked to show the size and number of gabions. In addition, each gabion shall be clearly coloured coded, or otherwise suitably identified, to indicate the size.

.3 Gabion mats shall be shipped in rolls of 30 m long, 2 or 3 m wide with ends, sides and dividers attached to base.

PART 4 EXECUTION

4.1 SITE PREPARATION

.1 All stumps, roots, debris, and loose boulders in excess of 100 mm in maximum dimension shall be removed and disposed off the right-of-way prior to placing of gabions. The necessary grading and excavation for

gabion structure shall be carried out to such lines and grades as indicated in the contract and as required to provide a smooth uniform gradient.

4.2 INSTALLATION

.1 Install gabions to lines and grades indicated or as directed by Owner.

.2 The foundation shall be excavated to an even finish and to the required grade.

.3 The contractor shall assemble gabions according to the manufacturer recommendations.

.4 The contractor shall unfold each gabion to the open position. The four corner edges shall be wired to secure the gabion shape. The edges of the diaphragms shall be wired to the gabions walls in the correct position.

.5 Each assembled gabion shall be securely wired to the adjacent gabions along the top and the vertical edges prior to placing of stone.

.6 In assembling individual units, the selvedges at the corners shall be bound together and the selvedges of diaphragms shall be bound directly to the fabric with binding wire. The binding wire, throughout the length of the selvedged, shall be tightly looped around every other mesh opening in such a manner that single and double loops are alternated. Loops shall be separated by a distance not greater than 100 mm.

.7 To achieve better alignment and finish, the contractor shall stretch gabions before filling.

.8 Where gabion units are grouped together in whatever configuration is called for in the contract, each unit shall be secured to adjoining units by binding along and throughout the length of each contacting selvedged edge, in a manner similar to that described for assembling individual units.

.9 Gabions shall be assembled so as to leave no wire ends projecting outside the basket on any exposed surface.

4.3 FILLING BASKETS

.1 On exposed faces of gabions, place stones by hand with flattest surfaces bearing against face mesh to produce a satisfactory alignment and appearance. The remaining rock is to be placed randomly by hand.

.2 After the first gabion in a row has been filled to provide the necessary weight, the remaining rock shall be placed only after the baskets have been stretched taut by means of a standard fence stretcher or by other means approved by the Owner and adjusted to proper alignment. Four or five gabions in a row may be stretched simultaneously.

.3 In order to prevent local deformation, when 0.91 m gabions or 0.46 m gabions are placed in rows, they shall be filled in stages. When the first basket has been filled, the second shall have been filled two-thirds of its depth and the third basket shall have been filled to one-third of its depth.

.4 Fill basket cells in lifts of 300 mm and connect opposite walls with two tie wires after each lift.

4.4 PLACING OF CONNECTING WIRES

.1 When a gabion has been filled to a depth of 0.23 m in the case of 0.46 m gabions or to a depth of 0.30 m in the case of 0.91 m gabions, two horizontal connecting wires, one in each direction, shall be placed. In the case of 0.91 m gabions, an additional horizontal connecting wire shall be placed in each direction at the end 0.60 m mark when the basket has been two-thirds filled. Connecting wires shall be looped around two adjoining mesh openings and shall be pulled hand tight.

.2 Where 0.46 m depth gabions are used for channelling or revetment, connecting wires are not necessary.

4.5 PLACING GABIONS

.1 Place baskets in position prior to filling with stones.

.2 Wire adjacent baskets together at corners so that joints are as strong as mesh.

.3 For underwater placement, gabions may be prefilled. Provide special devices to handle filled baskets without distortion and to place gabions in position. Connect adjacent basket together when in place using a diver.

4.6 SECURING LIDS

.1 When the basket has been filled, the lid shall be bent over by hand and with the use of a pinch bar, if necessary, inserted at intervals between the selvedges of the lid and the selvedges of the top and sides. The lid shall be pulled until the selvedges coincide and shall be secured to the front and ends by binding wire in a manner in accordance with subsection 4.2 of this specification.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for the supply and installation of various guide rail installation types together with the accompanying posts. Unless the type of guide rail installation is specified in the MERX Schedule of Quantities and Prices, the type of guide rail shall be in accordance with the applicable standard drawings for guide rail installation as outlined in the Standard Drawings Table of Contents. Where TI, Highway Specifications Book Standard Drawings are referenced in the Standard Drawings Table of Contents, guide rail shall be installed as per the corresponding Highway Standard Drawing.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications. This specification shall be read in conjunction with applicable standard drawings for guide rail installation as outlined in the Standard Drawings Table of Contents:

ASTM International

A123/A123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A153/A153M	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A307	Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 psi Tensile Strength
A780/A780M	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3))
F3125/F3125M	Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

CSA Group

G164	Hot Dip Galvanizing of Irregularly Shaped Articles
O80	Wood Preservation

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Standard Type Guide Rail with Additional Posts (Type “A”):

.1 Measurement for payment for the supply and installation of Standard Type Guide Rail, Guide Rail with Additional Posts, or Type "A" Guide Rail, as the case may be, shall be the length of that type of guide rail placed within the limits specified or designated by the Owner, measured in metres, rounded to one decimal place, measured end to end along the face of the straight railing and straight terminal sections, but not including the sloped and buried section.

.2 Standard Type Guide Rail (Type “B”):

.1 Measurement for payment for the supply and installation of Type "B" Guide Rail shall be the length of rail and terminal sections placed within the limits specified or designated by the Owner, measured in metres, rounded to one decimal place, measured straight end to straight end along one side only, but not including the sloped and buried section.

.3 Payment by the metre shall include in accordance with this specification:

.1 excavation of post holes,
.2 supply and install of all posts, rail sections, straight rail terminal sections, bolts, nuts, washers, spikes and nails, reflectors,
.3 the backfill of post holes, compaction of backfill,
.4 the disposal of waste material,
.5 the trimming of posts, the supply and application of wood preservative, and
.6 the cleaning, pre-treatment, and coating of steel rail with cold galvanizing compound where so required.

.4 Sloped and Buried Guide Rail Section:

.1 Measurement for payment for the supply and installation of the sloped and buried guide rail section associated with the Types “A” or “B” Guide Rail Systems above shall be by the each and include in accordance with this specification:
.2 excavation of post holes,
.3 supply and install of all posts, anchors, rail section, angled rail sections, bolts, nuts, washers, spikes and nails,
.4 the backfill of post holes, compaction of backfill,
.5 the disposal of waste material,
.6 the trimming of posts,

.7 the supply and application of wood preservative, and
.8 the cleaning, pre-treatment and coating of steel rail with cold galvanizing compound where so required.

.5 Where the guide rail structure is a composite of more than one type of guide rail installation, then measurement for payment shall be by the metre of each type of guide rail installation making up the composite.

.6 Measurement for payment for buried end sections will be by means of the number of buried end sections placed as directed by the Owner.

2.2 SUBMITTALS

.1 Submit in accordance with Section 01340.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for guide rail, wood, and coatings and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit product data and manufacturer's installation/application instructions for paints and coating products to be used.

.1 Submit WHMIS - SDS - Safety Data Sheets.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Newfoundland and Labrador, Canada.

2.3 ENVIRONMENTAL REQUIREMENTS

.1 Guide rail posts located in Protected Water Supply areas but outside the buffer zones indicated on the Section 39 Permit issued by ECC, Water Resources Management Division shall only be chromated copper arsenate (CCA) treated type.

.2 Guide rail posts located in Protected Water Supply areas but inside the buffer zones indicated on the Section 39 Permit issued by ECC, Water Resources Management Division shall be untreated.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Guide Rail

.1 Guide rail parts furnished under these specifications shall be interchangeable with similar parts, regardless of their source of manufacture.

.2 The rail elements shall consist of a corrugated steel W-beam with corrugations symmetrical about the horizontal axis and such that the edges and centre of the rail element may contact each post.

.3 The individual rail elements shall be of the Standard Type (W-beam) consisting of 2.75 mm thick (12 gauge) rail of length not less than 4125 mm, having post bolt slots 3810 mm apart centre to centre for Standard Type Guide Rail; and 1905 mm apart centre to centre for Guide Rail with Additional Posts.

.4 The rail metal shall be open hearth oxygen furnace or electric furnace steel having an elongation of not less than 12 per cent in 50 mm and shall withstand a cold bend, without cracking, or 180 degrees around a mandrel of a diameter equal to 2.5 times the thickness of the plate.

.5 The rail elements shall be hot-dip galvanized before or after fabrication. In accordance with ASTM A123/A123M or CSA G164.

.6 Rail element joints shall be capable of withstanding a tensile load of not less than 350 kN without failure. The rail element shall not deflect more than 140 mm when tested as a simple beam with the traffic face up and with a 8.9 kN load applied at the centre of a 3650 mm span through a 76 mm wide flat bearing.

.7 The quality of the work shall be equivalent to good commercial practice and all edges, bolt holes and surfaces shall be free of torn metal, burns, sharp edges and protrusions.

.8 Rail sections shall be supplied by the Contractor.

.9 Two (2) certified copies of mill test reports of each batch from, which the rail element is formed, shall be furnished to the Owner, if so required.

.2 Sloped and Buried Rail Section

.1 Angled rail sections shall be in accordance with the dimensions identified on the applicable standard drawings for guide rail installation as outlined in the Standard Drawings Table of Contents. The sections shall be shop fabricated from rail sections conforming to the requirements. No punching, cutting or welding will be permitted in the field.

.2 The weld shall be cleaned, pre-treated and coated with cold galvanizing compound as outlined.

.3 Where corrugated steel beam is cut with a saw, drilled, or welded, the beam shall be thoroughly cleaned with a wire brush to remove scale, rust, slag residue, weld splatter, etc. and wiped clean. The cleaned surface shall receive at least one application of metal

conditioner to de-oxidize, de-grease and phosphatize the metal surface to be treated if the surface is oily. Pre-mixed, ready-to-apply, liquid-zinc compound should be applied to the prepared, clean, dry metal surface. The cold-galvanizing compound must be of a type that imparts cathodic action against corrosion. The cold-galvanizing compound should have a minimum 50 mm overlap of the surrounding undamaged galvanized metal.

.4 Both metal conditioner and cold-galvanized compound must be approved by Underwriters Laboratories Inc. for component coatings - organic and shall be in accordance with ASTM A780/A780M. All materials must be applied in accordance with the manufacturer's instructions.

.5 The Contractor shall supply the angled sections.

.3 Rail Terminal Section

.1 Rail terminal sections shall be of the standard type, and in accordance with the applicable standard drawings for guide rail installation as outlined in the Standard Drawings Table of Contents. The metal and galvanizing shall be of the same thickness and quality as is stipulated for the rail sections.

.2 The Contractor shall supply the terminal sections.

.4 Fasteners

.1 All bolts, nuts and washers shall be in accordance with ASTM A307 or F3125/F3125M, except that rail splice bolts shall be button headed.

.2 Post bolts and splice bolts shall have shoulders of such shape and size that they fit into the bolt slot in the rails and thus prevent the bolt from turning.

.3 Post bolts shall be 16 mm diameter and 200 mm long for use with standard 150 mm x 150 mm posts, or 16 mm diameter and 250 mm long for use with 200 mm x 200 mm posts. The Contractor shall pay particular attention that post bolts be of sufficient length to accommodate the offset blocks as required.

.4 Post bolt washers for the back of posts shall be 45 mm in diameter and 4 mm thick.

.5 Bolts for anchors shall be 16 mm diameter and 350 mm long for use with standard 150 mm x 150 mm posts and anchors, or 16 mm diameter and 450 mm long for use with 200 mm x 200 mm posts and anchors. Washers shall be 45 mm round and 4 mm thick.

.6 Spikes for anchors shall be 125 mm galvanized spikes.

.7 Bolts, nuts, washers and other fittings shall be hot-dip galvanized in accordance with ASTM A153/A153M.

.8 The Contractor shall supply the bolts, nuts, washers and spikes.

.5 Signal Reflectors

.1 Silver signal reflectors and yellow signal reflectors shall be of size 75 mm x 100 mm. The contractor shall supply both types of signal reflector.

.2 Nails for securing signal reflectors, shall be supplied by the Contractor and shall consist of 30 mm galvanized flat head nails.

.6 New Posts and Anchors

.1 Timber for posts and anchors shall be sound, well-seasoned structural grade lumber.

.2 Only birch wood will be acceptable for 150 mm x 150 mm guide rail posts. Hemlock or other approved species will be acceptable for 200 mm x 200 mm guide rail posts.

.3 Posts shall have minimum dimensions of 150 mm x 150 mm x 2400 mm for “Standard Type Guide Rail” and for "Standard Type Guide Rail with Additional Posts".

.4 Anchors shall consist of either one piece of guide rail post cut 150 mm x 150 mm x 450 mm long, or two pieces of 38 mm x 140 mm x 450 mm lumber.

.5 After cutting to size, posts and anchors shall be pressure treated with wood preservation in accordance with CSA O80 Wood Preservation. The minimum weight of preservative retained per cubic metre of timber shall be 130 kg with empty cells.

.6 The Contractor shall supply all the required wood preservative treated posts and anchors.

.7 Wood Preservative

.1 Wood Preservative for use in treating field cut ends of posts shall be of the same type and chemical composition as that used in the original treatment.

.2 The Contractor shall supply the wood preservative.

.3 The minimum required depth of penetration of wood preservative shall be 13 millimetres. To determine penetration, a borer core shall be taken from 20 pieces in each charge. If 80 % of the borings meet the penetration requirements, the charge shall be accepted.

.4 Incising will normally be required. However, this requirement will be waived if specifications for both penetration and retention are satisfied.

.5 If requested by the Owner’s Representative, the Contractor shall provide penetration and retention test reports for the guide posts and guide rail posts supplied for the project.

PART 4 EXECUTION

4.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for guide rail installation in accordance with manufacturer's written instructions.

.1 Inform the Owner of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Owner.

4.2 INSTALLATION

.1 Galvanized materials shall be loaded, hauled and handled in such manner that galvanizing will not be damaged. All bare, abraded, and damaged surfaces shall be cleaned, pre-treated if required and coated with cold galvanizing compound as outlined above.

.2 Guide rail shall be placed to the lengths, lines and grades set by the Owner. Except where directed otherwise by the Owner, the guide rail shall be installed in accordance with the applicable standard drawings for guide rail installation as outlined in the Standard Drawings Table of Contents.

.3 A sloped rail section shall be placed at each end of a run of guide rail unless directed otherwise by the Owner.

.4 The end post at an angled rail section shall have an anchor secured to the bottom of the post.

.5 Where a 150 mm x 150 mm x 450 mm timber anchor is used it shall be secured to the post by means of a galvanized nut and 16 mm diameter bolt 350 mm long together with two 45 mm round 4 mm thick galvanized washers.

.6 Where a double 38 mm x 140 mm x 450 mm lumber anchor is used it shall be secured to the post by means of four 125 mm galvanized spikes.

.7 Field boring and cutting to length of anchors will be permitted, provided that the hole is treated with two coats of wood preservative before driving the bolts and provided that the cut end is treated with two coats of wood preservative before burying.

.8 The Contractor shall excavate holes for the posts such that when placed in the holes the bottom of the posts are at least 1500 mm below the ground surface.

.9 Posts shall be set plumb and to the established lines and grades and shall be placed at 3810 mm intervals, unless directed otherwise by the Owner.

.10 The posts shall be firmly backfilled with selected material, free of large rock, placed in layers of thickness not greater than 100 mm. Each layer shall be thoroughly compacted before the next layer is placed. Should the backfill be dry then each layer shall be moistened before tamping.

.11 All backfill shall be compacted to 95 % of Standard Proctor Density (ASTM D698).

.12 All excavated waste material shall be disposed of along the sides of fill, or in other locations as directed by the Owner.

.13 The rails shall be secured to even lines such that the centre of the rail is 635 mm above the edge of pavement or road surface.

.14 The Contractor shall bore holes in the posts for the post bolts and treat the holes with two coats of wood preservative before driving the bolts.

.15 Rail elements and terminal sections shall be lapped so that the exposed ends will not face approaching traffic.

.16 The bolted connections of the rail element to the post shall be capable of withstanding a 22.5 kN pull at right angles to the lines of the railing.

.17 When the attachment of the rail elements to the posts has been completed, the tops of the posts shall be cut to a point 75 mm above the top of the rail as shown in the applicable standard drawings for guide rail installation as outlined in the Standard Drawings Table of Contents. The tops of the posts shall be treated with two coats of wood preservative after cutting.

.18 Signal reflectors shall be attached to posts at terminal sections, posts at the welded angled sections, and to every fourth post in a length of guide rail. Silver reflectors shall be placed facing oncoming traffic and yellow reflectors shall be placed on the opposite side except for on divided highway.

.19 On divided highway, silver reflectors shall be placed facing oncoming traffic on the outside shoulder and yellow reflectors shall be placed facing traffic on the median shoulder.

.20 The Contractor shall drill nail holes in the reflectors, bend the reflectors to the required shape and secure the reflectors with 30 mm galvanized flat head nails as shown in the applicable standard drawings for guide rail installation as outlined in the Standard Drawings Table of Contents.

4.3 PAINTING AND TOUCH-UPS

.1 Galvanized steel touch-ups:

.1 Clean damaged surfaces with wire brush removing loose and cracked coatings.

.1 Apply two (2) coats of organic zinc-rich paint to damaged areas.

.2 Pre-treat damaged surfaces in accordance with manufacturer's written recommendations for zinc-rich paint.

.3 Painted steel:

.1 Apply one (1) coat of primer and two (2) coats of finish paint to exposed surface.

.4 Painted posts and any offset blocks:

.1 Apply two (2) coats of paint to exposed surfaces of posts and any offset blocks.

4.4 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01710.

.2 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools and equipment in accordance with Section 01710.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

.2 Payment at the contract price for the Supply and Installation of Guide Rail of a particular type shall be compensation in full for all labour, materials, and equipment to: excavate post holes, supply and install all posts, anchors, rail sections, rail terminal sections, modified end shoes, standard hazard markers, bolts, nuts, washers, spikes and nails, bend rail sections where required to a uniform radius, backfill post holes, compact backfill, dispose of surplus excavation material, trim posts, supply and apply wood preservative, install reflectors, clean, pre-treat, and coat steel rail with cold galvanizing compound where so required, all in accordance with this specification.

.3 Payment at the contract price for the Supply and Installation of buried end sections shall be compensation in full for all labour, materials, and

equipment to: excavate post holes, supply and install posts, anchors, buried end sections, bolts, nuts, washers, spikes and nails, backfill post holes, compact backfill, dispose of surplus excavation material, trim posts, supply and apply wood preservative, install reflectors, clean, pre-treat, and coat steel rail with cold galvanizing compound where so required, all in accordance with this specification.

This specification outlines the requirements for the salvage of an existing guide rail and posts from one location, and the reinstallation of the guide rail at another location using either the salvaged rail sections and posts, or the salvaged rail sections and new posts. Where Department of Transportation and Infrastructure (TI), Highway Design and Construction Division, Highway Specifications Book Standard Drawings are referenced in the Standard Drawings Table of Contents, guide rail shall be installed as per the corresponding Highway Standard Drawing.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications. This specification shall be read in conjunction with applicable standard drawings for guide rail installation as outlined in the Standard Drawings Table of Contents:

ASTM International

A153/A153M	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A307	Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength
D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3))
F3125/F3125M	Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

CSA Group

O80	Wood Preservation

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Measurement for payment for the Salvage and Reinstallation of Guide Rail, whether installed on New or Salvaged Posts, shall be the length of the reinstalled guide rail placed within the limits designated by the Owner, measured in metres, rounded to one decimal place, measured end to end along the face of the railing and terminal sections.

.2 No separate payment shall be made to the Contractor for the cost to:

.1 Dismantle and salvage the rail sections.
.2 Transport the rail sections and terminal sections to a secure storage site provided by the Contractor at their own expense.
.3 Excavate and salvage the guide rail posts.
.4 Transport the guide rail posts to a secure storage site provided by the Contractor at their own expense if required to be re-used or to a site designated by the Owner if new posts are to be provided.
.5 Store the rail sections and guide rail posts as required.
.6 Backfill and compact the excavation.
.7 Excavate holes for posts at the required new location.
.8 Supply new preserved wood posts and anchors.
.9 Transport the stored rail sections and rail terminal sections from the storage site to the place of installation.
.10 Supply the bolts, nuts, washers and spikes.
.11 Assemble and secure the anchors to the posts as required.
.12 Assemble the guide rail to the required lines and grade.
.13 Backfill post holes, compact backfill, dispose of excavated waste material, trim posts, supply and apply wood preservative to cut ends and drill holes, and install reflectors.

2.2 ENVIRONMENTAL REQUIREMENTS

.1 Guide rail posts located in Protected Water Supply areas but outside the buffer zones indicated on the Section 39 Permit issued by ECC, Water Resources Management Division shall only be chromated copper arsenate (CCA) treated type.

.2 Guide rail posts located in Protected Water Supply areas but inside the buffer zones indicated on the Section 39 Permit issued by ECC, Water Resources Management Division shall be untreated.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Rail Sections, Sloped and Buried Rail Sections, and Rail Terminal Sections

.1 Only salvaged rail sections, sloped and buried rail sections, and rail terminal sections deemed acceptable by the Owner shall be used in the re-assembly.

.2 Fasteners

.1 All bolts, nuts and washers shall be in accordance with ASTM A307 or F3125/F3125M, except that rail splice bolts shall be button headed.
.2 Post bolts and splice bolts shall have shoulders of such shape and size that they fit into the bolt slots in the rails and thus prevent the bolt from turning.
.3 Post bolts shall be 16 mm diameter and 200 mm long for use with standard 150 mm x 150 mm, or 16 mm diameter and 250 mm long for use with 200 mm x 200 mm posts.
.4 Post bolt washers for the back of the post shall be 45 mm round and 4 mm thick.
.5 Bolts for anchors shall be 16 mm diameter and 350 mm long for use with standard 150 mm x 150 mm posts and anchors, or 16 mm diameter and 450 mm long for use with 200 mm x 200 mm posts and anchors. Washers shall be 45 mm round and 4 mm thick.
.6 Spikes for anchors shall be 125 mm galvanized spikes.
.7 Bolts, nuts, washers and other fittings shall be hot-dip galvanized in accordance with ASTM A153/A153M.
.8 The Contractor shall supply the bolts, nuts, washers and spikes.
.9 Should any of the salvaged bolts, nuts and washers be suitable for re-use, then the Contractor may use these components.

.3 Signal Reflectors

.1 Silver signal reflectors and yellow signal reflectors shall be of size 75 mm x 100 mm. Reflectors to be supplied by the Contractor.
.2 Nails for securing signal reflectors, shall be supplied by the Contractor and shall consist of 30 mm galvanized flat head nails.

.4 New Posts and Anchors

.1 Timber for new posts and anchors shall be sound, well-seasoned structural grade lumber.
.2 Only birch wood will be acceptable for 150 mm x 150 mm guide rail posts. Hemlock or other approved species will be acceptable for 200 mm x 200 mm guide rail posts.
.3 Posts shall have minimum dimensions of 150 mm x 150 mm x 2400 mm for “Standard Type Guide Rail” and for "Standard Type Guide Rail with Additional Posts".
.4 Anchors shall consist of either one piece of 150 mm x 150 mm x 450 mm timber, or two pieces of 38 mm x 140 mm x 450 mm lumber.
.5 After cutting to size, posts and anchors shall be pressure treated with wood preservative in accordance with CSA O80 Wood Preservation. The minimum weight of preservative retained per cubic metre of timber shall be 130 kg with empty cells.

.6 Where the contract item is given as "Salvage and Reinstallation of Guide Rail On New Posts" then, the Contractor shall supply all the required wood preservative treated new posts and anchors.

.5 Re-usable Posts and Anchors

.1 Only salvaged posts and anchors deemed acceptable by the Owner shall be used in the re-assembly, and then only if the contract item is given as, "Salvage and Reinstallation of Guide Rail On Salvaged Posts". Where the contract item is given as, "Salvage and Reinstallation of Guide Rail On New Posts" then, salvaged posts shall not be used.

.6 Wood Preservative

.1 Wood preservative for use in treating field cut ends of posts shall be of the same type and chemical composition as that used in the original treatment.
.2 The Contractor shall supply the wood preservative.
.3 The minimum required depth of penetration of wood preservative shall be 13 mm. To determine penetration, a borer core shall be taken from 20 pieces in each charge. If 80 % of the borings meet the penetration requirements, the charge shall be accepted.
.4 Incising will normally be required. However, this requirement will be waived if specifications for both penetration and retention are satisfied.
.5 If requested by the Owner’s Representative, the Contractor shall provide penetration and retention test reports for the guide posts and guide rail posts supplied for the project.

PART 4 EXECUTION

4.1 DISMANTLING OF EXISTING GUIDE RAIL

.1 The Contractor shall exercise care in dismantling and removing rails and terminal sections so that they are not damaged and remain suitable for re-use. The rails and terminal sections shall be transported to, and stored at, a secure storage site provided by the Contractor at their own expense, pending their re-assembly at a new location.

.2 Should any material, designated for reinstallation or just salvage, be damaged or lost by the Contractor, then the Contractor shall be charged with the costs of replacement with equivalent new material. Damaged material shall become the property of the Contractor and shall be disposed of.

4.2 REMOVAL AND SALVAGE OF EXISTING POSTS

.1 The Contractor shall exercise care in excavating posts so that they are not damaged and remain suitable for re-use.

.2 Where the contract item is given as, "Salvage and Reinstallation of Guide Rail On Salvaged Posts", then the posts shall be transported to, and stored at a location designated by the Owner.

.3 Where the contract item is given as, "Salvage and Reinstallation of Guide Rail On Salvaged Posts", then the posts shall be transported to and stored at, a secure storage site provided by the Contractor at their own expense pending their re-use at a new location.

.4 Should any post designated for salvage and reinstallation, be damaged or lost by the Contractor, then the Contractor shall be charged with the cost of replacement. Damaged posts shall become the property of the Contractor and shall be disposed of.

4.3 BACKFILLING POST HOLES

.1 The Contractor shall backfill to the required grade using the excavated materials if suitable. Should the excavated material be unsuitable, or should there be insufficient suitable backfill material from the excavation, then the Owner will direct that material from a cut or borrow area will be used to complete the backfilling.

.2 Backfill shall be placed in layers not exceeding 200 mm in thickness loose measurement. Each layer shall then be compacted to the required compaction before a further layer is placed.

.3 Backfill consisting of other material or other material borrow shall be compacted to not less than 95 % of the Standard Proctor Density (ASTM D698).

.4 In rock backfill material where Standard Proctor test cannot be carried out, compaction shall be continued until a compaction is achieved that is equivalent to that obtained in a fill when there is no visible movement of fill under a vibrating vibratory compactor with vibratory roller of length not less than 1.5 metres.

.5 The backfilled hole or trench shall be levelled and trimmed to provide sightly contours and adequate drainage.

4.4 INSTALLATION

.1 The guide rail sections, sloped and buried rail sections, terminal rail sections and posts shall be transported to the location where they are required.

.2 Guide rail shall be placed to the lengths, lines and grades set by the Owner. The guide rail shall be installed in accordance with the applicable standard drawings as outlined in the Standard Drawings Table of Contents, except where directed otherwise by the Owner.

.3 A sloped and buried rail section shall be placed at each end of a run of guide rail unless directed otherwise by the Owner.

.4 The end post at a sloped and buried rail section shall have an anchor secured to the bottom of the post.

.5 Where a 150 mm x 150 mm x 450 mm timber anchor is used it shall be secured to the post by means of a galvanized nut and 16 mm diameter bolt 350 mm long together with two 45 mm round 4 mm thick galvanized washers.

.6 Where a double 38 mm x 140 mm x 450 mm lumber anchor is used it shall be secured to the post by means of four 125 mm galvanized spikes.

.7 Field boring and cutting to length of anchors will be permitted, provided that the hole is treated with two coats of wood preservative before driving the bolts and provided that the cut end is treated with two coats of wood preservative before burying.

.8 Where the contract item is given as, "Salvage and Reinstallation of Guide Rail On Salvaged Posts" then, posts with the original anchors may be used provided that the anchor is sound. Should the anchor have been damaged during salvage then the Contractor shall replace the anchor on the post using new materials at their own expense.

.9 The Contractor shall excavate holes for the posts such that when placed in the holes the bottom of the posts are at least 1500 mm below the ground surface.

.10 Posts shall be set plumb and to the established lines and grades and shall be placed at 3810 mm intervals, unless directed otherwise by the Owner.

.11 The posts shall be firmly backfilled with selected material, free of large rock, placed in layers of thickness not greater than 100 mm. Each layer shall be thoroughly compacted before the next layer is placed. Should the backfill be dry then each layer shall be moistened before tamping.

.12 All backfill shall be compacted to 95 % of Standard Proctor Density (ASTM D698).

.13 All surplus excavated material shall be disposed of along the sides of fill, or in other locations as directed by the Owner.

.14 The rails shall be secured to even lines such that the centre of the rail is 635 mm above the edge of pavement or road surface.

.15 The Contractor shall bore holes in the posts for the post bolts and treat the holes with two coats of wood preservative before driving the bolts.

.16 Rail elements and terminal sections shall be lapped so that the exposed ends will not face approaching traffic.

.17 The bolted connections of the rail, element to the post shall be capable of withstanding a 22.5 kN pull at right angles to the lines of the railing.

.18 When the attachment of the rail elements to the posts has been completed, the tops of the posts shall be cut to a point 75 mm above the top of the rail in accordance with the applicable standard drawings as outlined in the Standard Drawings Table of Contents. The tops of the posts shall be treated with two coats of wood preservative after cutting.

.19 Signal reflectors shall be attached to posts at terminal sections, posts at the welded angled sections, and to every fourth post in a length of guide rail. Silver reflectors shall be placed facing oncoming traffic and yellow reflectors shall be placed on the opposite side except for divided highway.

.20 On divided highways, silver reflectors will be placed facing oncoming traffic on the outside shoulder and yellow reflectors will be placed facing traffic on the median shoulder.

.21 The Contractor shall drill nail holes in the reflectors, bend the reflectors to the required shape and secure the reflectors with 30 mm galvanized flat head nails in accordance with the applicable standard drawings as outlined in the Standard Drawings Table of Contents.

.22 When reinstalling salvaged posts, the original reflectors shall be removed and new reflectors shall be attached.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

.2 Payment at the contract price for Salvage and Reinstallation of Guide Rail on New Posts, shall be compensation in full for all labour, materials and use of equipment to: dismantle the rail sections, transport the rail sections and terminal sections to a secure storage site provided by the Contractor

at their own expense, store the rail sections, excavate and salvage the guide rail posts and transport them to the nearest Department Depot, backfill and compact the excavation, excavate holes for posts at the required new location, supply new preserved wood posts and anchors, transport the stored rail sections and rail terminal sections from the storage site to the place of installation, supply the bolts, nuts, washers and spikes, assemble and secure the anchors to the posts, assemble the guide rail to the required lines and grade, bend rail sections where required to a uniform radius, backfill post holes, compact backfill, dispose of surplus excavation material, trim posts, supply and apply wood preservative to cut ends and drill holes, and install reflectors.

.3 Payment at the contract price for Salvage and Reinstallation of Guide Rail with Salvaged Posts, shall be compensation in full for all labour, materials and use of equipment to: dismantle the rail sections, excavate and salvage the guide rail posts, transport the rail parts and posts to a secure storage site provided by the Contractor at their own expense, store the rail parts and posts, backfill and compact the excavation, excavate holes for posts at the required new location, transport the stored rail parts and posts from the storage site to the place of installation, supply the bolts, nuts, washers and spikes, supply assemble, and secure new anchors where the original anchors are damaged, assemble the guide rail to the required lines and grade, bend rail sections where required to a uniform radius, backfill post holes, compact backfill, dispose of surplus excavation material, trim posts, supply and apply wood preservative to cut ends and drill holes, remove original reflectors, and install new reflectors.

.4 Payment at the contract price for Salvage of Guide Rail, shall be compensation in full for all labour, materials and use of equipment to: dismantle the rail sections, salvage all suitable hardware, excavate and salvage the guiderail posts and transport the rail sections, hardware and posts to the nearest Department Depot and stockpile the salvaged materials as directed.

This specification outlines the requirements for the supply and installation of pedestrian hand railing constructed of steel pipe complete with steel pipe posts. Locations shall be as shown on the drawings or as directed by the Owner.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications. This specification shall be read in conjunction with applicable standard drawings for handrail installation as outlined in the Standard Drawings Table of Contents:

ASTM International

A53/53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 The unit of measurement shall be in linear metres as measured along the top rail between the centres of the posts for each detail and type of footing or connection detail indicated and shall include installation and painting.

.2 The form and dimensions of the handrail shall conform to those given in the drawings. The length shall be as required to suit the particular site conditions. The contractor shall vary the spacing of the posts such that the spacing is uniform throughout the length of the rail.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Where a pedestrian path is adjacent to the handrail location, the MI 04170 drawing shall be used unless otherwise directed by the Owner. Posts and rails shall consist of 50 mm inside diameter galvanized schedule 40 steel pipe in accordance with ASTM A53/53M.

.2 Where there is no pedestrian path adjacent to the handrail location, the Highway Design and Construction Form 1216-1 detail shall be used unless otherwise directed by the Owner.

.3 The railing shall be pre-fabricated before erection. Joints between rails and posts shall be made by cutting and fitting to ensure complete contact.

.4 Joints shall be welded.

.5 Welds and surrounding heat-damaged areas shall be galvanized after fabrication or otherwise protected from corrosion with a zinc base coating.

.6 Railing shall be delivered to the site complete and ready for erection.

PART 4 EXECUTION

4.1 INSTALLATION

.1 Holes for posts shall be drilled or preformed in concrete walls, walks, steps, sidewalks or headwalls as required.

.2 Posts shall be embedded in cement grouts in accordance with the bedding detail in the drawings.

.3 After installation, posts and rails shall be prepared and painted as follows:

.1 Clean galvanize steel with a metal conditioner as specified.
.2 Prime steel with one coat of zinc oxide primer as specified.
.3 Paint steel with two coats of exterior enamel in colour specified by the Owner.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for constructing sub-drains with granular filter material to lines and grades indicated or directed.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure (TI), Highway Design and Construction Division, Highway Specifications Book:

Section 420.02.01	Supply and Installation of Pipe for Storm Sewers and Perforated Pipe for Sub-Drainage: Aluminized & Polymer Laminated Steel Pipe Materials

CSA Group

B137	Thermoplastic Pressure Piping Compendium
B1800	Thermoplastic Nonpressure Piping Compendium

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Excavation and backfill will be measured in accordance with Section 02223.

.2 Bedding gravel and filter material will be measured in cubic metres of material incorporated into work to specified paylines indicated in the Contract Documents. No deduction to be made for volume occupied by drain.

.3 Supply and installation of sub-drains will be measured horizontally from centre to centre of maintenance holes or catchbasins over surface after work has been completed, in metres, for each type and size installed. In cases where drain is not connected to maintenance holes or catchbasins, measurement will be actual length in place.

.4 Filter Fabric will be paid in accordance with Section 02897.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Perforated corrugated steel pipe to meet following requirements:

.1 In accordance with TI, Highway Specifications Book, Section 420.02.01.
.2 Asphalt coated, type AC or galvanized corrugated steel pipe.
.3 Metal thickness unless otherwise indicated:

Diameter (mm)	Thickness of Metal (mm)
150 to 200	1.2
250 to 300	1.6

.2 Plastic pipe and fittings: in accordance with CSA B137, nominal inside diameter 100 mm.

.3 High-Density Polyethylene pipe: CSA B137.

.4 Perforated plastic pipe and fittings in accordance with CSA B1800.

.5 Bedding gravel or crushed stone; hard, durable particles, graded evenly in size from 16 mm to 18 mm.

.6 Granular filter material to meet following requirements:

ASTM Sieve (mm)	% Passing
10.00	100
5.00	95–100
2.50	80–100
1.25	50–90
0.630	25–65
0.315	10–35
0.160	1–10

PART 4 EXECUTION

4.1 TRENCHING

.1 Do excavating, trenching and backfilling in accordance with Section 02223.

.2 Do not place bedding or filter material prior to approval of excavation.

4.2 BEDDING

.1 Place 100 mm layer of bedding material as indicated and compact to minimum 95 % of corrected maximum dry density.

4.3 INSTALLATION

.1 Lay drains on prepared bed, true to line and grade with inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with bed throughout full length.

.2 Commence laying at outlet and proceed in upstream direction. Lay perforated pipes with perforations downwards at angels indicated on the drawings. Make joints tight in accordance with manufacturer's instructions. Do not allow water to flow through pipes during construction except as approved. Make watertight connections to existing drains, new or existing maintenance holes and catch basins where indicated or as directed. Surround and cover drain with filter material in uniform 150 mm layers to an elevation of at least 150 mm above top of drain and compact to at least 95 % of corrected maximum dry density.

.3 Backfill remainder of trench in accordance with Section 02223.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

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This specification outlines the requirements for constructing pipe culverts and culvert extensions and includes the requirements for excavation, bedding and placing of the pipe, and backfilling operations. This specification does not outline the requirements for the supply and installation of structural plate pipe or pipe arch.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

American Association of State Highway and Transportation Officials (AASHTO)

M36	Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains
M196	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
M274	Standard Specification for Steel Sheet, Aluminum Coated (Type 2), for Corrugated Steel Pipe
M294	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60- in.) Diameter

ASTM International

A760/A760M	Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
A762/A762M	Standard Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
A929/A929M	Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
B209/B209M	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
B745/B745M	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12400 ft-lbf/ft^3 (600 kN-m/m3))
D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
D3350	Standard Specification for Polyethylene Plastics Pipe and

Fittings Materials

CSA Group

A179	Mortar and Grout for Unit Masonry
A257	Standards for Concrete Pipe and Manhole Sections
A3000	Cementitious Materials Compendium
B1800	Thermoplastic Nonpressure Piping Compendium
G401	Corrugated Steel Pipe Products

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Supply and installation of pipe culvert including couplings, will be measured in metres in place for each size, thickness and class of pipe. Measurement to be made over surface after work has been completed.

.2 Excavating, backfill and bedding for road and driveway culverts will be measured and paid in accordance with Section 02223.

.3 Where Rip-rap is required for driveway culverts, measurement for payment shall be made in accordance with Section 02270.

.4 Measurement for payment for water tight cut-off collars, prefabricated end sections, and debris racks where indicated on the contract drawings, shall be paid by the each. Cast in place concrete headwalls shall be measured and paid by the cubic meter. Handrails shall be measured and paid in accordance with Section 02284.

PART 3 PRODUCTS

3.1 ALUMINIZED STEEL PIPE

.1 Aluminized corrugated steel pipe, couplers, wyes, tees, bends, adapters, nuts and bolts shall conform to the requirements of the most recent revisions of the following specifications: AASHTO M274, AASHTO M36, ASTM A760/A760M, ASTM A762/A762M, ATSM A929/A929M and CSA G401. Wall thickness as specified by the Owner in the MERX Schedule of Quantities and Prices, but not less than:

Pipe diameter (mm)	Wall thickness (mm)	Corrugation
100–500	1.6	Any
600–1200	2.0	Any
1400–1800	2.0	76 mm x 25 mm helical corrugation
2000–2400	2.8	76 mm x 25 mm helical corrugation 125 mm x 25 mm annual corrugation

.2 Provide water-tight cut-off collars as indicated on the contract drawings.

.3 Prefabricated end sections, wing walls as indicated on the contract drawings.

3.2 ALUMINIZED TYPE-2 PIPE

.1 Aluminized corrugated steel pipe, couplers, wyes, tees, bends, adapters, nuts and bolts shall conform to the requirements of the most recent revisions of the CSA G401 specification. Wall thickness as specified by the Owner in the MERX Schedule of Quantities and Prices, but not less than:

Pipe diameter (mm)	Wall thickness (mm)	Corrugation
150–500	1.6	Any
600–1200	2.0	63 mm x 13 mm helical
1400–1800	2.0	125 mm x 25 mm helical
2000–2400	2.8	125 mm x 25 mm helical
2700–3600	3.5	125 mm x 25 mm helical

.2 Provide water-tight cut-off collars as indicated on the contract drawings.

.3 Pre-fabricated end sections, wing walls as indicated on the contract drawings.

3.3 POLYMER LAMINATE PIPE

.1 Polymer laminate corrugated steel pipe, couplers, wyes, tees, bends, adapters, nuts, and bolts shall conform to the requirements of the most recent revisions of the CSA G401specification. Wall thickness as specified by the Owner in the MERX Schedule of Quantities and Prices, but not less than:

Pipe diameter (mm)	Wall thickness (mm)	Corrugation
150–500	1.6	Any
600–1200	2.0	63 mm x 13 mm helical
1400–1800	2.0	125 mm x 25 mm helical
2000–2400	2.8	125 mm x 25 mm helical
2700–3600	3.5	125 mm x 25 mm helical

.2 Provide water-tight cut-off collars as indicated on the contract drawings.

.3 Pre-fabricated end sections, and wing walls as indicated on the contract drawings.

3.4 ALUMINUM PIPE

.1 Corrugated Aluminum Pipe and couplers shall be manufactured from coil alloy Alcad 3004-H34 with 7072 cladding and conform with the latest revisions of the following specifications: AASHTO M19692, ASTM B745/B745M, ASTM B209 / B209M. Wall thickness as specified by the Owner in the MERX Schedule of Quantities and Prices, but not less than:

Pipe diameter (mm)	Wall thickness (mm)	Corrugation
300–1000	1.91	Any
1200–1800	2.67	76 mm x 25 mm helical
2000–2400	3.43	76 mm x 25 mm helical

.2 Contact pipe manufacturer for recommended wall thickness on pipe diameters larger than 2400 mm.

.3 Provide water-tight cut-off collars as indicated on the contract drawings.

.4 Pre-fabricated end sections, wing walls as indicated on the contract drawings.

.5 Corrugated aluminum pipe shall be acceptable for use in salt water environments.

3.5 CONCRETE PIPE MATERIALS

.1 Non-reinforced concrete pipe: CSA A257 for Class II strength.

.2 Reinforced concrete pipe: CSA A257 Class II strength.

.3 Rubber gaskets for joints: CSA A257.

.4 Bituminous joint filler: ASTM D1751.

.5 Cement mortar joint filler:

.1 Portland cement: CSA A3000.
.2 Sand: CSA A179.
.3 Mortar to be one part by volume of cement to two parts of clean, sharp sand mixed dry. Add sufficient water after mixing to give optimum consistency for hand application.

3.6 PLASTIC PIPE MATERIALS

.1 Couplers and plastic pipe, consisting of corrugated polyethylene pipe, shall be of a type, size and strength acceptable to the Owner and in accordance with AASHTO M294, ASTM D3350 and CSA B1800. The Contractor shall provide the plastic pipe and couplers.

3.7 GRANULAR BEDDING AND BACKFILL

.1 Granular bedding and backfill material: Bedding and gravel or sand containing no particles larger than 50 mm and not more than 10 % passing 0.075 mm sieve, unless otherwise specified. Material to be free of snow and frozen lumps. Bedding material shall not be placed on a frozen earth grade.

PART 4 EXECUTION

4.1 TRENCHING AND BACKFILL

.1 Do trenching and backfill work in accordance with Section 02223.

.2 Trench line and depth requires the Owner's approval prior to placing bedding material or pipe.

.3 Do not backfill until pipe grade and alignment checked and accepted by the Owner.

4.2 DEWATERING

.1 The Contractor shall provide, at their own expense, all means of keeping the excavations free from water which affects the satisfactory placing of the pipe.

4.3 BEDDING

.1 Place minimum thickness of 150 mm of approved granular material on bottom of excavation and compact to minimum 95 % of Corrected Maximum Dry Density.

.2 Shape bedding to fit lower segment of pipe exterior so that a width of at least 50 % of pipe diameter is in close contact with bedding and to camber indicated or directed, free from sags or high points.

4.4 LAYING ALUMINIZED STEEL PIPE

.1 Commence pipe placing at downstream end. Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length. Lay pipe with the inside circumferential laps facing downstream and longitudinal laps shall be located in the upper half of the pipe. Do not allow water to flow through pipes during construction except as permitted by the Owner.

4.5 JOINING ALUMINIZED STEEL CULVERTS

.1 Match corrugations or indentations of coupler with pipe sections before tightening. Tap couplers firmly as they are being tightened, to take up slack and ensure a snug fit. Insert and tighten bolts.

4.6 LAYING CONCRETE PIPE CULVERTS

.1 Begin at downstream end of culvert with female end of first pipe section facing upstream. Ensure barrel of each pipe is in contact with shaped bed throughout its length. Do not allow water to flow through pipes during construction except as permitted by the Owner.

4.7 JOINING CONCRETE PIPE CULVERTS

.1 Joints may be made with rubber gaskets, Concrete Pipe bituminous jointing compound or Portland cement mortar where a specific joint type is not otherwise specified.

.1 Rubber gasket joints:

.1 Install to manufacturers recommendations.
.2 Ensure that male ends are fully entered into female ends.

.2 Bituminous filled joint.

.1 Make joint with an excess of filler to form a continuous bead around outside of pipe and finish smooth on inside.

.2 Mortar joints.

.1 Prepare mortar as specified herein.
.2 Clean pipe ends and wet with water before joint is made.
.3 Place mortar in lower half of female end of pipe section in place.
.4 Apply mortar to upper half of male end of pipe section being installed.

.5 Join pipe ends and force joint up tight, taking care to ensure inner surfaces of abutting pipe sections are flush and even.
.6 Clean inside of pipe and annular space between ends of pipes after each joint is made.
.7 Fill joint with mortar and finish smooth and even.
.8 For pipes 800 mm or less in diameter fill joints before mortar in joints has set.
.9 For pipes over 800 mm in diameter postpone filling joint until backfilling has been completed. Re-clean joints before applying mortar.

4.8 LAYING PLASTIC PIPE CULVERTS

.1 Commence pipe placing at downstream end. Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length. Do not allow water to flow through pipes during construction except as permitted by the Owner.

.2 Plastic pipe shall be laid on a bed of 150 mm granular bedding material. Where excavation for foundation is required, the excavation shall be to 150 mm below the proposed invert elevations so that granular bedding material may be placed to provide a bed for the culvert. The granular bedding material shall be placed and shaped to conform to the underside of the culvert, and graded so as to provide a uniformly firm bed throughout the length of the culvert.

.3 The cover shall not be less than the manufacturer's recommended minimum cover.

4.9 JOINING PLASTIC PIPE CULVERTS

.1 Plastic pipe culverts shall be joined with couplers recommended by the manufacturer of the pipe being installed.

4.10 BACKFILLING

.1 Backfill around and over culverts as indicated or as directed.

.2 Place approved backfill material in 150 mm layers to full width, alternately on each side of culvert so as not to displace it.

.3 Compact each layer to 95 % of Corrected Maximum Dry Density in accordance with ASTM D698, taking special care to obtain required density under haunches.

.4 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross during construction of

project. Width of fill, at its top, to be at least twice the diameter or span of pipe and with slopes not steeper than 1:2.

.5 For driveway culverts minimum cover shall be as directed by the Owner.

.6 Frozen materials are not acceptable as backfill or cover material.

4.11 PROTECTION FROM TRAFFIC

.1 Prior to allowing the movement of construction equipment or any vehicular traffic over the completed structure, the depth of backfill over the culvert shall be at least equal to the minimum required for protection as specified in the contract.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for constructing, cleaning, deepening, widening and relocating water channels, other than those ditches that are contiguous with main grading operations, to design lines, grades, dimensions and typical cross sections shown on plans or established by the Owner.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Channel excavation for new channels will be measured in cubic metres in the original location.

.1 Channel Excavation (Rock): Volume of rock excavated will be calculated from cross-sections of original rock surfaces, design grade and typical cross-sections as shown on the Contract Drawings.

.2 Channel Excavation (Common): will be measured in cubic metres to theoretical paylines.

.2 Where depth indicated on the Contract Drawings or directed by the Owner is less than 300 mm below original rock surface, depth excavated for measurement purposes will be taken as 300 mm.

.3 Cleaning and deepening of existing channels will be measured in metres of channel.

PART 3 PRODUCTS

3.1 NOT APPLICABLE.

PART 4 EXECUTION

4.1 EXCAVATION

.1 Excavate to design lines, grades and cross-sections indicated.

.2 Deepen existing channels to design lines, grades and cross-sections indicated and clean channel bottom of debris and roots.

.3 Do not place excavated materials adjacent to channel in a manner that will impede flow of surface water from adjacent land.

.4 Upon completion of excavation, clean and trim site.

.5 Dispose of excavated materials as directed by the Owner.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for supply of timber and necessary fastenings, fabrication, placing and ballasting of timber cribwork as specified.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

A307	Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 psi Tensile Strength

CSA Group

B111	Wire Nails, Spikes and Staples
G40.20/G40.21	General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
G164	Hot Dip Galvanizing of Irregularly Shaped Articles
O80	Wood Preservation

Other

Regulations of the Canadian Lumber Standards Accreditation Board

Timber Design Manual 1974 issued by Laminated Timber Institute of Canada

The National Lumber Grades Authority (NLGA)

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Timber cribwork will be measured in cubic metres of completed work including rock ballast as specified in the Contract Documents.

.2 Cubic measure of cribs will be determined by product of following dimensions measured in place:

.1 Height: average of measurements taken at each vertical from bottom of lowest timber to top side of uppermost course of timber.

.2 Width: average of measurements between outside faces of exterior longitudinal timbers, each width measured on top ties of each row of cross ties.

.3 Length: measured horizontally along centre-line of crib between outside faces of exterior cross ties.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Timber: use timber graded and stamped in accordance with applicable grading rules and standards of associations or agencies approved to grade lumber by the Regulations of the Canadian Lumber Standards Accreditation Board.

.2 Species: Douglas Fir Group A.

.3 Grade: No. 1 Structural

.4 Grading authority: The National Lumber Grades Authority (NLGA)

.5 Preservative treatment: CSA CAN / CSA O80 Series-08:21.

.1 For fresh water cribwork no wood preservative shall be used.
.2 For salt water cribwork treat in accordance with CSA CAN / CSA O80 Series-08:21, with the following minimum assay retentions: Waterborne preservatives 24 kg/m^3, oil-borne preservatives 30 kg/m^3.

.6 Miscellaneous steel:

.1 Hot dip galvanized: to CAN/CSA-G164
.2 Wire nails, spikes, staples: CSA B111.
.3 Bolts, nuts, washers: to ASTM A307.
.4 Ogee washers: Timber Design Manual 1974 issued by Laminated Timber Institute of Canada, and as follows: ogee washers to be of cast iron free from injurious defects or impurities.
.5 Steel straps and plates: CSA G40.20/G40.21 Grade 350W.
.6 Drift bolts: CSA G40.20/G40.21 from round stock, button head and diamond or wedge point.

.7 Ballast stone for filling cribs: minimum dry bulk density in place of 2600 kg per cubic metre. Supply hard durable quarry stone containing no organic material, silt, clay or foreign substances. Ballast stone to be well graded with maximum sizes not exceeding 200 mm and not more than 10 % of material by mass passing 25 mm sieve.

PART 4 EXECUTION

4.1 PREPARATION

.1 Dredge area of crib base to elevations shown on the contract drawings.

.2 Before construction provide sufficient ballast to completely fill cribs.

.3 Take closely spaced accurate soundings 1500 mm centre to centre or less precisely located by template to determine actual slope of base area of crib and construct crib bottom to match base slope.

4.2 CRIB CONSTRUCTION

.1 Precut timber prior to preservative treatment. There will be no field application of preservative treatment when pressure treated timbers are to be used for a water intake cribwork structure.

.2 Bore holes for drift bolts 1.5 mm smaller diameter than bolt and for full length of bolt. Bore holes for machine bolts to same diameter as bolts.

.3 Construct timber cribwork to full height prior to sinking in final position in work.

.4 Levelling pieces: place levelling pieces beneath bottom timbers in such a manner that they will conform to shape of base area. Place levelling pieces horizontally so that succeeding pieces will be solidly secured at intersections of bottom timbers and vertical posts and other levelling pieces with machine bolts of proper length.

.5 Bottom timbers: place bottom timbers lengthwise, and crosswise to form bottom three courses of cribs. Crosswise bottom timbers to be of one piece. Lengthwise bottom timbers to be minimum 6 m long. Splice timbers in lengthwise direction at centre of a 1.5 m long splice block. Stagger butt joints in bottom timbers so that no joint is further than 0.5 m from a crosswise timber and joint will not be located in same bay as a joint in course below. Secure three courses of bottom timbers together with machine bolts at every intersection with each other and vertical posts.

.6 Ballast floor: place ballast floor on pockets on bottom or middle course of bottom timbers. Secure each ballast floor timber to bottom timbers with drift bolts so that adjacent ballast floor timbers are not secured to same bottom timber.

.7 Longitudinals: butt join exterior and interior longitudinals in centre of a 1.5 m block. Secure block to lower timber with drift bolt at centre and secure longitudinals to be spliced to block with drift bolts at ends. Longitudinals to be as indicated on the contract drawings. Stagger joints in longitudinal timbers so that adjacent longitudinals, directly above or below,

will not be joined in same bay or on same vertical post. Secure longitudinals to intersection of cross ties with drift bolt and to intersection of vertical posts with machine bolt every third course of longitudinals. Countersink machine bolts on exterior face above Lowest Normal Tide (LNT).

.8 Cross ties: to be in one length across cribs. Secure cross ties to intersection of longitudinals with drift bolt and to intersection of vertical posts with machine bolt every third course of cross tie. The top course shall be machine bolted as well. All machine bolts on the exterior face from elevation 300 mm below LNT to the deck elevation shall be countersunk.

.9 Vertical posts: to be in one length from bottom of cribwork to top of cribwork. Extend front posts to elevation LNT.

.10 Fillers: place filler timber as indicated. Secure fillers with drift bolts to timbers immediately below.

.11 Drift Bolts: will have length equal to thickness of timbers to be fastened less 50 mm.

.12 Machine Bolts: will have length equal to thickness of timbers being fastened plus thickness of washers plus 40 mm less depth of countersinking, if countersinking is indicated on the contract drawings.

4.3 HANDLING TREATED TIMBER

.1 Handle treated material to avoid damage causing alteration in original treatment.

.2 Treat in field, cuts and damage to surface of treated material with an appropriate preservative in accordance with CSA CAN / CSA O80. Ensure that damaged areas such as abrasions nail and spike holes, are thoroughly saturated with field treatment solutions in accordance with CSA CAN / CSA O80.

.3 Do NOT field treat any timbers when being used for a water intake structure.

4.4 BALLAST

.1 Place ballast stone in a manner that will not damage timber cribwork. Owner to approve placing method.

.2 Place ballast so that differential height of fill between adjacent cells will be less than 600 mm.

4.5 TOLERANCES

.1 Construct crib overall dimensions to tolerance of 1 in 300.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for corrected maximum dry density.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

C127	Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
D4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table

PART 2 GENERAL

2.1 MAXIMUM DRY DENSITY

.1 Maximum dry density to be determined to ASTM D698, Method D with particles exceeding 16 mm removed from sample.

2.2 CORRECTED MAXIMUM DRY DENSITY

.1 Where the in-situ material being tested for compaction contains particles exceeding #4000 sieve, maximum dry density will be corrected using the following equation:

$$\mathrm{D} = \frac{\mathrm{D1} \times \mathrm{D2}}{\mathrm{F1D2} + \mathrm{F2D1}}$$

Where:

D = corrected maximum dry density kg/m^3 for in-situ material being tested.

F1 = fraction (expressed as a decimal) of total field sample passing ASTM 4.75 mm sieve

F2 = fraction (expressed as a decimal) of total field sample retained on ASTM 4.75 mm sieve (equal to 1.00 - F1)

D1 = maximum dry density, kg/m^3 of material passing ASTM 4.75 mm sieve

D2 = bulk density, kg/m^3, of material retained on passing 4.75 mm sieve, equal to 1000 G where G is bulk specific gravity (dry basis) of material when tested in accordance with ASTM C127.

.2 For free draining soils and soil-aggregate mixtures, determine D1 (maximum dry density) to ASTM D4253, Dry Method.

PART 3 PRODUCTS

3.1 NOT APPLICABLE.

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 No separate or direct payment will be made for work specified in this specification. Costs of all work specified is deemed to be included in the lump sum and unit prices quoted in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for constructing Portland cement concrete walks, curbs and gutters, along with the installation of catch basin frames and grates that lie within the flow lines of the curb and gutter system, to lines, grades, dimensions and typical cross-sections or as directed.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

A1064/A1064M	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete, Type 2 Class
D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3), Method D)
D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

CSA Group

A23.1/A23.2	Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete

Canadian General Standards Board (CGSB)

1.2-98	Boiled Linseed Oil

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure (TI), Highway Design and Construction Division, Highway Specifications Book:

Section 904.04.08	Concrete Structures: Contraction Joints

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Excavation: will be measured in accordance with Section 02224. Limit for excavation shall be 300 mm each side of the concrete structure.

.2 Granular base Class "A" and sub base "Class B": will be measured in cubic metres within the areas and to the thicknesses indicated on the contract drawings, unless otherwise specified. Limit for bedding will be 300 mm each side of the concrete structure.

.3 Concrete walks, combined curb and sidewalk, curb and gutter, and concrete curb will be measured in metres to dimensions specified and shown on the contract drawings. The unit of measurement includes lowbacks, pedestrian ramps, bull noses and any other modifications inherent in the system. Driveway ramps will be measured separately in metres along the sidewalk to the dimensions specified and as shown on the contract drawings.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Concrete: Section 03300.

.2 Concrete mix design to produce 32 MPa minimum compressive strength at 28 calendar days and containing 2 mm maximum size coarse aggregate with water/cement ratio and Air Category in accordance with CSA A23.1/A23.2, Table 8 for Class "C2" exposure and 80 mm slump at time and point of deposit. Air Entrainment in accordance with CSA A23.1/A23.2, Table 10.

.3 Joint filler: in accordance with TI, Highway Specifications Book, Section 904.04.08, or equivalent.

.4 Granular sub base Class B in accordance with Section 02233.

.5 Curing compound in accordance with ASTM C309, Type 2 Class.

.6 Boiled linseed oil in accordance with CAN/CGSB-1.2-98.

.7 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water soluble soap.

.1 Acceptable product: Noxcrete by Bird-Goodco, Formshield by W.R. Grace.

.8 Fiber expansion joint filler: Meadows Sealtight Fiber Expansion Joint Filler in accordance with ASTM D1751, or equivalent.

.9 Wire mesh: ASTM A1064/A1064M.

.10 Reinforcing steel: In accordance with Section 03200.

PART 4 EXECUTION

4.1 GRADE PREPARATION CONCRETE

.1 Excavate to lines, depths and widths indicated or directed.

.2 Construct embankments using excavated material free from organic matter or other objectionable materials. Provide for minimum 0.5 m shoulders, where applicable, outside of neat lines of concrete.

.3 Provide borrow material for fill when a deficiency of excavated material exists. Place fill in 150 mm layers and compact to at least 100 % of maximum density ASTM D698, Method D.

4.2 GRANULAR BASE

.1 Obtain Owner's approval of sub-grade before placing granular base.

.2 Place granular base material to lines, widths, and depths indicated or directed. Compact to at least 100 % of maximum density ASTM D698, Method D.

4.3 CONCRETE

.1 Obtain Owner's approval of granular base and reinforcing steel prior to placing concrete.

.2 Do concrete work in accordance with Section 03300 and as specified herein.

.3 Round edges, including edges of joints, with 10 mm radius edging tool. Finish surfaces to within 3 mm in 3 m from line, level or grade, as measured with a straightedge placed on surface. Finish exposed surfaces to a smooth uniform finish, free of open texturing and exposed aggregate. Do not work more mortar to surface than required. Do not use neat cement as a drier to facilitate finishing. Broom finish surface to provide non-skid texture.

.4 Cure and protect concrete in accordance with CSA A23.1/A23.2. Alternatively, apply curing compound to finished surface within one hour of placing at a rate recommended by manufacturer.

.5 If corrosion protection for de-icing salts is specified use water cure method.

4.4 FORMING

.1 Form vertical surfaces to full depth using forming material that will not deform under loading by plastic concrete. Securely position forms to required lines and grades. Coat forms with form release agent.

.2 Obtain approval of forms before placing concrete.

.3 Install transitions from full curb to drop curb, 450 mm long where indicated or directed.

.4 Slip forming may be approved subject to evaluation of mechanical equipment proposed for use. For evaluation by Owner place 50 metre trial section for Owner's approval.

4.5 EXPANSION AND CONTRACTION JOINTS

.1 Install joints in concrete walk as indicated or directed at intervals of:

.1 Expansion joints, a maximum of 6 m or in accordance with subsection 4.5.3 of this specification.

.2 Transverse contraction joints at approximately the width of the sidewalk but not more than 1.5 times sidewalk width or 3 metres (30 times slab thickness).

.2 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide. When concrete curb and gutter is constructed adjacent to concrete pavement, the contraction joint spacing of the curb and gutter shall coincide with that of the concrete pavement. When concrete curb and gutter is constructed adjacent to asphalt pavement, transverse joints shall have a uniform spacing not exceeding 4.5 m.

.3 Install expansion (isolation) joints around maintenance holes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure, and also before and after curve sections and at intersections of sidewalk and/or curb, to full depth of concrete. Seal joints with approved sealant.

.4 Install transverse contraction joints 25 mm deep either by oiled steel separators, which are removed after concrete has set sufficiently, or by sawing the set concrete.

.5 Combined curb and sidewalk to be provided with a continuous dummy joint 150 mm from the face of the curb. This joint to be similar to the transverse contraction joint and to be 25 mm deep.

.6 Contraction joint spacing shall vary to coincide with the centreline of maintenance holes, hydrants, poles or other box outs.

4.6 BACKFILL

.1 Allow concrete to cure for 7 calendar days prior to backfilling.

.2 Backfill to designated elevations with suitable material, compact and shape to required contours as indicated or directed by the Owner.

4.7 CORROSION PREVENTION

.1 Apply when specified or directed by the Owner for protection against de-icing salts. Apply with spray method only, two coats of one to one mixture of boiled linseed oil and kerosene.

.2 Ensure concrete surfaces are dry, free of dirt or dust, and at least 14 calendar days old before applying coating. Apply each coat at a rate of 0.1 litres per square metre.

.3 Dry first coat thoroughly before further application.

.4 Protect adjacent surfaces from spray.

PART 5 BASIS OF PAYMENT

.1 All costs associated with work as outlined in this specification shall be deemed to be included in the appropriate unit and lump sum price quoted as outlined in the Measurement for Payment subsection of this section and included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for the supply and application of Tack Coat to pavement surfaces prior to repaving with asphaltic concrete.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure (TI), Highway Design and Construction Division, Highway Specifications Book:

Section 320 Tack Coat

The latest edition of the TI, Highway Specifications Book, as published by the Highway Design and Construction Division, Division 3 – Specifications for Pavement, Selected Granular Base Course and Related Materials will apply to all asphalt, granular and associated works placed on municipal projects, funded by the Department.

PART 2 GENERAL

2.1 MEASUREMENT OF PAYMENT

.1 Measurement for payment shall be by means of the horizontal area actually treated with tack coat lying within the area designated by the Owner for treatment. Measurement shall be by Plan Quantity Payment by area in square metres.

PART 3 PRODUCTS

.1 Refer to TI, Highway Specifications Book, Section 320 https://www.gov.nl.ca/ti/hdc/

PART 4 EXECUTION

.1 Refer to TI, Highway Specifications Book, Section 320 https://www.gov.nl.ca/ti/hdc/

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

.2 Payment at the contract price for Tack Coat shall be compensation in full for all labour, materials and equipment-use to; clean the existing surface, supply and apply the tack coat, together with the provision of all required traffic control necessary.

This specification outlines the requirements for the supply and placement of hot mix asphaltic concrete pavement.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure (TI), Highway Design and Construction Division, Highway Specifications Book:

Division 3 - Specifications for Pavement, Selected Granular Base Course and Related Materials

Section 330	Hot Mix Asphalt Concrete
Section 331	Performance Grade Asphalt Binder
Section 332	Hot Mix Asphaltic Concrete – Method Specification
Section 333	Hot Mix Asphaltic Concrete – End Product Specification
Section 337	Warm Mix Asphalt

PART 2 GENERAL

2.1 EXCEPTIONS TO HIGHWAY SPECIFICATIONS BOOK

.1 The latest edition of the TI, Highway Specifications Book, as published by the Highway Design and Construction Division, Sections listed in the References subsection of this section will apply to all asphalt, granular and associated works placed on municipal projects, funded by the Department, with the following exceptions:

.1 Replace all references to the Materials Engineering Division (MED), depending on context, with the Owner or the testing laboratory.

.2 Compensation for quality control and testing will be in accordance with Section 01400 and govern in case of a conflict with the HDC Highway Specifications Book.

.3 The minimum rated capacity for the asphalt mixing plant is 70 tonnes per hour delivered to the spreader, with a production history to support this requirement.

.4 The Material Transfer Device/Vehicle (Section 330.07.09) will not be utilized unless specifically required and included in the MERX Schedule of Quantities and Prices.

.5 Further to the “Asphalt Density” section (332.07.03), cores will only be performed when requested by the Owner and/or Regional

Engineer and at the project expense for the initial test per section of road. Subsequent testing (if required as a result of a dispute) will be at the Contractor's expense.

.6 There will be no implementation of liquidated damages or bonuses as specifically outlined in 333 Hot Mix Asphaltic Concrete – End Production Specification. The General Conditions will govern.

.7 Asphalt Cement (Sections 332.09.03 and 333.12.03) and Blending Sand (Sections 332.09.04 and 333.12.04) will not be considered individual bid items but are to be included in the "Hot Mix Asphalt Concrete Pavement" prices in the MERX Schedule of Quantities and Prices.

.8 There are no exceptions to the size and number of rollers specified in TI, Highway Specifications Book.

.9 Asphaltic Patching (333.11) will be in accordance with Section 02574.

.10 Placement of roadway paving is only permitted after the cut-off dates (330.05) and before the spring season with the approval of the Owner and MI's Regional Office. All other placement conditions must also be met.

.11 Inherent to the request to place asphalt after the cut-off dates (330.05) and before the spring season, the Contractor agrees to supply a two (2) year warranty on the quality of the asphalt placed.

.12 If a roadway consists of only one asphaltic lift, the cut-off dates for placement (330.05) is that of a Surface Mix.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 NOT APPLICABLE

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined below and as included in the MERX Schedule of Quantities and Prices.

.2 Measurement for Payment will only be made for those materials accepted for use under this specification and then only when incorporated into the work at the required locations and thicknesses as indicated on the plans. The Contractor shall not be paid more than 105 % of the calculated

quantities based on theoretical limits (using 2.45 tonne/m^3) and approved tickets. This additional quantity is included in the MERX Schedule of Quantities and Prices.

.3 Asphaltic Concrete Base and Surface Course as well as Adjustments will be paid by the tonne.

.4 Asphaltic Concrete Walkways and Ditches will be paid for by the linear meter for the various thicknesses and widths outlined in the MERX Schedule of Quantities and Prices

This specification outlines the requirements for the supply and placement of materials to repair the asphaltic concrete removed in the carrying out of the works.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

D977	Standard Specification for Emulsified Asphalt
D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
D2419	Standard Test Method for Sand Equivalent values of Soils and Fine Aggregate

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Measurement for removal and replacement of existing asphalt pavement removed during trench excavation shall depend on the width of trench in accordance with Section 02223 for the installation of the pipe. The width of pavement removed along the trench for the installation of the pipe shall not exceed 500 mm each side of the specified trench width for main lines 0 to 4 m deep, not exceed 1000 mm each side of the specified trench width for main lines greater than 4 m to 6 m deep and not exceed 1500 mm each side of the specified trench width for main lines greater than 6 m deep. The width of pavement removed along the trench for the installation of pipe in service laterals shall not exceed 300 mm each side of the specified trench width for service lines 0 to 4 m deep, and not exceed 600 mm each side of the specified trench width for service lines greater than 4 to 6 m deep, and not exceed 900 mm each side of the specified trench width for service lines greater than 6 m deep.

.2 If the Contractor removes or damages pavement or surfaces beyond the limits specified above, such pavement and surfaces shall be replaced or repaired at the expense of the Contractor.

.3 Asphalt removal and disposal designated in the contract documents or as directed by the Owner for thicknesses up to 110 mm shall be paid by the square metre to the lines established by the Owner. Thicknesses over 110 mm shall be paid by the square metre unit price prorated on the basis of price per 110 mm.

.4 Asphalt patching of approved asphalt removed, as designated in the contract documents or as directed by the Owner, shall be paid by the square metre including patch preparation such as asphalt cutting, tack coat, compaction of granular base, asphalt cement on existing asphalt faces, milling, as well as placing of new asphalt. The top 50 mm lift is to be milled back 300 mm into the existing asphalt. This milling width is to be included in the measurement.

.5 The minimum width for asphalt removal and replacement adjacent to concrete will be 0.5 m.

.6 Recapping of asphalt patching when directed by the Owner will be paid for by the tonne in accordance with Section 02552.

.7 Temporary asphalt patching, as designated in the contract documents or as directed by the Owner, shall be paid by the square metre including placing and compaction of granular base. Temporary asphalt shall be 40 mm thick.

.8 For pothole patching, cutting shall be paid by the linear metre. All other patching/paving items have the cutting considered incidental to the unit.

.9 Asphalt work for a section of work (as determined by the Owner) less than 2.5 metres wide shall be a patch regardless of the length. Asphalt work for a section of work (as determined by the Owner) less than 100 square metres shall be a patch. All other asphalt work (as determined by the Owner) will be paid by the tonne in accordance with Section 02552.

.10 Driveway reinstatement or patching will be paid under and in accordance Section 01710.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Granular base: material in accordance with Section 02233.

.2 Asphaltic concrete shall be in accordance with Section 02552. Recycled asphalt may be used only if it is included in the MERX Schedule of Quantities & Prices and only in areas indicated in the drawings.

.3 Tack Coat:

.1 Tack coat shall consist of SS-1 (Slow setting) emulsified asphalt diluted with an equal volume of water prior to the application in accordance with ASTM D977.

PART 4 EXECUTION

4.1 CONSTRUCTION

.1 Weather Limitation:

.1 Permanent patching shall be carried out only when the temperature of the air is 7 ° C and rising and when not raining.

.2 Temporary patching may be specified by the Owner, when the ambient air temperature is less than 7 ° C, for one winter use and may be replaced with permanent patching the following summer.

.2 Time Limitation:

.1 Asphalt patching after October 15 shall be temporary patching and may be replaced with permanent patching the following summer at the discretion of the Owner.

.3 Cutting Out:

.1 The areas to be patched shall be agreed upon by the Owner. The Contractor shall cut out the sections marked true and square with a power buster or other means acceptable to the Owner to expose a fresh vertical face clear of any broken or loose material.

.4 Application of Asphaltic Material:

.1 In all areas where new asphalt is to meet existing asphalt, a tack coat of asphaltic cement is to be applied to the face of the existing asphalt prior to placing the asphaltic concrete.

.5 Placing Asphalt:

.1 Before any placing of asphalt, the Contractor shall compact all backfilled materials and place and compact to 95 % Modified Proctor Density, of granular base A to the thickness of original bedding and to a maximum of 150 mm in accordance with Section 02233. The Contractor shall also ensure that all asphaltic patching shall be equal in thickness to the original pavement but in no case shall be less than 50 mm or more than 100 mm.

.6 Spreading and Finishing:

.1 Spreading and finishing shall be carried out as specified. A mechanical spreader shall be used on areas that are deemed by the Owner to be large enough for such application.

.7 Rolling:

.1 Rolling shall be in accordance with Section 02552.

.8 Clean Up:

.1 The Contractor shall dispose of all cut out asphaltic concrete or waste materials at a dumping site approved by the Owner.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification covers the requirements for cold planing existing pavement. The cold planing shall expose sufficient curb and gutter to allow full curb height restoration after eventual resurfacing, and shall extend to a width sufficient to restore an acceptable cross section.

PART 1 REFERENCES

1.1 NOT APPLICABLE

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Measurement for payment shall be on the basis of the required surface area subject to cold planing to the required depth as specified by the Owner. The area shall be computed in square metres to the nearest whole number.

PART 3 PRODUCTS

3.1 NOT APPLICABLE

PART 4 EXECUTION

4.1 SCOPE

.1 This specification covers the requirements for cold-milling existing pavement. The cold planing shall expose sufficient curb and gutter to allow full curb height restoration after eventual resurfacing, and shall extend to a width sufficient to restore an acceptable cross section. Cold planning of asphalt to tie–in new asphalt will be to the depth of the specified layer.

4.2 EQUIPMENT

.1 The cold planing shall be accomplished using a cold-milling machine. The cold-milling machine shall be a self-driven rotating drum type, capable of removing asphalt 100 mm thick and at least 1200 mm wide in a single pass. Cutting depth shall be adjustable from 0 mm to 100 mm over the length of the drum. The machine shall have automatic grade control and be able to load milled material directly into trucks, or be able to windrow the material for subsequent pick-up by other equipment.

4.3 OPERATIONS

.1 The existing pavement shall be removed to the depth specified in the Contract Documents. Should the pavement not be removed to the required depth in the first pass, then the Contractor shall return again to mill down the pavement to the required depth.

.2 Removal may be required across the full width of the road, one lane width, one lane and shoulder width or in tapered strips along the curb, depending upon the suitability of the resulting cross section. In areas where the cold milling equipment cannot remove the pavement to the depths required, such pavement shall be removed to the required grade using other means acceptable to the Owner.

.3 Prior to paving operations commencing, a transverse butt joint must be constructed. If a transverse vertical cut is milled in the existing pavement at the limit of the Work Area, the contractor shall immediately construct with hot mix asphalt concrete a temporary smooth 1.5 meter long taper. The temporary taper must be removed prior to paving of the milled area.

.4 Lanes shall be completed to the same location at the end of the day’s cold milling operation where it is intended to have both lanes milled.

.5 All residue left by the cold planing process shall be removed immediately from the road. Mechanical sweeping shall be performed at the end of each day's operations. Low points in the asphalt as a result of cold planing operations at the end of each day’s operation, where water ponding may occur, shall have the shoulder milled for draining rainfall. Any guide rail contaminated as a result of cold planing or sweeping operations shall be cleaned to the satisfaction of the Owner. Any milled material that is lost over the shoulder shall be immediately retrieved and disposed of in an approved manner.

.6 The Contractor shall dispose of residue at an approved waste disposal area provided by the Contractor at their own expense.

.7 The Contractor shall continuously maintain the Work Site free of potholes and standing water and in a condition providing for a safe and efficient flow of traffic, from the time of removal, until such time as the new asphalt concrete is placed. Hot mix asphalt concrete shall be placed in the potholes; cold mix or RAP are acceptable only as a temporary repair. Areas cold milled must be paved within 7 calendar days of the cold milling operation. Signage indicating the driving condition of the milled surface shall be posted. Milled and aged asphalt concrete surfaces shall be treated with bituminous tack coat prior to the placing of asphalt concrete.

4.4 USE OF MILLED MATERIAL FOR SHOULDERING

.1 For projects where milled material is identified for use as shouldering material, the following conditions apply:

.1 The milled material is to be placed on the shoulder using an approved shouldering machine. Direct placement from the conveyor of the milling machine onto the shoulder will not be permitted.
.2 The material must be compacted immediately after placing.
.3 Milled material shall not be placed on the shoulders within 15 meters of a body of water.
.4 Excess milled material that cannot be used for shoulders will become the property of the Contractor.

4.5 USE OF MILLED MATERIAL FOR STOCKPILING FOR OWNER

.1 For projects where milled material is identified for use by the Owner, the material shall be loaded and hauled to a stockpile site as indicated in the contract document or as directed by the Owner.

.2 If the Contractor removes the specified thickness in more than one layer, then material from each layer must be stockpiled separately, unless otherwise indicated in the contract documents.

.3 Proper stockpiling procedures must be used, and care shall be taken not to contaminate or consolidate the reclaimed asphalt concrete stockpile.

.4 If a potential for contamination of the RAP exists due to ground conditions at the stockpile site, a layer of clean, fine grained material shall be evenly distributed as a base for the stockpiles. The cost of preparing and providing the layer of clean, fine grained material as a base for the stockpiles shall be included in the unit price bid for cold planing asphalt.

.5 The height of the RAP stockpiles shall be a maximum of 3 metres to limit the consolidation of the stockpile material and no loaders, crawl tractors, trucks or other equipment shall be permitted to travel on the stockpile.

PART 5 BASIS OF PAYMENT

.1 Payment at the contract unit price shall be compensation in full for all labour, materials and use of equipment to; carry out the cold planing to the required depth, load and haul away and dispose of the residue at a waste disposal site provided by the Contractor at their own expense, or a site designated by the Owner, and sweep the planed surface. All work associated with loading, transporting, placing, grading and compacting

milling materials along shoulders shall be considered incidental to this item.

This specification outlines the requirements for full depth asphalt reclamation, often referred to as pulverizing. It is a recycling technique in which existing asphalt pavement is crushed in place and mixed with a portion of the underlying granular base to form a homogeneous, blended mixture. The recycled mixture is then shaped and compacted for use as granular base in the new road structure.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Other

Ministry of Transportation, Ontario, LS 621	Method of Test for Determination of Amount of Asphalt Coated Particles in Coarse Aggregate

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Measurement for payment shall be in square meters of actual area of roadway pulverized. The measurement calculations shall be based on actual existing asphalt width determined from field measurements and the length of the actual horizontal distance covered as determined by the Owner.

PART 3 PRODUCTS

3.1 NOT APPLICABLE.

PART 4 EXECUTION

4.1 SCOPE

.1 Pulverizing is a process by which the existing asphalt pavement is crushed in place into small size particles and mixed with part of the existing granular base to total depth equivalent to twice the old asphalt thickness. This is accomplished in one operation with a pulvi-mixer type of equipment.

.2 If underlying granular layers have insufficient thickness, the Owner’s Representative must be notified immediately.

.3 The pulverized mixture is re-levelled and re-profiled prior to compaction.

4.2 PROCEDURE

.1 The Contractor shall pulverize the existing asphalt pavement (asphalt and granulars) to a total maximum depth of 160 mm unless noted otherwise in the Contract Documents. The pulverized material shall have 100 % passing a 40 mm sieve and shall be blended uniformly. This process shall be performed using a Caterpillar Reclaimer RR-250 or equivalent.

.2 Any material larger than 40 millimetre in dimension shall be removed from the surface of the Work.

.3 Pulverized material shall contain no more than 50 % asphalt coated particles when tested in accordance with the latest version of MTO LS-621.

.4 After the pulverizing operation has been completed the Contractor shall prepare the roadway for Hot Mix Asphalt Paving. This shall include saw cutting the asphalt, rough grading, and addition of new Granular Class “A” as directed by the Owner, fine grading and compaction. If the Owner requires the gradation of the pulverized material to be adjusted, thorough mixing of new Granular Class “A” with the pulverized material will be required. The profile and cross section shall be restored to the satisfaction of the Owner.

.5 The grading and compaction shall be in accordance with Section 02233. The Contractor shall be responsible for maintaining the gravel surface in a condition acceptable to the Owner until the Hot Mix Asphalt Paving is complete. The roadway shall not be left unpaved more than seven (7) calendar days after pulverization of the old asphalt and the pulverized or unpaved Work Area shall not be greater than 4 km in road length.

.6 Contractors are reminded that the Dust Control subsection of Section 01560, applies.

PART 5 BASIS OF PAYMENT

.1 Payment at the contract price for Pulverization of Existing Asphalt will be considered compensation in full for all plant, labour and material use to: saw cut asphalt at the limits of pulverizing, pulverize the existing asphalt and granulars to a total depth of 160 mm or as specified in the MERX Schedule of Quantities and Prices, rough grading, fine grading including blending of new Granular Class A and compaction, and dust control as deemed necessary by the Owner.

.2 Should the actual depth of pulverization be in excess of 160 mm or the thickness noted in the unit price table, the unit price bid per square meter will be prorated as follows:

$$\text{Prorating Factor (PRF)} = 1 + \frac{0.75(\text{A} - \text{B})}{\text{B}}$$

Where:

A = actual depth

B = stipulated contract depth

PRF > 1.0

Example of Prorated Unit Price for area with depth greater than 220 mm:

A = 250 mm (this would indicate existing asphalt at 125 mm and underlying granulars at 125 mm)

B = 220 mm (stipulated contract depth)

$$\text{Prorating Factor (PRF)} = 1 + \frac{0.75(250 - 220)}{220}$$

$$\text{Prorating Factor (PRF)} = 1.1023$$

.3 Payment for the new Granular Class “A” will be made according to Section 02233.

This specification outlines the requirements for preparing pavement surfaces prior to surface treatments or thin overlays.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure (TI), Highway Design and Construction Division, Highway Specifications Book:

Section 350 Crack Sealing

PART 2 GENERAL

2.1 GENERAL

.1 The latest edition of the TI, Highway Specifications Book, as published by the Highway Design and Construction Division, Division 3 – Specifications for Pavement, Selected Granular Base Course and Related Materials will apply to all asphalt, granular and associated works placed on municipal projects, funded by the Department.

2.2 MEASUREMENT FOR PAYMENT

.1 Crack cleaning and filling will be measured in metres rounded to one (1) decimal place.

PART 3 PRODUCTS

.1 Refer to TI, Highway Specifications Book, Section 350 https://www.gov.nl.ca/ti/hdc/

PART 4 EXECUTION

.1 Refer to TI, Highway Specifications Book, Section 350 https://www.gov.nl.ca/ti/hdc/

PART 5 BASIS OF PAYMENT

.1 All costs associated with work as outlined in this specification shall be deemed to be included in the appropriate unit price quoted as outlined in

the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for the supply and application of yellow and white paint materials for traffic markings on roadway pavement.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

Government of Newfoundland and Labrador, Department of Transportation and Infrastructure (TI), Highway Design and Construction Division Specifications Book
ASTM International

D185	Standard Test Methods for Coarse Particles in Pigments
D476	Standard Classification for Dry Pigmentary Titanium Dioxide Products
D562	Standard Test Method for Consistency of Paint Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer
D605	Standard Specification for Magnesium Silicate Pigment (Talc)
D711	Standard Test Method for No-Pick-Up Time of Traffic Paint
D868	Standard Practice for Determination of Degree of Bleeding of Traffic Paint
D869	Standard Test Methods for Evaluation Degree of Settling of Paint
D1155	Standard Test Method for Roundness of Glass Spheres
D1214	Standard Test Method for Sieve Analysis of Glass Spheres
D1309	Standard Test Method for Settling Properties of Traffic Paints during Storage
D2205	Standard Guide for Selection of Tests for Traffic Paints
D2243	Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings
D2369	Standard Test Method for Volatile Content of Coatings
D3723	Standard Test Method for Pigment Content of Water-Emulsion Paints by Low-temperature Ashing
D3960	Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paint and Related Coatings
E1347	Standard Test method for Color and Color-Difference

Measurement by Tristimulus Colorimetry

Canadian General Standards Board (CGSB)

1- GP-71	Methods of Testing Paints and Pigments
1.206-M-89	Hot Applied Alkyd Traffic Paint

Other

Transportation Association of Canada Manual of Uniform Traffic Control Devices for Canada

Transportation of Dangerous Goods Act1992

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Pavement markings including symbols and letters shall be measured by lump sum measure.

2.2 SUBMITTALS

.1 The Contractor shall submit, in writing before work commences, the names of the suppliers of paint and glass beads.

.2 The Contractor shall submit, as received from each supplier, certification that the materials supplied conform to the requirements of this Section; and instructions on the proper storage and use of the materials.

.3 The Contractor shall submit, in writing, certification that the Equipment proposed for the Work is capable of applying the pavement markings as outlined in the Contract Documents.

PART 3 PRODUCTS

3.1 MATERIALS

.1 All materials shall be supplied by the Contractor.

.2 Either oil-based or waterborne paint may be used in the Work.

.3 Oil-Based Traffic Paint:

.1 The paint shall meet CGSB Specification 1.206-M, but with paragraphs of that specification modified as shown in below.

Paragraph	Modifications for this section
3.3	"... and shall meet the requirements for consistency (para. 4.1) and no-pick-up time (para. 4.2):
4.1	Minimum changed from 80 to 85
4.2	Maximum changed from 6 to 8
4.3	Maximum changed from 60 to 90
4.7	Minimum changed from 34 to 37
4.10	Pigment composition (minimums in kg/L):

Pigment Description	Yellow	White Chrome
Yellow (as PbCrO4)	0.10	N/A Silicon
dioxide (as SiO2)	0.20	0.20
Titanium dioxide	0.075	0.15

4.14	Change ASTM E97 to ASTM E1347. Add: yellow not less than 60 %
4.15	Paint colours to match samples provided by TW
6.2.1	Change 60 seconds to 90 seconds
6.2.2	Add: SiO2 shall be determined using classical gravimetric method on insoluble portion of paint

.4 Waterborne Traffic Paint:

.1 The paint shall be a homogeneous water-based mixture of particles well ground to a uniform smooth consistency, free of skin, dirt and other foreign matter, capable of being sprayed evenly and smoothly at its intended temperature and covering solidly when applied to the pavement.

.2 The paint shall be supplied ready-mixed for use without adding water.

.3 Handling and storage qualities shall provide an acceptable degree of settling, uniformity, consistency, and absence of skinning and thixotropic properties. The paint shall be capable of being sufficiently atomized to produce a uniformly applied paint stripe without side splatter and overspray within the limitations of conventional striping equipment.

.4 The paint materials shall be of a quality and consistency such that the paint's colour will not change in service to impair the visibility of the markings. The paint film shall be flat in finish. White and yellow

markings shall be visible in daylight and under artificial light after the addition of overlay glass beads.

.5 The colour of the paint shall conform to the colour of white and yellow paint chips supplied by the Owner upon request.

.6 The chemical composition shall be determined by the paint manufacturer but shall comply with the requirements below.

Property	Min	Max	Test Method
Pigment Content (% by mass)[1]	56	62	ASTM D3723
Volatile matter (% by mass)		24	ASTM D2369
Non-Volatile Vehicle (% by mass)	16.75		CGSB 1-GP-71, Method 19.1
Coalescing Agent (2,2,4-trimethyl −1,3 pentanediol monoisobutyrate) (% by mass of solid polymer)	10		
Type of Binder	Rohm & Haas Rhoplex Fastrack 3427 Emulsion, Dow Chemical DT-250NA Emulsion, or Owner-approved equivalent		
White Paint Titanium Dioxide (g/L)[2]	150		
Yellow Paint Titanium Dioxide (g/L)[2]	75		
Medium Chrome Yellow (g/L) (Lead chromate content - min 87 %)	100		

NOTES:
1) To be 20 % talc that meets ASTM D605 with a photovolt green filter reflectance of 90 % minimum
2) Titanium Dioxide pigment shall meet ASTM D476 type II

.7 The physical properties shall comply with the requirements below.

Property	Min	Max	Test Method
No-Pickup Time, minutes		8	ASTM D711
Non-tracking Time, seconds[1]		60	
Volatile Organic Compound (VOC) Content excluding water, g/L		150	ASTM D3960
Freeze-Thaw Resistance	Pass		ASTM D2243

Property	Min	Max	Test Method
Viscosity, Krebs Unit (KU) at 25 °C	80	100	ASTM D562
Viscosity Change (KU) after heat-shear Stability Test at 25 °C		10	Caltrans 8010-61G-30
Skinning Properties	Nil	Nil	CGSB 1-GP-71, Method 10.1
Coarse Particles (% by mass): 250 µm 150 µm	Nil	Nil 0.01	ASTM D185 & D2205
Settling Rate (Up to 6 months)	8.0 6.0		ASTM D869 ASTM D1309
Bleeding	4		ASTM D868
Hiding Power (m2/L)	8.4		Pfund cryptometer with #3.5 wedge
	4.0		CGSB 1-GP-71 Method 14.2
Reflectance (colour difference) % Yellow White	 50 80		ASTM E1347

NOTE: 1) Non-tracking time based on 375 µm (15 mils) wet film thickness applied on dry pavement having temperature > 10 °C, under humidity conditions ≥ 80 %.

.5 Overlay Glass Beads

.1 Beads shall be true smooth, lustrous spheres manufactured from glass of a composition designed to be resistant to the effects of traffic wear and weathering. No foreign material shall be contained in or among the beads.

.2 Glass beads shall meet the gradation requirements below when tested in accordance with ASTM D1214 on sample sizes of 50 to 100 g.

ASTM Sieve Size (µm)	Percent Passing
850	100
600	80–100
300	20–35
150	0–8
75	0–2

.3 Glass beads shall be colourless to the extent that they do not impart a noticeable hue to the paint.

.4 The refraction index of the glass beads shall not be less than 1.50 when tested in accordance with CGSB Specification 1-GP-71, Method 49.1.

.6 Roundness:

.1 A minimum of 75 % by mass of the glass beads shall be true spheres.

.2 The percentage of true spheres shall be determined by ASTM D1155, or, on a sample of approximately 1000 beads in a culture dish, by counting the number of true spheres under reflected light and magnification as follows:

.1 Retained on the 300 um sieve size, under 50x magnification;

.2 Passing the 300 um sieve size, under 100x magnification.

.3 Failure to meet roundness requirements will be cause for rejection.

.7 Imperfections:

.1 The surface of the beads shall be smooth, lustrous and free of film, cavities, pits or scratches. Not more than 25 % of the true spheres shall have imperfections in the form of milkiness, air inclusions, dark specks and incipient fractures.

.2 Testing for imperfections will be performed in accordance with CGSB Specification 1- GP-71, Method 149.1.

.8 Moisture Resistance:

.1 Beads shall be treated so as to overcome the effect of water (vapour or liquid) on the beads before the beads are added to the painted marking.

.2 Beads shall not agglomerate during storage and application, and shall flow freely from dispensing equipment whenever surface and atmospheric conditions are satisfactory for painting.

.3 Moisture resistance will be tested on a 100 g sample of beads placed in a 500 mL beaker, to which an equivalent volume of

distilled water shall be added. After standing for 5 minutes the water shall be decanted and the glass beads transferred to a clean dry beaker.

.1 After standing for 5 minutes the beads shall be poured slowly via a funnel into a standard stem of 125 mm length and 10 mm inside diameter.
.2 The beads shall flow through the stem without stoppage. Slight initial agitation to start the flow at the beginning of the test is permissible.

.9 Chemical Stability:

.1 Exposure of glass beads to paint film constituents, humidity, atmospheric conditions or diluted acid or alkali solutions shall not result in dulling of the surface that would adversely affect reflective properties of the beads.
.2 Glass beads shall be resistant to deterioration by calcium chloride, as determined on a 10 g sample of beads placed in a 1000 mL beaker, covered with 500 mL of a calcium chloride solution (1.0 normal solution), left to soak for three hours, rinsed with 100 mL of distilled water three times, and air dried.

.1 The beads will be examined under a microscope and compared with an untreated sample. Dulling of the surface of the beads or other detrimental effects shall constitute failure of this test.

.10 Dual Coating of Glass Beads – For Waterborne Paint Only

.1 The beads shall have both a moisture-resistant silicone coating, and an adhesion-promoting silane coating. The beads shall pass the moisture resistance test (in accordance with Subsection 2.1.8 of this Section), and the adherence coating test.
.2 The adherence coating test shall use a solution of 0.2 grams of dansyl chloride dissolved in 25 mL of acetone. This solution may be used for several tests during the day if kept refrigerated in a closed dark container between uses. A fresh solution shall be made daily.
.3 The adherence coating test shall be performed as follows:

.1 Weigh 10 grams of beads and place in aluminium trays.
.2 Saturate the beads with dansyl chloride solution using an eyedropper.
.3 Dry the beads in an oven at 60 °C for 15 minutes. (Beads will be yellow and agglomerated).
.4 Rinse the beads in a funnel lined with new filter paper and pour 100 mL of acetone over them. Use suction during this step.

.5 Remove the beads from the funnel and place in aluminium trays.
.6 Over-dry the beads until free flowing.
.7 Place the glass beads on filter paper and inspect colour under ultra-violet light in a dark room. A yellow-green fluorescence will be observed if adherence coating is present.

.4 If all beads have a yellow green fluorescence, the adherence coating is properly applied and the beads are acceptable. If only some of the beads have a yellow-green fluorescence, the beads are not properly coated and this is a cause for rejection. If no yellow-green fluorescence are seen, adherence coating was not applied and this is a cause for rejection.

PART 4 EXECUTION

4.1 GENERAL

.1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Owner.

.2 The Work shall be performed in accordance with the Transportation Association of Canada (TAC) Manual of Uniform Traffic Control Devices for Canada (MUTDC), Part C.

.3 Traffic paint shall be transported in accordance with the Transportation of Dangerous Goods Act. Drivers certified under the Act may be employed by the Contractor to transport traffic paint under the authority of the Owner's permit, provided that the conditions of the permit are adhered to.

4.2 EQUIPMENT

.1 The Contractor shall supply all Equipment needed for applying pavement markings, as recommended by the manufacturer of the pavement marking paint products. Equipment shall not contaminate the paint or other pavement marking materials or cause damage to the pavement.

.2 Line Painting Equipment:

.1 Line painting Equipment shall be capable of applying centre, lane and edge line markings to the required thickness and at widths of 100 or 200 mm, as a uniform stripe with sharp edges.
.2 The Equipment shall have a glass bead dispenser and shall be capable of applying the beads to the wet painted line uniformly at the recommended rate by means of a pressurized overlay glass bead gun.

.3 The Equipment shall have a heater capable of heating the paint to any temperature up to 80 ° C and maintaining a constant temperature during the spraying operation.

.4 The Equipment shall have a metering device to measure the number of litres of paint applied.

.5 The Contractor shall supply one or more shadow vehicles mounted with an arrow board and signs to adequately warn and advise the driving public of the slow moving striping vehicle and wet pavement marking paint ahead.

.3 Equipment for Other Pavement Markings:

.1 Equipment for applying other pavement markings shall be capable of applying paint at the required thickness and dispensing glass beads to the wet paint uniformly at the required rates.

.2 Equipment shall be capable of painting the longitudinal lines outlining cross-hatched islands at a width of 100 mm or 200 mm, and cross-hatching bars and "Stop" bars at a width of 400 mm.

.3 Equipment shall be capable of painting arrows and similar markings, using templates supplied by the Owner.

.4 Paint Removal Equipment:

.1 Equipment shall be made available for removal of pavement markings as ordered by the Owner, or as required to correct markings applied in error or non-conformance per TI, Highway Specifications Book 334.07.02. The Equipment shall be capable of removing markings with minimal damage to the pavement surface.

.5 Timing of the Work:

.1 Pavement markings shall be applied within the following time frames after completion of paving under the Contract:

.1 No sooner than seven (7) calendar days (to allow the new asphalt concrete to cure), and for white edge lines no sooner than completion of shoulder grading; and

.2 No later than 14 calendar days for arterial highways and 21 calendar days for other classes of highway.

.6 Pre-marking:

.1 The Owner shall provide the measurements and pre-markings on the pavement to establish the position of pavement markings, as follows:

.1 Painted symbols at the beginning of each type of centreline marking identified in Table 5, and painted dots along the centreline;
.2 Painted dots to mark edgelines that are not parallel to centreline, as on tapers to auxiliary lanes; otherwise the Contractor shall paint edgelines using the pre-marked or painted centreline as the control line;
.3 Outline of each cross-hatched island; and
.4 Location of each type of arrow.

.2 The Contractor shall notify the Owner at least ten business days prior to the Work under this Section, to allow the Owner to schedule the pre-marking crew.
.3 Should the Contractor's line-painting Equipment be unable to paint parallel edgelines using the centerline as control per Subsection 3.2.6.1.2 of this Section, the Contractor shall premark the edge lines or otherwise ensure they are painted parallel to the centerline.

.7 Surface Preparation:

.1 Pavement markings shall be applied only on clean and dry surfaces. Any contaminants such as dirt, loose particles and oily residue shall be removed before painting.

.8 Application:

.1 All pavement markings shall be accurately placed based on pre-markings, and shall present a crisp, uniform appearance in daylight and darkness.
.2 The applied markings shall be to the satisfaction of the Owner with respect to paint thickness, retro-reflectivity, the straightness and spacing of lines, the accuracy of dimensions and positioning of other markings, and absence of overspray and tracking.
.3 The Contractor shall be responsible for control of the paint spray during application so that it does not get on vehicles or other private property. In the event that this occurs, the Contractor shall be responsible for the costs of removing the paint off the private or public property and the repair of any damage that occurs as a result of the paint or its removal.
.4 Longitudinal lines shall be of the types and widths shown below.

Line Type	Colour	Width (mm)
Single Solid	Yellow White	100 100/200
Single Broken	Yellow White	100 100/200
Combination (Solid Beside Broken)	Yellow	100
Double Solid	Yellow	2 lines x 100

.1 Single broken 100 mm-wide lines between traffic lanes shall have a "skip" pattern of 1:3 (3 m line and 9 m space).
.2 Single broken 200 mm wide lines that mark the edge of travelled lane through a taper, auxiliary lane or intersection shall have a skip pattern of 1:1 (3 m line and 3 m space).

.5 Cross-hatching lines shall be 400 mm wide, uniformly spaced at 6 m and at an angle of 2:1 in the direction of travel (2 units along the direction of travel to 1 unit perpendicular to it), and/or as directed by the Owner.

.6 Stop bars shall be 400 mm wide, applied at 90˚ to the edge of the travelled lane across the lane(s) as indicated in the Contract Documents or as directed by the Owner.

.7 Pavement markings

.1 Shall be applied only on dry pavement having a surface temperature as follows:

.1 For Oil-based Paint, 5 ºC and rising; or
.2 For Waterborne Paint, 10 ºC and rising.

.2 Paint shall be applied to the pavement surface to a minimum dry thickness of 255 µm ±25 µm.
.3 Overlay glass beads shall be applied at a rate of 0.7 kg/L of paint.

.8 Retroreflectivity shall meet the following requirements when tested no sooner than ten business days and no later than twenty business days after application of markings:

.1 Yellow Paint 200 mcd/lx/m²
.2 White Paint 250 mcd/lx/m²

.9 Pavement markings shall be applied in a manner that reduces tracking by the wheels of vehicles that cross over the painted markings.

.1 Tracking of longitudinal centre, lane and edge lines shall not exceed 3 % of line length as determined by the Owner.

.10 Pavement markings that do not conform to the requirements of this Section Documents and/or as specified by the Owner shall be removed and/or replaced as directed by the Owner.

.9 Sampling and Testing of Materials

.1 The Contractor shall arrange for the Owner to take samples of paint, 1 L minimum for each colour, from the paint truck on site.

.2 The Owner shall take on-site random samples of glass beads, 15 kg minimum, for testing at a laboratory.

.3 Testing costs shall be borne by the Owner if test results are satisfactory, and by the Contractor if test results fail. In the latter case, samples from another batch of paint and/or glass beads shall be taken for new tests.

.4 Should the Contractor wish to appeal any test results, such appeal may be made only once and in writing within 48 hours of their receipt of test results.

.1 The Contractor shall make provision for the Owner to obtain additional samples for the appeal testing, the results of which shall be binding on both the Owner and the Contractor.

PART 5 BASIS OF PAYMENT

.1 All costs associated with work as outlined in this specification shall be deemed to be included in the appropriate unit price quoted as outlined in subsection 1.1 Measurement for Payment and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for constructing new, adjusting and sealing over existing, maintenance holes, catch basins and ditch inlets as indicated or as directed.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

American Association of State Highway and Transportation Officials (AASHTO)

HL-93	Vehicular Live Loading, Truck, Tandem, Design Lane Load
HS-25	Interpretation of HL-93

ASTM International

A48/A48M	Standard Specification for Gray Iron Castings
B221	Standard Specification Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
C139	Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes
C478/C478M	Standard Specification for Precast Reinforced Concrete Manhole Sections
D256	Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers –Tension, Die “C” Method
D4412	Standard Test Methods for Sulfate-Reducing Bacteria in Water and Water-Formed Deposits, Die “C” Method
D624	Standard Test Methods for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers, Die “B” Method
D646	Standard Test Method for Mass per Unit of Paper and Paperboard of Aramid Papers (Basic Weight)
D698	Standard test methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
D790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
D1248	Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
D2240	Standard test Method for Rubber Property – Durometer Hardness

CSA Group

A23.1/A23.2	Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete
A3000	Cementations Materials Compendium
G164	Hot Dip Galvanizing of Irregularly Shaped Articles

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Excavation and backfill will be measured in accordance with Section 02223

.2 Maintenance holes, including cover, will be measured in units within depth classification as follows, measured from top of cover or grating to the lowest invert:

.1 2 m or less
.2 Greater than 2 m but not more than 2.5 m.
.3 Greater than 2.5 m but not more than 3 m.
.4 Greater than 3 m but not more than 3.5 m.
.5 Greater than 3.5 m but not more than 4 m.
.6 Greater than 4 m but not more than 4.5 m.
.7 Greater than 4.5 m but not more than 5 m.
.8 Greater than 5 m but not more than 5.5 m.
.9 Greater than 5.5 m but not more than 6 m
.10 Greater than 6 m but not more than 6.5 m

.3 Maintenance hole inflow protectors shall be paid by the each.

.4 Outfall structures, drop maintenance holes, special maintenance holes, catch basins including cover, and cast-in-place maintenance holes will be measured in units.

.5 Adjusting tops of existing maintenance holes or catch basins will be measured in units.

.6 Sealing over existing maintenance holes or catch basins will be measured in units.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Concrete

.1 In accordance with Section 03300.
.2 Cement in accordance with CSA A3000, type 10.
.3 Concrete mix design to produce 30 MPa for pre-cast maintenance holes, catch basins and ditch inlets and 25 MPa for cast-in place maintenance holes. Maximum size aggregate shall be 40 mm except 28 mm for pre-cast units. The water/cement ratio and air category shall be in accordance with CSA A23.1/A23.2. The exposure condition F1 shall be used for catch basins and ditch inlets and F2 for maintenance holes. Air entrainment in accordance with CSA A23.1/A23.2.

.2 Concrete reinforcement in accordance with Section 03200.

.3 Precast maintenance hole sections in accordance with ASTM C478/C478M, circular or oval. The top sections shall be flat slab top type with opening offset for vertical ladder installation. All sections shall be cured by the manufacturer not less than 7 calendar days before shipping and date stamped with the casting date.

.4 Precast catch basin sections in accordance with ASTM C139, ASTM C478/C478M.

.5 Ribbed waterstops: Extruded PVC of sizes indicated to following properties:

.1 Tensile strength in accordance with ASTM D412, Die 'C' method, minimum 11.4 MPa.
.2 Elongation in accordance with ASTM D4412, Die 'C' method, minimum 275 %.
.3 Tear resistance in accordance with ASTM D624, Die 'B' method, minimum 48 kN/m.

.6 Precast Joints: to be made watertight using rubber ring gaskets.

.7 Non-shrink grout in accordance with Section 03300.

.8 Mortar:

.1 Aggregate in accordance with CSA A3000.
.2 Cement in accordance with CSA A3000.

.9 Ladder rungs to be aluminum in accordance with ASTM B221, Alloy 6351, Temper T6. Rungs to be safety pattern (drop step type).

.10 Safety landings shall be placed in all maintenance holes having a depth greater than 5 metres as measured from the top of cover to the invert of outlet pipe. They shall be constructed and located as specified by the Owner. See Standard Drawings Table of Contents.

.11 Adjusting rings in accordance with ASTM C478/C478M.

.12 Drop maintenance hole pipe:

.1 Outside drop pipe to be same as sewer pipe.
.2 Inside drop, including force line hood to be as manufactured by Reliner/Duran Inc. or approved equal.

.13 Steel gratings, I-beams and fasteners: as indicated.

.14 Frames, gratings, covers to plan dimensions and following requirements:

.1 Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
.2 Grey iron castings in accordance with ASTM A48/A48M, strength class 30B.
.3 Castings to be coated with two applications of asphalt varnish, sand blasted or cleaned and ground to eliminate surface imperfections.
.4 Maintenance holes frames and covers: Heavy-duty municipal type for road service. Cover cast without perforations and complete with two 25 mm lifting holes. Clear opening to be 580 mm minimum, or such larger size as indicated on the Drawing. 170 kg per set.
.5 Catch basin frames and covers: Heavy-duty municipal type for road service. Standard catch basin 190 kg per set. Curb and gutter type, 250 kg per set.

.15 Maintenance hole inflow protection covers:

.1 The maintenance hole inflow protection cover and its associated valve body and components shall be manufactured from corrosion proof material suitable for atmospheres containing hydrogen sulphide and dilute sulphuric acid as well as gases associated with wastewater collection systems.
.2 The cover body shall be made from an acetate, Butyrate, Styrene material that in accordance with test requirements ASTM D256, D412, D2240, D790, D792, D646.
.3 The thickness shall not be less than 2.38 mm nor greater than 3.96 mm. The cover body shall be manufactured to the dimensions as shown on the contact documents to allow for easy installation in the maintenance hole frame.

.4 The gasket shall be made of closed cell neoprene. The gasket shall have a pressure sensitive adhesive on one side and be placed under the cover rim by the manufacturer. The adhesive shall be compatible with the cover material so as to form a long lasting bond in either wet or dry conditions of use.

.5 The gas relief valve shall be designed to relieve at a pressure of 0.45 kg. The valve body shall be made of medium density polyethylene. The venting tube shall be capable of sealing on dirt and small debris. The valve shall have a leak down rate not exceeding 45 L/24 hr. to eliminate the ponding of water over the maintenance hole cover after a rain storm.

.6 The valve shall be designed so that it is flexible and will not be broken by any movement of the cover over the valve proper. This valve configuration will allow the shallowest practical cover design eliminating unnecessary water retention or weight accumulation. The valve shall be easily removed for water drainage, should inspection be required immediately after or during a rain storm.

.7 The inflow protection cover shall be manufactured to fit the maintenance hole frame rim upon which the maintenance hole cover rests.

PART 4 EXECUTION

4.1 EXCAVATING AND BACKFILL

.1 Excavate and backfill in accordance with Section 02223.

.2 Obtain approval of the Owner before installing outfall structures, maintenance holes, catch basins, valve chambers or ditch inlets.

.3 Do not backfill any maintenance hole or other structure for which a leakage test is required, prior to completion of testing and acceptance of test by the Owner.

4.2 CONCRETE WORK

.1 Do concrete work in accordance with Section 03300.

.2 Place concrete reinforcement in accordance with Section 03200.

.3 Position metal inserts in accordance with dimensions and details indicated.

4.3 INSTALLATION

.1 Construct units in accordance with details indicated, plumb and true to alignment and grade.

.2 Complete units as pipe laying progresses. Maximum of three units behind point of pipe laying will be allowed.

.3 Pump excavation free of standing water and remove soft and foreign material before placing base. Fill any excavation below level of bottom of specified bedding as outlined in Section 02223.

.4 Cast base directly on undisturbed ground or when permitted by the Owner, set a precast concrete base on 150 mm minimum of granular material compacted in accordance with ASTM D698, Method D.

.5 For precast units:

.1 Make each successive joint watertight with approved rubber ring gaskets. Each lifting ring hole shall be grouted with non-shrink grout.

.2 Clean surplus grout and joint compounds from interior surface of unit as work progresses.

.6 For cast-in-place units:

.1 Place stub outlets and bulkheads at elevations and in positions indicated.

.2 Bench to provide a smooth U-shaped channel. Side height of channel to be full diameter of sewer. Slope adjacent floor at 1 on 5. Curve channels smoothly. Slope invert to establish sewer grade.

.3 Apply two coats of cement rendering to maintenance hole benching. Cement rendering shall consist of one part cement and two parts sand with sufficient mixing water. Surface to be rendered shall be roughened before concrete has fully set, and immediately before rendering is applied, cleaned of all oil, grease, laitance or foreign matter. Keep surface moist. Roughen between coats. Work into surface and give last coat smooth, steel trowel finish.

.7 Installing units in existing systems:

.1 Where a new unit is to be installed in an existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions required and install new unit as specified.

.2 Make joints watertight between new unit and existing pipe.

.3 Where deemed expedient to maintain service around existing pipes and when systems constructed are ready to be put in operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.

.8 Place frame and cover on top section to required elevation. If adjustment required use concrete, concrete ring, HDPE adjustment rings in

accordance with subsection 4.4.4 of this specification, or rubber risers in accordance with subsection 4.4.4 of this specification.

.9 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

.10 Install safety platforms in maintenance holes having a depth of 5 m or greater, as indicated.

4.4 ADJUSTING TOPS OF EXISTING UNITS

.1 Remove existing gratings, frames and store for re-use at locations designated by the Owner.

.2 Sectional units:

.1 Raise or lower straight walled sectional units by adding or removing precast sections as required.

.2 Raise or lower tapered units by removing cone section, adding, removing, or substituting riser sections to obtain required elevation, then replace cone section. When the amount of raise is less than 300 mm use grade rings or cast-in-place concrete.

.3 Cast-in-place:

.1 Raise cast-in-place units by roughening existing top to ensure proper bond and extend to required elevation with cast-in-place concrete.

.2 Lower cast-in-place units with straight wall by removing concrete to elevation indicated for rebuilding.

.3 When monolithic units with tapered upper section are to be lowered more than 1500 mm, remove concrete for entire depth of taper plus as much straight wall as necessary, then rebuild upper section to required elevation with cast-in-place concrete.

.4 Install additional maintenance hole ladder rungs in adjusted portion of units as required.

.5 Bring maintenance holes to required elevation using cast-in-place concrete.

.6 Re-set gratings and frames to required elevation on full bed of cement mortar, parge and trowel smooth.

.4 Frame and cover adjustments:

.1 High Density Polyethylene frame adjustment rings injection molded to ASTM D1248 designed and tested to withstand loading in excess of AASHTO HS-25 and sealed with a sealant approved by the manufacturer and installed in accordance with the manufacturer’s instructions.

.2 Rubber Adjustment Frame Risers density 1.098 ± 0.05 gm/cm^3, compression deformation under 1 MPa 6 ± 2 %, and tested to withstand loading in excess of AASHTO HS-25, and sealed with a sealant approved by the manufacturer and installed in accordance with the manufacturer's instructions.

.3 Cover adjustment rings must be cast iron.

4.5 MAINTENANCE HOLE INFLOW PROTECTION COVER

.1 The maintenance hole frame shall be cleaned of all dirt or debris before placing the inflow protection cover upon the rim.

.2 The inflow protection cover shall be fully seated around the maintenance hole frame rim to retard water from seeping between the cover and the maintenance hole frame rim.

.3 After installation, the inflow protection cover shall not infiltrate more than 45.5 L (10 gallons) in a 24 hr period.

4.6 INFILTRATION AND EXFILTRATION TEST

.1 Install watertight plugs or seals on inlets and outlets of each new sanitary sewer maintenance hole and fill maintenance hole with water. Keep maintenance hole full for 24 hours to allow maximum absorption. Leakage not to exceed 0.3 % per hour of volume of maintenance hole.

.2 If permissible leakage is exceeded:

a) By up to 0.03 % per hour of the volume of the maintenance hole, defects may be corrected on site by the manufacturer's representative using injected polyurethane. **Concrete mortar grouting is not acceptable.** Repeat testing until acceptable.

b) By more than 0.03 % per hour of the volume of the maintenance hole, the maintenance hole must be replaced at the Contractor's expense at the discretion of the Owner.

.3 In areas of high ground water, the allowable infiltration shall not exceed 0.3 % per hour of the volume of the maintenance hole.

.4 Test any water retaining structure or special maintenance hole in accordance with this specification, as directed by the Owner.

.5 Owner will issue a Test Certificate for maintenance holes passing test.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted

as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

.2 Prices quoted in the MERX Schedule of Quantities and Prices for maintenance holes, drop maintenance holes, catch basins, or other structures will be deemed to include benching, miscellaneous metals, ladder rungs, frames and covers, sewer backdrop (See Standard Drawings Table of Contents for appropriate Sewer Backdrop drawings), and any extra excavation and backfill required for construction space over and above that measured and paid for in accordance with Section 02223.

.3 Payment for maintenance holes and catch basins will be at the quoted price after construction, pouring, stripping, and cement finishing and the frame and cover is installed, and the maintenance hole is tested and ready for use in the system.

.4 For all maintenance holes or structures requiring an infiltration/exfiltration test, payment will be made to the maximum of 95 % of the value of the structure until the leakage testing is completed and accepted by the Owner.

This specification outlines the requirements for the supply and installation or retrofit of a pre-fabricated or cast-in-place sewage pumping station consisting of tank, submersible or auto priming centrifugal pumps, piping including all valves and all other components and accessories necessary for reliable operation.

Mechanical and electrical equipment will be accepted only from manufacturers with authorized dealers located in the province of Newfoundland and Labrador who will provide commissioning, warranty and follow–up service as required. A warranty of 24 months from the date of commissioning is required on all mechanical and electrical components.

Shop Drawings submitted by the Contractor for equipment and associated work must include written confirmation from the Authorized Dealer/Supplier that they will provide the required installation, commissioning, warranty repairs and follow up service as required. Shop drawings will not be reviewed without this document and delays incurred as a result of the contractor not meeting this requirement may be grounds for termination of the contract. Any costs associated with such delays shall be borne solely by the contractor.

REFERENCES

This specification refers to the following standards, specifications, or publications:

ASME International

B16.1	Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125 and 250

ASTM International

A36/A36M	Standard Specification for Carbon Structural Steel
A53/53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-coated, Welded and Seamless
A181/A181M	Standard Specification for Carbon Steel Forgings, for General-Purpose Piping
A536	Standard Specification for Ductile Iron Castings
C478	Standard Specification for Precast Reinforced Concrete Manhole Sections
C478M	Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric)

American Water Works Association (AWWA)

C151/A21.51	Ductile-Iron Pipe, Centrifugally Cast
C509	Resilient-Seated Gate Valves for water Supply Service
C606	Grooved and Shouldered Joints

CSA Group

A23.1-14/A23.2-14	Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
A82.1-14	Fired Masonry Brick Made from Clay or Shale
A179-14	Mortar and Grout for Unit Masonry
B242-11	Groove- and Shoulder-Type Mechanical Pipe Couplers
C22.1	Canadian Electrical Code, Part I Safety Standard for Electrical Installations
C22.2 No 108:14	Liquid Pumps

Underwriters Laboratories of Canada

S701-11	Standard for Thermal insulation, Polystyrene, Boards and Pipe Covering

Others

Electrical Equipment & Manufacturers Advisory Council (EEMAC)
ISO 9001 Quality Management Systems - Requirements
National Electrical Manufacturers Association (NEMA)
NFPA 70 and 820: National Electrical Code
NFPA 820: Standard for Fire Protection in Wastewater Treatment and Collection Facilities

PART 1 - GENERAL

1.1 MEASUREMENT FOR PAYMENT

Payment for all work and materials specified in this section will be by the lump sum unit as quoted in the Schedule of Quantities and Prices. Unless specifically marked optional and not specified elsewhere all items shall be supplied and installed.

.1 For each sewage pumping station specified under the Project Specific Specification using the format outlined in this Section.

.2 For each portable diesel generator specified under the Project Specific Specification using the format outlined in this Section.

.3 Overflows from sewage lift stations shall be paid in accordance with Sanitary Sewer Outfall Pipe as per Section 02704.

.4 Excavation and backfilling for lift stations shall be paid for in accordance with Section 02223. Measurement limits shall be the plan outside dimensions plus 2 m and shall be to the full depth of the structure from original ground to the bottom of the structure.

PART 2 - PRODUCTS

2.1 WET WELL CHAMBER

.1 The chamber shall be of inside dimensions with size and height as detailed on the drawings to be able to contain all associated equipment. The station shall be cast-in-place concrete, pre-cast concrete, steel, fibreglass reinforced plastic or approved equal. Benching is to be included with the chamber so that accumulation of sewage and solids is diminished.

.2 The unit shall be designed to prevent flotation under all conditions.

.3 Cast-in-place concrete shall be designed to produce 25 MPa minimum compressive strength at 28 calendar days and shall contain 40 mm maximum size coarse aggregate. The water cement ratio and air category shall be in accordance with CSA A23.1-14/A23.2-14, table 7 or class F-2 exposure. The slump at time and point of deposit shall be 80 mm. Air entrainment shall be in accordance with CSA A23.1-14/A23.2-14.

.4 Cast-in-place concrete exposed to de-icing chemicals or sea water shall be in accordance with the appropriate exposure condition of Table 8, CSA A23.1-14/A23.2-14. Air entrainment shall be in accordance with CSA A23.1-14/A23.2-14, table 10.

.5 Pre-cast concrete chambers shall be in accordance with ASTM C478. Concrete shall be designed to produce 30 MPa minimum compressive strength at 28 calendar days and shall be in accordance with the appropriate exposure conditions of subsections 2.1.3 and 2.1.4 of this specification. Top sections shall be flat slab top type with the opening offset for vertical ladder installation.

.6 The design of pre-cast chambers for pumping stations to be constructed of steel, concrete, fibreglass reinforced plastic or other material shall be as specified and approved by the Owner. Steel tanks require corrosion protection.

.7 Pre-cast stations shall be pre-assembled to the extent that safe and economic shipping permits, to minimize installation and start-up costs.

.8 The chamber shall be tested for infiltration and exfiltration in accordance with Section 02601, subsection 3.6 and shall be in accordance with the test requirements of that subsection 3.6.

.9 All electrical equipment installed in wet wells and/or areas not isolated from wet wells shall be approved for installation in Class I, Division 1 or Division 2, Group D hazardous locations. Installation of all equipment, including forced air ventilation as required, shall be in accordance with Section 18 of the Canadian Electrical Code, Part I (CSA C22.1) and NFPA 820.

2.2 PUMPS

.1 Submersible

.1 General

.1 Supply _____ submersible, non-clog or grinder pump(s). Each pump shall be equipped with _____ kW(hp) submersible, electric motor connected for operation on _____ volt, _____ phase, 60 Hz, with _____ m of neoprene-jacketed type SOW, composite cable, CSA certified appropriate sized for both power supply and monitoring functions. The pump unit shall be capable of delivering _____ L/s at _____ m TDH, with a shut-off head of _____ m (minimum). Each unit shall be supplied complete with a mating, cast iron _____ mm discharge connection and be fitted with _____m of galvanized Grade A8 chain or SS lifting cable, approved for overhead lifting and of adequate strength to permit raising and lowering of the pump.

.2 Pump and motor shall be of the close-coupled, integral design. Preference will be given to units employing motor and hydraulic units from the same manufacturer. The pump(s) shall be capable of handling raw, unscreened sewage. The discharge connection elbow shall be permanently installed in the wet well, together with the discharge piping.

.3 The pump(s) shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection and service.

.4 There will be no requirement for personnel to enter the chamber.

Sealing of the pumping unit to the discharge connection shall be accomplished by a simple linear downward motion of the pump. A sliding guide bracket shall be attached to the pump unit. Guide devices that are integral with the pump casing will be unacceptable. The entire weight of the pumping unit shall be guided by rigid guide bar(s) and pressed tightly against the discharge connection elbow, providing a tight seal through either metal-to-metal contact or through an elastomer gasket.

.5 No portion of the pump shall bear directly on the floor of the chamber. The pump, with its appurtenances and cable, shall be capable of continuous submergence under water, without loss of watertight integrity, to a depth of 20 m.

.6 Major pump components shall be grey cast iron, Class 30, with smooth surfaces, devoid of blowholes and other irregularities.

7 All exposed nuts and bolts shall be 300 series SS construction. All surfaces coming into contact with sewage, other than SS or brass, shall be protected by an approved, sewage-resistant coating. The impeller shall be coated with an alkyd-resin primer. The pump exterior shall be finished with a non-toxic top coat. Chlorinated-rubber paint or other special epoxy primers and top coats shall be available when required to meet special or abnormal liquid considerations.

.8 All mating surfaces where watertight sealing is required shall be machined and fitted with nitrile rubber O-rings. Fittings shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces.

.9 Controlled compression of nitrile rubber O-rings without the requirement of a specific torque limit is necessary. No secondary sealing components, rectangular gaskets, elliptical O-rings, grease or other devices or materials shall be used.

.10 The volute shall be of a single part, non-concentric design and shall have smooth fluid passages, large enough at all points on the volute to pass any size solids that can pass through the impeller.

.11 The impeller shall be of grey cast iron, Class 30 or better, dynamically balanced, enclosed, non-clog or recessed design having a long throughlet without acute turns. The impeller shall be capable of handling solids, fibrous material, heavy sludge, and other matter found in normal sewage applications. The impeller shall be a _____ vane design, and shall be capable of passing a minimum _____ mm

sphere.

.12 A wear ring system shall be installed to provide efficient sealing between the volute and impeller, and shall consist of a stationary ring of brass or cast iron, which is drive-fitted to the volute inlet.

.13 Grinder Pumps shall have hardened stainless shredding ring and grinder to reduce sewage to a small size for discharge through small diameter piping.

.14 The fit of the impeller into the volute / motor assembly shall be such that no stringy debris or other materials may enter the area of the outer mechanical seal.

.2 Cable

.1 The power and/or control cable(s) shall be suitable to reach the control panel without splicing. The cable shall be approved by CSA.

.3 Cable Entry

.1 The cable entry, water-seal design shall preclude specific torque requirements to ensure an impermeable seal.

.2 The cable entry(s) shall be comprised of a cylindrical elastomer grommet, flanked by SS washers, all having a close tolerance fit against the cable's outside diameter and the entry's inside diameter, and compressed by the entry body, until it bottoms out on a shoulder, assuring controlled compression. Cable sealing systems that utilize mastic, adhesive, epoxy resin, or sealing compounds as a primary seal shall be capable of preventing entry of moisture even through a damaged cable to a submerged depth of 20 m.

.3 The cable entry body contains a strain relief function, separate from the function of sealing the cable. The strain relief will be applied from the outer side of the cable entry assembly.

.4 Guide Bars

.1 Vertical guide bar(s) shall be provided with each pump to ensure correct alignment of the pump with the automatic discharge connection. For each pump, the guide bar(s) shall consist of Schedule 40 SS pipe, securely fixed at the lower end to the discharge connection by means of special bosses, provided. The guide bar(s) shall extend from the discharge connection toward ground level and shall be securely fixed by a galvanized or equivalent bracket (upper guide bar holder), anchored to the station roof. The bracket shall also be provided with special inserts to position the guide bars rigidly.

.5 Discharge Connections

.1 A cast iron, automatic discharge connection shall be provided for

each pump to connect the pump to the discharge piping. The discharge connection shall be permanently fixed in position by four (4) SS anchor bolts attached to the bottom of the pump chamber. Discharge connections shall permit rapid and precise installation or removal of the pumps without entering the pump chamber.

.6 Shaft and Seals

.1 The pump shaft shall be of AISI 400 series SS. This is a nickel-bearing chromium steel, heat-treated, designed to superior mechanical properties providing greater corrosion and abrasion-resistant characteristics. Each pump shall be provided with a tandem mechanical shaft seal system.

.2 The upper of the tandem set of seals shall contain one stationary ring and one positively-driven rotating ring functioning as an independent secondary barrier between the pumped liquid and the stator housing. The rings shall be constructed of either silicon-carbide or tungsten-carbide material.

.3 The lower of the tandem set of seals shall function as the primary barrier between the pumpage and the stator housing. This set shall consist of a stationary ring and a positively-driven rotating ring, both of which shall be constructed of silicon-carbide.

.4 For conventional double mechanical seals, each seal interface shall be held in place by its own spring system. Conventional double mechanical seals containing either a common single or double spring, acting between the upper and lower units, shall not be considered acceptable or equal to the dual, independent seal specified. A common spring is only acceptable where cartridge type seals are used that cannot be disassembled.

.5 The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaced. Each pump shall be provided with a lubrication chamber for the shaft sealing system. The chamber shall be designed to assure that air is left in the chamber to absorb the expansion of the lubricant due to temperature variations.

.7 Bearings

.1 The pump shaft shall rotate on two independent bearings either permanently lubricated or run in lubricant. The support (upper) bearing shall be a single-row ball bearing and the main (lower) bearing shall be a two-row angular contact ball bearing, sized to take all radial and shock loads.

.8 Lifting Davit

.1 A lifting davit must be supplied to allow for easy removal of either pumps.

.2 A chain hoist or winch shall be attached to the davit. The chain hoist or winch shall be suitable for acceptance of the pump lifting chain / cable. This pump lifting arrangement will allow the pump to be lifted by its chain/cable, in a single lift, thus providing a simple method of removing the pump(s) for inspection and service. The chain hoist or winch shall have a minimum one (1) ton lifting capacity.

.2 Auto-Priming

.1 Pumps shall be designed to handle raw, unscreened, domestic sanitary sewage. Pumps shall have _____ mm suction connection, and _____ mm discharge connection. Each pump shall be selected to perform under following operating conditions:

Capacity (L/s)	_____
Total Dynamic Head (m)	_____
Total Dynamic Suction Lift (m)	_____
Maximum Repriming Lift (m)	_____
Maximum Static Suction Lift (m)	_____
Total Discharge Static Head (m)	_____
Minimum Submergence Depth (m)	_____

A table summarizing the above information shall be provided on the drawings.

.2 Pumps shall be auto-priming centrifugal type of either horizontal or vertical design. Pumps shall pass a minimum of a 63 mm spherical solid for 75 mm pumps and a minimum of a 75 mm spherical solid for 100 mm pumps and larger. For self-priming pumps, internal passages shall meet the minimum solids size to prevent maintenance or self-priming issues. Pumps that are not self-priming shall have each pump equipped with a dedicated vacuum priming system for each pump.

.3 The manufacturer of the pumps shall have a quality management system in place and shall be ISO 9001 Certified.

.4 Materials and Construction Features

.1 Self-Priming Pumps

.1 Pump casing: Casing shall be cast iron Class 30and shall incorporate the following features:

.1 Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.

.2 A Fill port cover plate shall be provided and incorporate a hand nut/clamp bar assembly for opening. Hand nut threads shall provide slow release of pressure with the clamp bar being retained by retention lugs. A Teflon gasket shall prevent adhesion of the fill port cover to the casing.

.3 A drain plug shall be provided to insure complete and rapid draining.

.2 Cover plate: A cover plate shall included to allow for removal of pump blockages and servicing of the impeller, seal, wear plate or check valve without the need to remove piping and shall incorporate following:

.1 Be constructed of cast iron Class 30 and retained by hand nuts for complete access to pump interior.

.2 Be equipped with a replaceable wear plate.

.3 Be equipped with a pressure relief valve of rating to safely protect the pump system.

.4 Sealed to the pump casing via gaskets or O-rings.

.5 Be equipped with pusher bolts to assist in removal of cover plate from pump casing.

.6 Be equipped with a handle for positioning and removal.

.3 Rotating Assembly: A rotating assembly, which includes impeller, shaft, mechanical shaft seal, oil seals, bearings, seal plate and bearing housing, shall be removable as a single unit without disturbing the pump casing or piping and shall incorporate the following features:

.1 Seal plate and bearing housing shall be cast iron Class 30. Separate oil filled cavities, vented to atmosphere, and shall be provided for the shaft seal and bearings. The same oil shall not be used to lubricate both bearings and seal. Cavities shall be cooled by the liquid pumped. Seals shall be provided to prevent leakage of oil.

.1 The bearing cavity shall have an oil level sight gauge and fill plug check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil

without removal of the fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.

.2 The seal cavity shall have an oil level sight gauge and fill/vent plug. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the fill/vent plug.

.3 Seals shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.

.2 Impeller shall be ductile iron, two-vane, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lock screw and conical washer.

.3 Shaft shall be AISI 4140 alloy steel unless otherwise specified by the Owner, in which case AISI 17-4 pH stainless steel shall be supplied.

.4 Bearings shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil lubricated from a dedicated reservoir. Pump designs that use the same oil to lubricate the bearings and shaft seal shall not be acceptable.

.5 Shaft seal shall be oil lubricated mechanical type. The stationary and rotating seal faces shall be tungsten carbide. The stationary seal seat shall be double floating by virtue of a dual O-ring design; an external O-ring shall secure the stationary seat to the seal plate, and an internal O-ring shall hold the faces in alignment during periods of mechanical or hydraulic shock (loads which cause shaft deflection, vibration, and axial/radial movement). Elastomers shall be viton. Cage and spring to be AISI 316 stainless steel. Seal shall be oil lubricated from a dedicated reservoir. The same oil shall not lubricate both shaft seal and shaft bearings. Seal shall be warranted for a minimum of four years.

.4 Adjustment of the impeller face clearance (distance between impeller and wear plate) shall be accomplished by external

means.

.1 Clearances shall be maintained by external shimless cover plate adjustment, utilizing collar and adjusting screw design for incremental adjustment of clearances by hand. Requirement of realignment of belts, couplings, etc., shall not be acceptable. Cover plate shall be capable of being removed without disturbing clearance settings.

.2 There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the cover plate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above.

.3 Clearance adjustments that require movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

.3 Vacuum-Primed Vertical Pumps

.1 Pumps shall be of a vertical, centrifugal, non-clog design of heavy cast-iron construction and designed for use in sewage applications.

,2 The bearing closest to the impeller shall be designed for a combined thrust and radial load. This bearing shall be locked in place so that endplay is limited to the clearance within the bearing therefore minimizing seal wear caused by linear movement of the shaft. Seal wear shall be further limited by a minimum distance between the top of the impeller and the bearing.

.3 The upper bearing shall carry radial loads only and be free to move in a linear direction with thermal expansion of the pump shaft.

.4 The shaft shall be solid stainless steel through the mechanical seal to eliminate corrosion issues.

.5 Each pump shall be equipped with a dedicated vacuum priming system and the pump is to be primed from the lower pressure area behind the impeller so as to eliminate the possibility of solids entering and clogging the priming system. The priming system shall be capable of operating in a “Constant Prime” mode whereby the pumps are kept primed constantly or in a “On Demand” mode where priming only occurs when a pump is called on to run and if it is not already primed. The pump shall be equipped with a pump

priming chamber that is monitored by the priming and control systems. To prevent blockages in the priming system, no passageway through which liquid passes shall be smaller than 64 mm.

.6 The pump shall be equipped with a failure to pump sensor mounted on the discharge checkvalves thus indicating that the pump is operating based on opening of the checkvalve.

.7 The pump shall be arranged so that the rotating element can easily be removed from the pump casing with the need to disconnect the electrical wiring or disassembling the motor, impeller, backhead or seal in order to allow any blockages to be removed from the pump or suction line.

.8 Where semi-open impellers are used, adjustable and replaceable wear rings are to be installed.

.9 The pump shall be equipped with a mechanical seal constructed so that it automatically drains and primes each time the pump is drained and primed to prevent freezing and breakage of the seal during power outages in sub-freezing temperatures. The seal shall be of carbon and ceramic materials. The rotating ring shall be held in its mating position against the stationary ring by a stainless steel spring. The seal assembly shall be held in place by a non-corroding seal housing.

2.3 PIPING

.1 Pipe: All station piping shall be in accordance with the spec, electric resistance weld steel pipe, schedule 40, and/or ductile iron shall be in accordance with AWWA C151/A21.51, Class 53.

.2 Fittings: Forged welding fittings shall be in accordance with ASTM A181/A181M; grooved standard rigid couplings shall be in accordance with CSA B242-11; ductile iron grooved fittings to ASTM A536.

.3 Flanges: In accordance with ASME B16.1, Class 125. Ductile iron grooved end flanges to ASTM A536.

.4 Wall Pieces: All wall pieces to have slip-on flanges, welded to the pipe and located in the centre of the wall. Exterior wall pieces to be cement-lined ductile iron, flanged inside and plain end outside. Exterior connections to forcemain to be by suitable dresser style coupling. Ductile iron shall be in accordance with AWWA C151/A21.51 with flexible cut grooves to AWWA C-606 may be used. All mechanical joints shall be restrained from separation.

.5 Valves:

.1 Non-clog ball check valves and ballcentric plug valves shall be installed in each pump discharge line. Each valve shall have a throughway size equal to the pump discharge pipe size to ensure full, free-flow operation. Grooved end Plug Valves & Check Valves to AWWA C606, laying length to AWWA C509.

.2 Valves external to wet well:

.1 Where valves are installed external to the wet well, the following valve types may be used:

.1 Check Valve: Each pump shall be equipped with a full flow type check valve, capable of passing a 75 mm spherical solid, with flanged ends and be fitted with an external lever and spring. The valve seat shall be constructed of stainless steel and shall be replaceable. The valve body shall be cast iron and incorporate a 75 mm clean-out port. Valve clapper shall have a molded neoprene seating surface incorporating low pressure sealing rings. Valve hinge pin and internal hinge arm shall be stainless steel supported on each end in brass bushings, sealing busing shall have double O-rings. O-rings shall be easily replaceable without requiring access to interior of valve body. Valve shall be rated at 1200 kPa water working pressure, 2400 kPa PSI hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 75 mm spherical solid shall not be acceptable.

.2 Plug Valve: A 3-way plug valve shall allow either or both pumps to be isolated from the force main. The plug valve shall be non-lubricated, tapered type. Valve body shall be semi-steel with flanged end connections drilled to 125 pound standard. The drip-tight shutoff plug shall be mounted in stainless steel bearings, and shall have a resilient facing bonded to the sealing surface. Valve shall be operated with a single lever actuator providing lift, turn, and reseat action. The lever shall have a locking device to hold the plug in the desired position.

.6 All internal piping will be prefabricated and galvanized (hot-dip method) prior to

installation. Stainless steel bolts and fasteners will be used to assemble all internal piping and valves. All grooved pipe & fittings to be galvanized prior to installation. The station header pipe shall be equipped with a cleanout port of the same size as the header.

.7 Influent and discharge lines shall terminate in a standard 150 lb. flange connection, or a standard grooved cap & rigid coupling shall be in accordance with CSA B242-11, inside the lift station chamber.

.8 Wet well vent piping and control mounting assembly shall be mounted as shown on the drawings. A mounting plate with 50 mm conduit nipples shall be set in the concrete at the time of pour. Sufficient conduit nipples shall be provided for each pump circuit, the level regulation system, and other electrical systems as indicated on the project drawings. Both conduit and vent pipe base will be open at the bottom. The wet well vent pipes shall be of 100 mm schedule 40 piping, and this assembly shall be of hot-dip galvanized construction.

2.4 MISCELLANEOUS ITEMS

.1 Steel Splash Plate (where required). Fabricated from Steel ASTM A36/A36M, as detailed. To be painted with one coat of zinc based paint. Inter-zinc by International Paints, Carbo-zinc by Standard Manufacturing, or approved equal.

.2 Valve Chamber Drain (where required): Floor drain from valve chamber into wet well to be 50 millimetre diameter.

.3 Flushing Valve Connection (optional): A 64 diameter flushing valve connection to be installed on pump header pipe in the valve chamber as indicated. Valve to be Crane No. 429, or approved equal. Stub & cap, threaded to Owner's fire hydrant standard, to be installed as detailed.

.4 Insulation (where required): Expanded polystyrene to ULC CAN/ULC-S701-11, 50mm. Styrofoam, or approved equal.

.5 Ladders: A heavy duty portable non-conductive extension ladder shall be provided for each station and be of sufficient length to , extend to sump depth plus 2m. Ladders shall be CSA approved and be a minimum of Grade 1AA. Details to be submitted in accordance with Section 01340 for Owner's review and approval.

.6 Padlock: Padlocks shall have a, laminated brass body with brass shackle suitable for use in a marine environment and in quantity as identified on the drawings. Padlocks shall be keyed to Master Lock No. 2081 c/w four keys .

2.5 PORTABLE DIESEL GENERATOR

.1 Supply and commission a _____ kW, _____ phase _____ volt portable diesel generator, CSA approved, complete with 120 volt, GFCI convenience receptacle, rated at 15 amp; a receptacle for connection of power cord to the lift station emergency receptacle. All receptacles to have weather protectors. Engine to be diesel, alternator to be brushless type rated for full load, continuous duty; minimum 95 litre fuel tank with the requirement that the tank be upsized to achieve 24 hour run time under station load, with bottom tapered to a collection sump with drain cock, control panel with main breaker, 12 volt electric start with battery charging circuit, residential muffler. Engine and alternator to be close coupled and mounted on a sufficiently rated spring axel trailer with fenders, fender lights, wheels, toe eye extension, ____ meters of extension cable with mating plug compatiable with existing stations in the town or as specified on the project drawings.

2.6 MOTOR

.1 Submersible

.1 The pump motor shall be of the squirrel-cage induction type design, housed in a watertight chamber of maximum efficiency and durability. The motor shall be designed for continuous duty capable of sustaining a minimum of fifteen (15) starts per hour. At the design condition, the motor shall not draw more than _____ kW at nominal voltage of utility supply quality at a maximum speed of _____ rpm.

.2 The motor stator shall be directly shrink fitted into the stator housing. Preference will be given to pumps with cast iron stator housings. The use of bolts, pins or other fastening devices requiring penetration of the stator housing shall be rejected. The stator winding and leads shall be insulated with moisture-resistant varnish capable of withstanding a temperature of 155 degrees C or the motors maximum temperature rise, whichever is greater. The stator shall be dipped and baked three (3) times in Class F varnish or better. Motors shall be inverter duty rated when the control system utilizes a variable frequency drive.

.3 The rotor bars and short-circuit rings shall be made of aluminum. Thermal

sensors shall be used to monitor stator temperatures on all pumps. The stator shall be equipped with not less than two (2) thermal switches embedded in the end coils of the stator windings (one switch per phase to protect the motor against surcharges and high temperature). These shall be used in conjunction with, and supplemental to, external motor overload protection, and wired to the control panel.

.4 The pump shall be equipped with moisture/leaking detection system to detect any moisture or leaks into the pumping unit. The signals from the thermal switches and the moisture detector shall be wired to the control panel to shut down the pump in the event of a moisture or thermal fault.

.5 Where required by the pump manufacturer, the control of the moisture detector and the winding thermal switches shall be accomplished by using a control/indicator relay(s) that will be installed and wired inside the control panel to stop the pump unit upon a fault signal.

.6 Cooling :

.1 Pumps shall be designed such that adequate cooling is provided by the surrounding environment or pumped media without the danger of overheating during continuous operation in ambient temperatures up to 40^{o} C. Pumps shall not be dependent on an external cooling source. Pumps incorporating a cooling system utilizing the pumped media shall not have the cooling performance compromised by materials commonly found in sewage pumping applications nor shall they require maintenance to clear cooling ports or passages.

.2 Auto-Priming

.1 Motors:

.1 Pump motors shall be _____ kW, , _____ RPM, NEMA design B with cast iron frame with copper windings, induction type, with Class F insulation and 1.15 Service Factor for normal starting torque and low starting current characteristics, suitable for continuous service. The motors shall not overload at the design condition or at any point in the operating range as specified. Motors shall be suitable for operation using the utility power available. Motors shall be at a minimum of open, drip-proof construction and be equipped with an integral fan for forced air circulation

.2 Motors shall be tested in accordance with provisions of ANSI/IEEEE Std. 112, Method B.

.2 Drive Transmission:

.1 Pumps shall be either driven by a V-belt or close-coupled.

.2 Pump drives to be enclosed on all sides by a guard constructed of fabricated steel or combination of materials included expanded, perforated, or solid sheet metal. No opening to a rotating member shall exceed a half (1/2) inch.

.3 Where V-belts are utilized:

.1 The sheave/belt combination shall provide the speed ratio needed to achieve the specified pump operating conditions.

.2 Each drive assembly shall utilize at least two V-belts providing a minimum combined safety factor of 1.5. Single belt drives or systems with a safety factor of less than 1.5 are not acceptable. Computation of safety factors shall be based on performance data published by the drive manufacturer.

2.7 ACCESS FRAME AND COVER

.1 The aluminum access frame shall be fabricated using an extrusion of 6351 aluminum. The cover shall be fabricated using a plate of 5086 aluminum designed to withstand shear and deflect not more than 1/79 of the maximum span for minimum specified loads of 7.2 kPa uniform load or 1100 kg point load. The cover shall rest on a rubber gasket and shall be hinged along one side with a continuous aluminum hinge.

.2 The top of the access frame shall be flush, the handle recessed. A padlock shall be installed within the recess to lock the cover in the closed position.

.3 A cover stay shall be provided that allows the cover to be locked in the open position.

.4 Where applicable, each access frame shall be capable of supporting the full weight of any equipment that can be installed through its opening.

.5 The access frames shall be designed for embedding into the concrete top of a sewer station, the extrusion shall be shaped such as to provide good anchoring to the concrete. All surfaces in contact with the concrete shall be bitumastic coated.

.6 Where multiple frames are used, the frames shall be capable of being installed side-by-side by bolting them together using standardized bolting kits.

.7 Where applicable, aluminum rail nuts shall be provided within the extrusions, permitting an upper guide bar holder, a level regulator hanger and a chain hook to be attached without any modifications required to the frame.

.8 A bilingual confined space warning label shall be clearly displayed on the underside of the cover.

.9 Access frames shall be provided with a rigid fall-through safety grate that will allow access to level regulators for cleaning and adjusting as well as visual inspection of the chamber. The grating shall be painted in a high visibility colour, hinged, and provided with the ability to be locked closed.

2.8 LIQUID LEVEL CONTROL

.1 Liquid level regulators shall be provided to control the operation of the pumps in accordance with variations of sewage levels in the pump chamber.

.2 Float type level regulators shall consist of a switch enclosed in a watertight polypropylene casing, and shall be suspended from the top of the pump chamber by means of a three conductor, SJOW or PVC-jacketed cable and set at pre-determined elevations within the pump chamber.

.1 The centre of gravity of the float type level regulator being in a different position from the centre of buoyancy, results in the regulator tilting whenever the liquid level reaches it, thus activating the switch to energize or de-energize the control circuit.

.2 The float type level regulator shall be installed on a galvanized hanger fitted with non-metallic cable glands. Level regulator cables shall run directly to the control panel. Cable lengths shall be selected to suit site conditions without the need for splicing.

.3 The air bubbler level control system shall utilize an electronic pressure switch that shall continuously monitor the wet well level, permitting the operator to read wet well level at any time. Upon operator selection of automatic operation, the electronic pressure switch shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "lead pump stop level", the electronic pressure switch shall stop this pump. These actions shall constitute one pumping cycle. Should the wet well level continue to rise, the electronic pressure switch shall start the second pump when

the liquid reaches the "lag pump start level" so that both pumps are operating. These levels shall be full adjustable with a local LED status indicator.

.1 The electronic pressure switch shall include a DC power supply to convert 120VAC control power to 12VDC EPS power. The power supply shall be 500 mA (6W) minimum and be UL listed Class II power limited power supply.

.2 The electronic pressure switch shall be equipped with an electronic comparator and solid state output relay to alert maintenance personnel to a high liquid level in the wet well. An indicator, visible on the front of the control panel, shall indicate that a high wet well level exists. The alarm signal shall be maintained until the wet well level has been lowered and the circuit has been manually reset. High water alarm shall be furnished with a dry contact wired to terminal blocks.

.4 Ultrasonic level transmitters shall use non-contacting ultrasonic technology to provide effective monitoring for a range up to 15 meters. The beamwidth of the ultrasonic level transmitter shall be sufficiently narrow as to avoid nuisance detections of station components such as pumps or piping, or shall incorporate programming to ignore these items. The level transmitter shall have a 4-20 mA output to provide level information to the pumping station controller.

.5 Submersible level transducers shall be designed for use in sewage applications and constructed of non-corroding materials. Cables shall be of sufficient length to reach control panel without splicing, be rated to suspend the level transducer without the support of other cables, and incorporate a vent tube equipped with user replaceable vent filter to prevent moisture from entering the level transducer electronics. The level transducer shall have a 4-20 mA output to provide level information to the pumping station controller. Scaling shall be for full station depth with an overpressure rating a minimum of two (2) times full scale. The level transducer shall be installed in a 100 mm diameter pipe inside the station to protect against fat buildup. The pipe shall be supported at top and bottom to the wall of the pump station via hot dip galvanized supports. Where more than one length of pipe is required, the joint shall be supported to the wall. The level transducer cable shall be supported from the top of the pipe via a non-metallic cable gland.

.6 Level sensing probes shall use the conductive properties of the sewage to complete a circuit to ground from a probe controller installed in the station control panel via metallic sensors mounted on the probe. The system shall consist of

probe controller in the pump control panel, intrinsically safe barrier, and the sensing probe.

.1 The probe shall be constructed of non-conductive PVC with ten (10) pairs of sensors evenly spaced along its length. The sensors shall be constructed of stainless steel that will not corrode in a sewage environment and shall be of minimal projection to prevent materials from hanging up on them. The probe shall have a flexible cable suitable for sewage environments and capable of supported the weight of the probe without the need for other support. The cable shall be secured to the top of the probe with a compression fitting and the probe assembly shall be injected with an epoxy or urethane resin to fully encapsulate all internal components and connections into one unit. The cable shall contain a conductor for each pair of sensors with each conductor uniquely marked for identification of the sensor pair. Markings shall be at regular intervals not exceeding 300 mm. The probe shall be equipped with a stainless steel hanger for suspension from the top of the station in a turbulent part of the wet well. The hanger shall be equipped with a polyurethane squeegee through which the probe can be pulled to remove any deposits that may build up on the probe.

.2 The probe controller shall be mounted in the inner door of the pump control panel and shall monitor all of the sensor pairs of the level probe and provide a visual indication of the submerged sensors thus providing a visual indication of the well level. The probe controller shall be equipped with ten (10) digital outputs, one for each sensor pair, and one (1) 4-20 mA analog output to provide level information to the pump controller. An intrinsically safe barrier shall be installed between the level probe and the probe controller.

2.9 PUMP CONTROL PANEL

.1 Submersible Pump Control Panel

.1 General

.1 All parts shall be of the best industrial quality, designed for extended, reliable and maintenance-free operation under extreme weather conditions. Electro-mechanical components shall normally be limited to a strict minimum.

.2 The enclosure shall be of heavy industrial quality, SS, and shall be weatherproof to EEMAC 4x with a minimum of a 3-point closing

mechanism activated by a single handle in order to provide reliable outdoor operation. Quarter turn fasteners or screws are not considered adequate means of securing the outer door against weather. The box shall be fitted with a heavy steel inner door. The exterior door shall be hinge-mounted with a 135-degree angle opening to allow easy access to the components.

.3 The control panel shall be equipped with a main disconnect switch, automatically interlocked with the inner door to electrically isolate the components of the control panel when the inner door is open.

For ratings up to 100 A, the main disconnect switch shall be of the fusible type, with fuses rated at 100,000 A short-circuit capacity. For capacities above 100 A, the main disconnect switch shall be a thermal-magnetic circuit breaker having a fast response, with a high interrupting capacity approved by the Owner, and sealed contact chambers with clear covers for inspection.

.4 Each pump circuit shall be fitted with an adjustable 3-pole, thermal magnetic-circuit breaker or current-limiting motor protector and overload relay. The response time under short-circuit conditions shall be less than one-quarter of a cycle; the action shall open all poles, thus avoiding single-phase operation of three-phase pumps.

.5 The circuit breaker and overload relay shall exhibit stable operation under varying temperature conditions (from -25 degrees C up to 50 degrees C). The circuit breaker shall have a high interrupting capacity independent of the thermal setting.

.6 Each pump circuit shall be fitted with a 3-pole, fast-acting magnetic contactor, designed for a minimum of 20 years service under normal operating conditions of sewage pumping stations. Under overload conditions, the circuit shall be designed to open the overload relay first and then the contactors.

.7 The control shall be equipped with not less than a 100-watt heating element integral with a thermostat and a protective shield around the heating element to prevent injuries.

.8 A manual line transfer switch, complete with a weatherproof, exterior-mounted receptacle, shall be installed

.9 Phase failure and phase reversal protection shall be installed in three phase stations only.

.2 PLC / Micro Processor Controller Based:

.1 The pump manufacturer shall supply a completely assembled control panel based on a solid-state microprocessor or PLC controller with a

fault diagnostic system and pump running time recorder, specially designed and programmed for the operation of two or more submersible pumps, _____ kW, _____ volts, _____ phase, as specified. Where specified by the Owner an electro-mechanical panel may be provided. This panel shall provide basically the same functions as the PLC based, except for the float fault function.

.2 Isolated handles for each motor protector shall be mounted on the inner door.

.3 A state-of-the-art, microprocessor-based or PLC control with fault diagnostics and display shall be used to provide failsafe operation of the sewage pumping station and shall fulfil, but not be limited to the following functions:

.1 The controller shall control the starting, stopping and alternation of the pumps and shall include a 15-second time delay between the consecutive start of either pump to prevent high inrush currents which would result if both pumps were started at the same time.

.2 The controller shall provide a visual indication showing which level regulator is activated. The controller shall monitor any failure in any of the level regulator circuits. If any of the level regulators are out of service, the next higher level regulator shall assume automatically the duties of the faulty regulator. At the same time, a visual indicator shall identify the faulty level regulator.

For example: if float is faulty, float 2 will assume the duties of float 1; float 3; the duties of float 2, and float 4, the duties of float 3 and 4. Even in the event of fault occurrences in all of the level regulator circuits the control shall at least send an alarm.

.3 The controller shall have a visual indicator showing the pump(s) in operation and/or a demand for a pump to operate.

.4 The controller shall monitor the pump heat sensor output(s) and shall shut off the overheating pump before high temperature damage to the insulation.

.5 The controller shall monitor any leakage of water into the stator housing and shall shut off the faulty pump and initiate the alarm.

.6 The controller shall start the back-up pump whenever a faulty condition stops the service pump.

.7 The controller shall identify the degree of urgency of all fault conditions and classify them as "malfunction" or “emergency”. An optional (as specified by the Owner) remote monitoring system shall transmit these conditions to a remote location through telemetry.

.8 High priority faults, identified as "emergency", which require immediate intervention, are only alarmed when a definite risk of flooding exists.

.9 Low priority faults are identified as "malfunctions" and their correction may be scheduled during the regular maintenance activities of the following day.

.10 Upon inspection, the diagnostic display will identify any fault that has occurred since the last visit, even if the fault has self-corrected or no longer exists.

.11 An alarm silencing push button shall be included to stop the alarm from unnecessary operation, once the station operator has taken notice of the fault.

.12 Physical MANUAL/OFF/AUTO switches shall be mounted on the inner door to allow manual pump operation.

.13 An alarm test button shall be incorporated for testing the alarm circuits.

.14 Visual indication of pump station operation and alarms shall be through either a LED panel or HMI.

.4 A duplex receptacle with ground-fault circuit interrupter at 120 V shall be installed for connection of a convenience lamp. An exterior-mounted, vandal-proof, shatter proof alarm light, two running-time recorders, and a two-pump, running-time recorder shall be installed. To prevent water leaks into the control enclosure, the alarm light shall not be mounted on the top of the control enclosure

.5 The controller shall operate the pumps as per the following sequence:

.a	Float 1:	stop both pumps and alternate pumps
.b	Float 2:	run duty pump
.c	Float 3:	run standby pump
.d	Float 4:	emergency alarm

.3 PLC/RTU Based:

.1 The pump manufacturer shall supply a completely assembled control panel based on a PLC/RTU controller complete with graphics touch

screen operator interface and remote communications using modbus protocol or option modbus TCP/IP protocol via high-speed Internet access. The panel shall be designed and programmed for the operation of two or more submersible pumps, _____ kW, _____ volts, ... phase as specified. The panel shall provide space for a UHF or 900 MHz data radio.

.2 A PLC/RTU shall be used to provide fail safe operation of the sewage pumping station. All control system parameters required to implement the pumping station operation shall be entered using the touch screen. The system shall be designed to be 100% user configurable to allow the operator to perform the initial start-up and any future adjustments to the parameters, set points, alarms set points, etc. The PLC/RTU shall fulfill, but not be limited to the following functions:

.1 The PLC/RTU shall control the starting, stopping and alternation of the pumps and shall include a user selectable time delay between the consecutive start of either pump to prevent high inrush currents which would result if both pumps were started at the same time.

2 The PLC/RTU shall be interfaced to a minimum of a 125 mm, 256 color graphics touch screen for data entry and monitoring. The screen shall display a minimum of 320 trend points on the X-axis to permit on screen plotting of all data points. The range between points shall be user selectable, in seconds.

.1 The screen shall display active and current alarms and alarm history of the last 25 alarms.

.2 The following alarms shall be displayed:

- pump under current
- pump over load
- pump high temperature
- pump leakage
- transmitter fault
- high well level
- low well level
- voltage fault

.3 The screen shall have a graphical representation of the pumping station showing the following:

- pump hours

- pump starts
- pump amps
- pump status
- well level
- station inflow
- pump flow
- combined pump flow

.3 The PLC/RTU shall be programmed to log well level, pump starts, pump amps, pump hours and station inflow. The data logger shall have a minimum storage capacity of 10,000 records with user selectable logging rate. This data shall be stored to a removable memory storage device to upload to a computer for analysis. Where this data is stored in a proprietary format, the software package necessary to view this data shall be provided with the pump station.

.4 All operating parameters are to be entered from the touch screen through a series of configuration screens and include but is not limited to the following:

- Well Level Transmitter Span
- Well Level Transmitter Zero
- Float or Level Transmitter operation selection
- Float normally open or normally closed selection
- Hi and Lo alarm Set points
- Lead, Lag, and Standby pump start and stop set points
- Leak and thermal fault enabling and selection for each pump
- Pump 1, 2 & 3 Start delay time
- Pumps Maintenance selection/interval
- Wet well surface area
- Riser Area
- Bench Level
- Auto clean settings
- Data log settings
- External alarm light settings
- Pump auto status

.5 The PLC/RTU shall be equipped with flash type non-volatile type memory.

.6 The PLC/RTU shall have sufficient communication ports for communication with all equipments specified.

.3 A duplex receptacle with ground-fault, interrupter at 120 V, 3 amps shall be installed for connection of a convenience lamp, and an exterior-mounted, vandal-proof, shatter proof alarm light. To prevent water leaks into the control enclosure, the alarm light shall not be mounted on the top of the control enclosure

.4 The control panel and PLC/RTU shall operate the pumps as per the following sequence:

.1 Pump stop level set point
.2 Stop both pumps and alternate pumps
.3 Lead pump run set point
.4 Run duty pump
.5 Standby pump run set point
.6 Run standby pump

.2 Self- Priming Pump Control Panel

.1 The pump station control panel shall be tested as an integral unit by the pump station manufacturer. The control panel shall also be tested with the pump station as a complete working system at the pump station manufacturer's facility.

.2 Panel Enclosure

.1 Electrical control equipment shall be mounted within a common NEMA 1 stainless steel, dead front type control enclosures. Doors shall be hinged and sealed with a neoprene gasket and equipped with captive closing hardware. Control components shall be mounted on removable steel back panels secured to enclosure with collar studs.

.2 All control devices and instruments shall be clearly labelled to indicate function.

.3 Branch Components

.1 Motor branch components to be of highest industrial quality, and securely fastened to the sub-plate.

.2 Circuit Breakers and Operating Mechanism

.1 A properly sized heavy duty circuit breaker, with RMS interrupting rating of _____. amperes at _____ volts, shall be furnished for each pump motor. The circuit breakers shall be sealed by the manufacturer after

calibration to prevent tampering.

.2 An operating mechanism installed on each motor circuit breaker shall penetrate the control panel door. A padlockable operator handle shall be secured on the exterior surface. Interlocks shall prevent opening the door until circuit breakers are in "OFF" position.

.3 Motor Starters

.1 An open frame, across-the-line, NEMA rated magnetic starter with under-voltage release, and overload protection on all three phases, shall be furnished for each pump motor. Starters of NEMA size 1 and above shall allow addition of at least two auxiliary contacts. Starters rated "O", "OO", or fractional size are not acceptable. Power contacts to be double-break type made of cadmium oxide silver. Coils to be epoxy molded for protection from moisture and corrosive atmospheres. Contacts and coils shall be easily replaceable without removing the starter from its mounted position. Each starter shall have a metal mounting plate for durability.

.4 Overload Relays

.1 Overload relays shall be solid-state block type, having visual trip indication with trip-free operation. Electrically resetting the overload will cause one (1) normally open and one (1) normally closed isolated alarm/control contact to reset, thus re-establishing a control circuit. Trip setting shall be governed by solid-state circuitry and adjustable current setting. Trip classes shall be 10, 15 and 20. Additional features to include phase loss protection, selectable jam/stall protection and selectable ground fault protection.

.2 A reset mounted through the control panel door, shall permit resetting the overload relays without opening the door.

.4 Control Circuit

.1 A normal duty thermal-magnetic circuit breaker shall protect all control circuits by interrupting control power.

.2 Pump mode selector switches shall permit manual start or stop of each pump individually, or permit automatic operation

under control of the liquid level control system. Manual operation shall override all shutdown systems, except the motor overload relays. Selector switches to be oil-tight design with contacts rated NEMA A300 minimum.

.3 Pump alternator relay to be electro-mechanical industrial design. Relay contacts to be rated 10 amperes minimum at 120 volts non-inductive. A switch shall permit the station operator to select automatic alternation of pumps, to select pump number one to be "lead" for each pumping cycle, or to select pump number two to be "lead" pump for each pumping cycle.

.4 Six digit elapsed time meter (non-reset type) shall be connected to each motor starter to indicate total running time of each pump in "hours" and "tenths of hours". An integral pilot light shall be wired in parallel to indicate that the motor is energized and should be running.

.5 A high pump temperature protection circuit shall override the level control and shut down the pump motor(s) when required to protect the pump from excessive temperature. A thermostat shall be mounted on each pump casing and connected to a pump shutdown circuit. If casing temperature rises to a level sufficient to cause damage, the thermostat causes the shutdown circuit to interrupt power to the motor. A visible indicator, mounted through the control panel door shall indicate motor stopped due to high pump temperature. The motor shall remain locked out until the pump has cooled and circuit has been manually reset. Automatic reset of this circuit is not acceptable.

.6 A duplex ground fault receptacle providing 115 VAC, 60 Hz, single phase current, will be mounted on the side of the control enclosure. Receptacle circuit shall be protected by a 15 ampere thermal-magnetic circuit breaker.

.7 Wiring

.1 The pump station, as furnished by the manufacturer, shall be completely wired, except for power feed lines to the branch circuit breakers and final connections to remote alarm devices.

.2 All wiring, work, and schematic wiring diagrams shall comply with applicable standards and specifications of

the CEC.

.3 Control circuit wiring inside the panel, with exception of internal wiring of individual components, shall be 16 gauge minimum, type MTW or THW, 600 volts. Power wiring to be 14 gauge minimum. Motor branch wiring shall be 10 gauge minimum.

.4 Motor branch and other power conductors shall not be loaded above 60 degree C temperature rating, on circuits of 100 amperes or less, nor above 75 degrees C on circuits over 100 amperes. Wires shall be clearly numbered at each end in conformance with applicable standards. All wires on the sub-plate shall be bundled and tied. All wiring outside the panel shall be routed through conduit.

.5 Control wires connected to door mounted components shall be tied and bundled in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall allow the door to swing full open without undue stress or abrasion. Bundles shall be held on each side of hinge by mechanical fastening devices.

.8 Conduit

.1 Factory installed conduit shall conform to following requirements:

.1 All conduit and fittings to be CSA listed.

.2 Liquid tight flexible metal conduit to be constructed of smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight polyvinyl chloride cover.

.9 Grounding

.1 Station manufacturers shall ground all electrical equipment inside the pump station to the control panel back plate. All paint shall be removed from the grounding mounting surface before making final connection.

.10 Equipment Marking

.1 Permanent corrosion resistant name plate(s) shall be attached to the control and include following information:

1. Equipment serial number
2. Supply voltage, phase and frequency
3. Current rating of the minimum main conductor
4. Electrical wiring diagram number
5. Motor horsepower and full load current
6. Motor overload heater element
7. Motor circuit breaker trip current rating
8. Name and location of equipment manufacturer

.2 Control components shall be permanently marked using the same identification keys shown on the electrical diagram. Labels shall be mounted adjacent to device being identified.

.3 Switches, indicators, and instruments mounted through the control panel door shall be labelled to indicate function, position, etc. Labels shall be mounted adjacent to, or above the device.

2.10 ELECTRICAL WIRING

.1 Only equipment essential for the operation of the pump station shall be installed inside. Where possible, all fans, heaters, switches and junction boxes etc. shall be located outside to avoid corrosion or flood damage. All electrical wiring of the pump station shall be designed and supplied by the manufacturer in accordance with the Canadian Electrical Code and CSA draft bulletin S 2619. Pump power and level regulator cables shall be provided in sufficient length to run directly to the control panel via an external conduit. Conduit fittings and strain relief connectors shall be provided in sufficient number and size to permit installation of the conduit to the pumping station. All external conduits shall enter the control panel enclosure only through the bottom. Conduits from the wet well shall be sealed in accordance with the Canadian Electrical Code. Conduits shall be sealed with O- rings at entrances to control panels or junction boxes.

.2 All wiring in the pump station shall be coded either by colour or a numbering system. Pump power and level regulator cables shall be provided with sufficient length to run directly (no splices) to the control panel (except where otherwise specified), and shall be pulled through external conduits.

.3 All conductors in power wiring shall be no less than No. 14 AWG. Control wiring conductors may be smaller in size, in accordance with the current requirements of the circuit involved and all applicable standards.

.4 Power cables and control cables shall not be ran in the same conduit.

.5 Each pump cable shall be ran in its own dedicated conduit.

2.11 INSPECTION, TESTING AND SHIPMENT

.1 Inspection and Testing

.1 The pump/motor assembly shall be CSA approved as one, integral unit, shall be in accordance with CSA. Proof of this approval shall be submitted by the pump manufacturer together with the approval drawings. An approval of the motor unit only shall not be acceptable. The cable shall be CSA approved, SOW type, neoprene-jacketed, with a 90 degree Celsius rating.

.2 Any equipment in the pumping station that may have been provided by another supplier shall have been tested by the original supplier.

.3 The pump cable end will be sealed with a high-quality protective covering to make it impervious to moisture and/or water seepage, prior to shipping to job site and electrical installation.

2.12 LABELS

1. Suitable nameplates shall be permanently affixed onto the pumps, control enclosure components, and other operating components to indicate the purpose of the component or operating routine and parameters applying to the component. The lift station pumps and control equipment are CSA approved and the CSA logo appears on the nameplates of these components.

2.13 DRAWINGS AND DATA

.1 As soon as possible after receipt of an order, the contractor shall furnish the following, according to Section 01340:

1. General assembly drawings (plans, elevations, sections). These drawings shall reflect the necessary location and excavation required for the pumping station.

2. Outline dimension drawings, including, but not limited to:
   .1 Pumping station
   .2 Discharge connections
   .3 Liquid level regulator
   .4 Pumps
   .5 Station equipment
   .6 Access frames
3. Layouts and wiring diagrams for the complete station, including all power and control circuits.

PART 3 – MAINTENANCE AND OPERATIONS MANUALS

.1 Two hard and two electronic copies of the maintenance and operations manual shall be provided for each pumping station in accordance with Section 01720. These manuals shall contain, at a minimum, the following information:
   .1 Start-up reports from the pump service technician
   .2 The general assembly drawing(s) of the station confirming locations, sizes, elevations and equipment to be supplied.
   .3 An outline drawing of the pumps and discharge connections.
   .4 A performance curve for all pumps.
   .5 Information on the level regulation system and components.
   .6 A schematic diagram of the control system.
   .7 Start-up, operating and safety instructions for the system.
   .8 Operating and maintenance information for optional equipment.
   .9 Outline dimension drawings of the installed sewage pumping station as installed.
   .10 Layout and wiring diagrams for the complete station, including all power and control circuits.
   .11 Operators' and complete parts manual to provide complete maintenance and operation information on the station.

PART 4 – INSTALLATION SUPERVISION

.1 An authorized representative of the manufacturer shall be made available to:
   .1 Supervise the installation of the pumps.
   .2 Adjust the level regulators.
   .3 Test the controls.
   .4 Start, test and adjust the equipment for complete and satisfactory operation after installation.

.5 Explain and brief thoroughly, owner's representative on station functioning.

PART 5 – PROVISION FOR POWER

.1 The contractors shall make themselves aware of all existing electrical connections, existing service voltages, existing service capacities, and the electrical requirements for all equipment. The contractor is fully responsible for maintaining station operation during changeover of electrical services.

.2 The contractor is fully responsible to arrange with the electric power utility for temporary power, as required, to the site during construction.

.3 The contractor is fully responsible to schedule with the electric power utility the disconnection of existing electrical services and connection of new electrical services.

.4 The contractor is fully responsible to supply a power cable and use of a generator (if the generator is not included in the contract or available from the town) to test the auxiliary power for the lift station during commissioning. The cable will become the property of the town if a generator is included in the contract or if the Owner has a generator used during commissioning but will remain the property of the contractor if the generator used is the contractors.

PART 6 – BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in subsection 1.1 Measurement for Payment and as included in the Schedule of Quantities and Prices.

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This section covers the requirements for constructing storm sewers, sanitary sewers and service connections with bedding material to lines, grades and dimensions indicated or directed by the Owner.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

American Association of State Highway and Transportation Offices (AASHTO)

M196	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains

ASTM International

C655/C655M	Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
A760/A760M	Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
A796/A796M	Standard Practice for Structural Design of Corrugated Steel Pipe, Pipe-Arches, and Arches for Storm and Sanitary Sewers and Other Buried Applications
D3034	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
F679	Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
F794	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
B745/B745M	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
B209/209M	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3))

AWWA

C301	Prestressed Concrete Pressure Pipe, Steel-Cylinder Type

C302	Reinforced Concrete Pressure Pipe, Noncylinder Type
C303	Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type

CSA Group

A257	Standards for Concrete Pipe and Manhole Sections
G401	Corrugated Steel Pipe Products
B1800	Thermoplastic Nonpressure Piping Compendium
B137	Thermoplastic Pressure Piping Compendium
A3000	Cementitious Materials Compendium
PLUS 4012	Technical Guide: Visual Inspection of Sewer Pipe

Other

MSCCWater Research Centre (WRc), Manual of Sewer Condition Classification

NASSCO Certification

PART 2 GENERAL

2.1 AS-BUILT DRAWINGS

.1 Provide data necessary to produce As-Built Drawings, including details of pipe material, invert elevations at maintenance holes and connections, location of tees, bends, clean-outs, maintenance holes, saddles, laterals and caps.

2.2 MEASUREMENT FOR PAYMENT

.1 Excavation and backfill will be measured in accordance with Section 02223.

.2 Sanitary sewer and storm sewer will be measured through fittings and maintenance holes after the work is completed.

.1 Measurement will be made from centre to centre of maintenance holes, catch basins, and ditch inlets or;

.2 from centre of maintenance holes, catch basins, and ditch inlets to the end of the pipe where no maintenance hole, catch basin or ditch inlet is installed under this contract.

.3 Measurement will be horizontally:

.1 in metres over the centre line of the pipe when the grade of the pipe is less than 10 % and:
.2 in metres along the slope length of the pipe when the grade of the pipe is 10 % or greater, for each size pipe and depth class supplied and installed.

.3 Concrete bedding, head walls, and encasement of pipes will be measured in accordance with Section 03300.

.4 For service connections, measurement will be made in metres horizontally:

.1 where the grade is less than 10 % and along the slope length of the pipe
.2 when the grade is 10 % or greater, from the centre line of the main sewer to a point vertically above the end of the service connections of each size and class of pipe supplied and installed.
.3 The length of long radius bends will not be included as service pipe.

.5 Measurement of long radius bends on service connections shall be by the each

.6 Tees, caps, plugs and other fittings will be measured by unit.

.7 Measurement for TV camera inspection will be by the metre of pipe inspected and accepted.

.8 Measurement for a Closed Circuit Television (CCTV) inspection of pipeline shall be measured in metres on the ground surface along the centreline of the pipe sewer from the centre of one drainage structure to the centre of another drainage structure or outlet end of the pipe sewer. Measurement for pipe culverts shall be from one end of the pipe culvert to the other end of the pipe. In the event that a CCTV inspection is terminated due to a blockage or collapsed pipe or the pipe is inaccessible, measurement shall be in metres for the actual length of pipeline inspected as determined from the chainage indication on the record media.

.9 Granular bedding material will be measured in cubic metres of material incorporated into the work in accordance with Section 02223. No deduction for pipe up to and including nominal diameters of 300 mm will be made. Calculation of deduction will be made for pipe end area, based on the nominal diameter, for pipes in excess of 300 mm nominal diameter.

.10 Breaking into and connecting to existing maintenance hole will be measured by each such connection.

.11 Locating and connecting to existing sewer mains and stubs will be measured by each such main and stub connection.

2.3 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.

.2 Maintain existing sewage flows during construction.

.3 Submit schedule of expected interruptions to the Owner for approval and adhere to approved schedule.

PART 3 PRODUCTS

3.1 CONCRETE PIPE

.1 Non-reinforced circular concrete pipe and fittings in accordance with CSA A257, designed for flexible rubber gasket joints, mortar joints in accordance with CSA A257.

.2 Reinforced circular concrete pipe and fittings in accordance with CSA A257, designed for flexible rubber gasket joints, mortar joints in accordance with CSA A257 and ASTM C655/C655M

3.2 HYPRESCON PIPE

.1 Pipe and Fittings:

.1 Prestressed concrete pressure pipe, steel cylinder type, lined-cylinder type in accordance with AWWA C301 (L).
.2 Prestressed concrete pressure pipe, steel cylinder type, embedded-cylinder type in accordance with AWWA C301 (E).
.3 Reinforced concrete pressure pipe, non-cylinder type in accordance with AWWA C302.
.4 Reinforced concrete pressure pipe, steel cylinder type, pre-tensioned in accordance with AWWA C303.

3.3 STEEL PIPE

.1 Corrugated steel pipe, fasteners and coatings in accordance with CSA G401.

.2 Corrugated steel pipe, fasteners and coatings in accordance with CSA G401 except that the zinc coating mass (total on both sides) shall not be less than 1220 gm/m^2 may be used as an alternative to bituminous coated corrugated steel pipe.

.3 Spiral rib steel pipe in accordance with ASTM A760/A760M and ASTM A796/A796M.

3.4 ALUMINIZED TYPE-2 AND POLYMER LAMINATE

.1 Aluminized corrugated steel pip, couplers, wyes, tees, bends, adapters, nuts and bolts shall conform to the requirements of the most recent revisions of the CSA G401 specification. Wall thickness as specified by the Owner in the MERX Schedule of Quantities and Prices, but not less than the table below.

.2 Polymer laminate corrugated steel pipe, couplers, wyes, tees, bends, adapters, nuts and bolts shall conform to the requirements of the most recent revisions of the CSA G401 specification. Wall thickness as specified by the Owner in the MERX Schedule of Quantities and Prices, but not less than the table specification below.

Pipe diameter (mm)	Wall thickness (mm)	Corrugation
150 to 500	1.6	Any
600 to 1200	2.0	63 mm x 13 mm helical
1400 to 1800	2.0	125 mm x 25 mm helical
2000 to 2400	2.8	125 mm x 25 mm helical
2700 to 3600	3.5	125 mm x 25 mm helical

.3 Provide water-tight cut-off collars as indicated on the contract drawings.

.4 Pre-fabricated end sections, wing walls as indicated on the contract drawings.

3.5 ALUMINUM PIPE

.1 Corrugated Aluminum Pipe and couplers shall be manufactured from coil alloy Alcad 3004-H34 with 7072 cladding and conform with the latest revisions of the following specifications: AASHTO M196, ASTM B745/B745M, ASTM B209/B209M. Wall thickness as specified by the Owner in the MERX Schedule of Quantities and Prices, but not less than:

Pipe diameter (mm)	Wall thickness (mm)	Corrugation
300 to 1000	1.91	Any
1200 to 1800	2.67	76 mm x 25 mm helical
2000 to 2400	3.43	76 mm x 25 mm helical

.2 Contact pipe manufacturer for recommended wall thickness on pipe diameters larger than 2400 mm.

.3 Provide water-tight cut-off collars as indicated on the Contract Drawings.

.4 Pre-fabricated end sections, wing walls as indicated on the Contract Drawings.

.5 Corrugated aluminum pipe shall be acceptable for use in salt water environments.

3.6 PLASTIC PIPE

.1 Smooth wall polyvinyl pipe and fittings in accordance with ASTM D3034 and ASTM F679. Plastic pipe and fittings in accordance with CSA B1800 for 100 / 125 / 150 mm sizes, and for 200 mm to 675 mm sizes. Standard Dimensional Ratio (SDR): 35 for mains and SDR 28 for service pipe, unless otherwise indicated on the contract drawings, with locked-in gasket and integral bell system. Nominal lengths: 4 to 6 m.

.2 Profile wall polyvinyl chloride pipe with locked-in gasket and integral bell system. Pipe and fittings to be certified in accordance with CSA B1800 and ASTM F794. Pipe stiffness to be 320 kPa for sanitary sewer mains, this pipe not to be used for diameters less than 300 mm. Pipe stiffness to be minimum 210 kPa for storm sewer drains. Nominal length 4 m.

3.7 HIGH DENSITY POLYETHYLENE PIPE

.1 Pressure pipe in accordance with CSA B137 to be supplied in 12.2 metre lengths, iron pipe size. All polyethylene pressure pipe to be joined by means of thermal butt fusion or socket fusion, in accordance with the recommendations of the manufacturer. Approved butt fusion equipment to be used and all work to be carried out by workers skilled in the use of such equipment.

.2 Corrugated, double wall pipe in accordance with CSA B1800 for storm sewers. Pipes to have a smooth inner wall. Pipes may be bell and spigot style or plain end fastened with a coupling recommended by the manufacturer. Pipe stiffness to be minimum 210 kPa.

3.8 CEMENT MORTAR

.1 Portland cement in accordance with CSA A3000 normal type 10. Mix mortar one part by volume of cement to two parts of clean, sharp sand mixed dry. Add only sufficient water after mixing to give optimum consistency for placement. Do not use additives.

3.9 CORRUGATED ALUMINUM PIPE

.1 Corrugated Aluminum Pipe and Couplers, manufactured in accordance with AASHTO M196, ASTM B745/B745M, ASTM B209/B209M Alloy Alcad 3004 II34.

PART 4 EXECUTION

4.1 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction or sediment and erosion control drawings or plan, specific to site, whichever is more stringent].

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

.2 Clean pipes and fittings of debris and water before installation. Inspect materials for defects before installing. Remove defective materials from site.

.3 Clean and dry pipes and fittings before installation.

.4 Obtain Owner’s approval of pipes and fittings prior to installation.

.5 Establish location and extent of known service lines and complete any Work with or around existing underground services as per Section 1005.

4.2 TRENCHING AND BACKFILLING

.1 Do trenching and backfill work in accordance with Section 02223.

.2 Protect trench from contents of sewer or sewer connection.

.3 Trench alignment and depth as well as condition of trench bottom require approval prior to placing bedding material and pipe.

.4 Do not backfill trenches until pipe grade and alignment have been checked and accepted and infiltration and ex-filtration test results are within the limits specified. If the pipe is backfilled for any reason prior to testing, accept responsibility to meet the tests or to re-excavate and repair the line and pay all costs.

.5 Separation between Sewers and Water Mains shall be in accordance with Section 02713.

.6 Separation at service connections shall be in accordance with Section 02713.

4.3 CONCRETE BEDDING AND ENCASEMENT

.1 Do concrete work in accordance with Section 03300. Place concrete to details indicated or directed by Owner.

.2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. Rigidly anchor or weight pipe to prevent flotation when concrete is placed if necessary.

.3 Do not backfill over concrete within 24 hours after placing.

4.4 GRANULAR BEDDING

.1 Place granular bedding materials in unfrozen condition and in accordance with details specified or directed.

.2 Shape bed true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Do not use blocks when bedding pipe.

.3 Shape transverse depressions as required to within bell if bell and spigot pipe is used.

.4 Compact each layer full width of bed to at least 95 % of corrected maximum dry density in accordance with ASTM D698 Method D.

.5 Fill excavation below bottom of maintenance holes or structures with specified bedding material or common backfill as directed by the Owner.

4.5 INSTALLATION

.1 Lay and join pipes in accordance with manufacturer's recommendations.

.2 Handle pipe with approved equipment. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.3 Use laser-type instrument to control line and grade for sewers unless otherwise approved by the Owner.

.4 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.5 Commence laying at outlet and proceed in upstream direction with bell ends of pipe facing upgrade.

.6 Check alignment between maintenance holes as each portion is laid by means of a strong light shone through the pipe from maintenance hole to another. If less than half the full pipe cross-section at the light source is visible at the other end, realign pipes at no additional cost to the Contract, if so directed by the Owner.

.7 Do not allow water to flow through pipe during construction, except as may be permitted by Owner.

.8 Whenever work is suspended, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.9 Position and join pipes by approved methods. Do not use excavating equipment to force pipe sections together.

.10 Install PVC pipe and fittings in accordance with CSA B1800 and Uni-Bell.

.11 Lay corrugated steel pipe:

.1 With outside circumferential laps facing upgrade and longitudinal laps or seams at side or quarter points.

.2 With longitudinal centre line of paved invert coinciding with flow line.

.12 Joints:

.1 Corrugated steel pipe:

.1 Install flexible sealing rings where called for.

.2 Match corrugations or indentations of coupler band with pipe sections before tightening.

.3 Tap coupler firmly while tightening, to take up slack and ensure a snug fit.

.4 Ensure bolts are inserted and tightened.

.2 Pipe Joining:

.1 Install gaskets as recommended by manufacturer.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes carefully before joining.

.4 Maintain pipe joints free from mud, silt, gravel and other foreign material.

.5 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted. Use only manufacturers recommended lubricant.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.9 At rigid structures, install pipe joints not more than 600 mm from side of structure.

.3 Concrete pipe joints:

.1 Pipe Interior: Circular pipes 700 mm in diameter and larger, and arch or elliptical pipe equivalent to 900 mm diameter or larger shall have interior gap between ends of adjacent pipes filled with mortar. Apply mortar a minimum 7 calendar days after backfilling has been completed to allow pipe settlement to occur. Finish interior surface of joints smooth.

.2 Pipe Exterior: For bell and spigot pipe, mortar to be used for caulking outside of joints. Press and caulk mortar into place. Allow mortar to set minimum of one hour before backfilling.

.4 Hyprescon pipe joints:

.1 Joints:

.1 Bell and Spigot steel joint rings with confined O-rings, mortar protected.

.13 Block pipes as directed when any stoppage of work occurs to prevent creep during down time.

.14 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes as directed by the Owner. Backfill to prevent flotation as required or as directed by the Owner.

.15 Cut pipes as required for special inserts, fittings or closure pieces in a neat manner, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.

.16 Make watertight connections to maintenance holes or other structures. Provide details of proposed method of installing pipe stubs in structure walls to ensure a watertight joint. In the case of precast maintenance hole bases an integral joint gasket may be cast in the maintenance hole wall to receive the pipe stub. In the case of cast-in-place maintenance hole bases, the exterior pipe surface in contact with the structure wall shall be roughened or treated to provide a bond with the concrete. Any grout used to be non-shrink type.

.17 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes. Joint of saddle to pipe shall be structurally sound and watertight.

.18 Leave joints and fittings exposed for ex-filtration testing. Provide protection when required. If it is necessary to backfill sections of the sewer prior to testing, take full responsibility and bear all costs for any additional excavation and backfill to expose pipe, fittings or joints that may be necessary.

.19 When infiltration and ex-filtration test results are acceptable to Owner, backfill remainder of trench in accordance with Section 02223.

.20 Hand place granular material in uniform layers not exceeding 150 mm thick to minimum 300 mm over top of pipe. Dumping of material directly on top of pipe is not permitted.

.21 Place layers uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.

.22 Compact each layer to at least 95 % maximum density in accordance with ASTM D698, Method D.

4.6 SERVICE CONNECTIONS

.1 Install pipe in accordance with CSA B1800 and manufacturer's standard instructions and specifications.

.2 Maintain grade for 100 and 125 mm diameter sewers at 1 vertical to 50 horizontal unless directed otherwise by the Owner.

.3 Service connections to main sewer shall be approved tees including bends. "Inserta Tee" system, or approved equal, may be used. Do not use break-in and mortar patch-type joints.

.4 Service connections for Type PSM Poly (PVC) pipe to be certified in accordance with CSA B1800, depending on wall type and diameter.

.5 Service connection pipe shall not extend into interior of main sewer.

.6 Make up required horizontal and vertical bends from 45 degree bends or less, separated by a straight section of pipe with a minimum length of four (4) pipe diameters. Use long radius bends where applicable. 100 mm long radius bends shall have a minimum radius of curvature of 600 mm. 150 mm long radius bends shall have a minimum radius of curvature of 900 mm.

.7 Plug service laterals with watertight caps or plugs as approved by the Owner.

.8 Place location marker at ends of plugged or capped unconnected sewer lines. Each marker shall consist of a 38 x 89 mm stake extending from pipe end at pipe level to 0.6 m above grade. Paint exposed portion of stake red with designation SAN SWR LINE in black.

.9 Install service connections before carrying out infiltration and ex-filtration tests.

4.7 FIELD TESTING

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 Prior to video or photo CCTV inspection remove foreign material from sewers and related appurtenances by flushing with water.

.3 Perform infiltration or ex-filtration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.

.4 Complete infiltration and/or ex-filtration testing as directed by the Owner. Perform tests in presence of Owner. Notify Owner 24 hours in advance of proposed tests. For rehabilitation projects where sewers are being installed and immediately put into use, i.e. existing services are being connected as the sewer is being laid, infiltration and/or ex-filtration testing is not required.

.5 Carry out tests on each section of sewer between successive maintenance holes including service connections.

.6 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.

.7 Ex-filtration test:

.1 Fill test section with water in such a manner as to allow displacement of air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are begun.

.2 Immediately prior to test period add water to pipeline until there is a head of 1 metre over interior crown of pipe measured at highest point of test section or water in maintenance hole is 1500 mm above static ground water level, whichever is greater.

.3 Duration of ex-filtration test shall be one (1) hour.

.4 Water loss at end of test period shall not exceed maximum allowable ex-filtration over any section of pipe between maintenance holes.

.8 Infiltration test:

.1 Conduct infiltration test in addition to ex-filtration test.

.2 Install a watertight plug at upstream end of pipeline test section.

.3 Discontinue pumping operations for at least 3 calendar days before test measurements are to commence and during this time keep thoroughly wet at least one third of pipe invert perimeter.

.4 Prevent damage to pipe and bedding material due to flotation and erosion.

.5 Place a 90 degree V-notch weir, or other measuring device approved by Owner in invert of sewer at each maintenance hole.

.6 Measure rate of flow over a minimum of 1 hour, with recorded flows for each 5 min interval.

.9 Infiltration/ex-filtration shall not exceed 4.63 litres per millimetre of internal pipe diameter per kilometre per 24 hours which are the following limits in litres per hour per 100 m of pipe, including service connections.

Internal Pipe Diameter (mm)	Maximum Amount (L/hr)
100	1.93
150	2.89
200	3.86
250	4.83
300	5.79
350	6.75
400	7.72
450	8.68
500	9.65
550	10.61
600	11.58
700	13.51
800	15.44
900	17.37

.10 Repair and retest sewer line as required, until test results are within limits specified at no additional cost to the Contract.

.11 Repair visible leaks regardless of test results.

.12 Carry out any retesting of sewer sections that have previously passed ex-filtration and/or infiltration tests, as directed by the Owner. If any sewer section passes this initial retest, additional payment will be made for such retest of that section. If any sewer section does not pass this initial retest, repair and retest such sewer as required until test results are again within limits specified, at no additional cost to the Contract.

.13 A sewer section is defined as the length of pipe between successive maintenance holes.

.14 Deflection Test for PVC Pipe

.1 Carry out a deflection test on all sections of the sewer. The maximum allowable deflection under fully backfilled and compacted trench conditions shall not exceed 5 % before 30 calendar days and 7.5 % after 30 calendar days.

.2 Locations with excessive deflection shall be repaired and/or the pipe replaced at the Contractor's expense. The equipment used for the deflection test shall be that as recommended by the manufacturer, and may include an Electronic Deflectometer or a Rigid "Go-No-Go" Device. For the purpose of deflection measurement, the base inside diameters and the deflection mandrel dimensions are provided in the following table. To ensure accurate testing the lines shall be thoroughly cleaned. As shown below in the table for base inside diameters and deflection mandrel dimensions PVC SDR-35 (ASTM D3034).

Nominal Size	Base Inside Diameter (mm)	5 % Deflection Mandrel (mm)	7.5 % Deflection Mandrel (mm)
200	194.69	185	180
250	242.9	230.8	224.6
300	288.57	274	266.9
375	353.01	335.4	326.6

.3 For nominal sewer sizes not shown in above table the Mandrel dimensions shall be calculated as follows:

$$\text{Mandrel O. D.} = \frac{100 - \text{Y}}{100} \times \text{Base I. D.}$$

Where:
Y = Deflection Limit in %

4.8 CCTV INSPECTION OF PIPELINES

.1 The following information shall be submitted to the Owner ten business days prior to the start of the CCTV inspection operations:

.1 A copy of the CCTV operator's NASSCO Certification Certificate. A copy of said certificate is required for each CCTV operator working on the Contract. Operators shall have been certified or re-certified within the three years prior to the start of the Contract.

.2 A sample inspection report, resolution tests of digital video recording format, and digital data file. One submission is required for each camera proposed for use on the work. The camera make, model, and serial number shall be clearly identified on each video recording.

.3 The details of the coding accuracy verification system that is to be used to verify inspection accuracy shall be submitted for approval.

.2 Media storage and report presentation shall be cloud based unless prior approval is granted by the Department. All software will be NASSCO

import/export certified (refer to www.nassco.org for a full list of compatible software).

.1 Digital storage device (if approved) will be a minimum USB 2.0 or higher compatibility shall be placed inside envelopes with labels displaying the following information:

.1 Owner's Name
.2 Contract Number or Project Name
.3 Sewer Identification Number
.4 City or Town
.5 Street Name
.6 Inspection Date
.7 Consultant's/Contractor's name

.3 Inspection Report

.1 The report shall include a standard cover sheet showing the following:

.1 Location
.2 Performed By
.3 Date
.4 Contractor

.2 The report shall include a completed Index Page with the headers:

.1 Street Name, From M.H. No., To M.H, No., Page No.

.3 Whether inspected at the same time or not, the complete report will be presented together, from upstream to downstream maintenance hole.

.4 For video inspection results and findings, the heading will state:

.1 the street name
.2 the maintenance hole numbers applicable to this section
.3 the reference drawing number
.4 prevailing weather on the day of the inspection
.5 statement of soil condition in area of inspection, e.g., dry, wet, saturated, frozen
.6 the date of the inspection

.5 The key plan will consist of a small drawing (not to scale) showing the appropriate location of the two maintenance holes in relation to any nearby reference points such as houses (with corresponding civic numbers), telephone poles (with corresponding pole numbers), etc. This drawing will denote:

.1 the maintenance hole numbers
.2 the horizontal distance between the maintenance holes

.3 the direction of sewer flow

.6 The report shall include photographs of:

.1 pipe joints that display gaps, spread, or offset;
.2 signs of infiltration; protruding service lines; crushed, broken or cracked pipe;
.3 variance of the grade of the pipe section; and
.4 gravel or debris or other blockages which may impede flow.

.7 All photographs will labelled and have a corresponding labelled description for the photograph.

.8 All photographs will be numbered in order. This number will appear beside them and will be the same number referred to in the description.

.9 The last page of the report will consist of an area sewer plan to scale, showing the street inspected for the report and applicable maintenance numbers.

.10 Typical Key Plan Templates for Inspection Report

DEPARTMENT PROJECT NO.:

MUNICIPALITY:

STREET NAME:

FROM MH# TO MH#

REFERENCE DRAWING: LINE SECTION LENGTH:

DATE: PIPE SIZE:

WEATHER CONDITION: PIPE MATERIAL:

PIPE SECTION LENGTH: PIPE MATERIAL TYPE:

Sketch	Line length (m)	Photo #	Tape reference (hours, minutes)	Observations

.4 Digital photograph files shall meet or exceed a resolution of at least 800 x 600 pixels.

.5 Survey and camera equipment used to inspect water mains shall have been used exclusively for work in water mains only.

.6 The survey vehicle shall contain a separate area for viewing, recording, and controlling the CCTV operation. The viewing and control area shall be insulated against noise and extremes in temperature. External and internal sources of light shall be controlled in a manner as to ensure the light does

not impede the view of the monitor screen. Seating accommodation for one person shall be provided in addition to the operator seating to clearly view the monitor screen. All equipment used within the pipeline shall be stored outside the viewing, recording, and control area. The vehicle shall include a cell phone or suitable alternative as agreed by the Owner for the duration of the work.

.7 The surveying equipment shall be capable of surveying a length of pipeline up to:

.1 300 m when entry to the pipeline may be obtained at each end of the pipeline.
.2 30 m when rodding is used.
.3 150 m when a self-propelled unit is used when entry is at only one end of the pipeline.
.4 200 m when being towed.

.8 Work shall not commence in a work shift until the Owner is satisfied that all items of the survey equipment have been provided and are in full working order. Each survey unit shall contain a means of transporting the CCTV camera in a stable condition through the pipeline.

.9 When the CCTV camera is towed by winch and cable through the pipeline, all winches shall be stable during the entire CCTV inspection. All cables shall be of steel or of an equally non-elastic material to ensure the smooth and steady progress of the CCTV camera.

.10 Each unit shall carry sufficient number of guides and rollers so that, when surveying, all cables are supported away from pipe and maintenance hole edges. All CCTV cables and lines used to measure the camera's location within the pipeline shall be maintained in a taut manner and set at right angles, when possible, to run through or over the measuring equipment.

.11 The electronic systems, television camera, and monitor shall be of adequate quality to enable the following to be achieved:

.1 Camera: the pan and tilt camera shall have the capability of panning the pipe at 360 degrees with tilt capability of 275 degrees to ensure complete inspections and view of all laterals and deficiencies.
.2 Resolution: the live picture shall be visible with no interference and capable of registering a minimum number of lines of resolution at the periphery as indicated below:

.1 Fixed view camera 350 lines of resolution.
.2 Pan and tilt camera 400 lines of resolution.

.3 Colour Constancy: the lighting shall be set prior to commencing the survey to ensure the camera provides optimum results when used

with its own illumination source. To ensure colour constancy, no variation in illumination shall take place during the survey.

.4 Focus, Iris, and Illumination: the adjustment of focus and iris shall allow optimum picture quality to be achieved and shall be remotely operated. The illumination shall be such as to allow an even distribution of the light around the pipeline perimeter without the loss of contrast or flare out of picture shadowing.

.5 Monitor: monitors shall be a minimum size of 21 inches and shall support resolution equal to or greater than the corresponding video camera resolution.

.6 Digital Video Recorder: digital video recorders shall be able to capture in colour from the live video source with the following requirements:

.1 MPEG-2 or higher or as required by Owner.

.2 Minimum recorded video resolution shall be 420 lines.

.3 NTSC 720 x 480 @ 29.97 frames per second.

.4 The compression technology (codec) used in creating the MP4 digital video recordings shall be fully compatible with all the mainstream video players listed below:

.1 Windows Media Player, Windows and Mac

.2 Apple QuickTime Player, Windows and Mac

.3 VideoLAV VLC Player, Windows and Mac

.4 Video files that do not play properly and completely on all the above players will not be accepted and will require re-doing the CCTV inspection or other corrective procedure. Ensure that the entire inspection of a particular sewer or maintenance hole is contained on the same USB media. Record reverse set-up inspections of a sewer immediately after the original inspection where possible.

.12 When specified in the Contract Documents, pipelines shall be cleaned and flushed immediately prior to CCTV inspection.

.13 Prior to the start of the CCTV inspection, the resolution of digital MPEG video playback for each camera shall be confirmed by recording a resolution chart approved by the Owner, using the following procedure:

.1 Set up the camera as is done for the actual inspection.

.2 Show the camera being introduced and reaching its final position for the test.

.3 Fill the monitoring screen with the resolution chart.

.4 Illuminate the resolution chart evenly and uniformly without reflections ensuring that the illumination source accurately simulates the lighting used in the sewer.
.5 Record a test video for 30 seconds.
.6 Identify the camera make, model, and serial number on the recording.
.7 Record the test at the start of a digital recording.
.8 The resolution test shall be submitted to the Owner.

.14 Prior to commencement of the CCTV inspection, a formal coding accuracy verification system shall be developed and submitted to the Owner and implemented when approved.

.1 The coding accuracy shall be based on accuracy as a function of the number of defects or construction features not recorded, and the correctness of the coding and classification shall be recorded. Coding accuracy is to satisfy the following requirements:

.1 Header accuracy – 95 %.
.2 Detail accuracy – 85 %.

.2 Verification of coding accuracy shall be completed on a random basis on a minimum of 10 % of the inspection reports. A minimum of two accuracy verifications shall be completed for each operator for each week working and submit the results to the Owner for review.

.15 Inspections not satisfying the accuracy requirements shall be re-coded to meet the accuracy requirements and the accuracy of the inspections, immediately preceding and following the non-compliant inspection, shall be verified. This process shall be repeated until the preceding and subsequent inspections meet the accuracy requirements.

.16 Coding accuracy checks shall be submitted to the Owner along with the corresponding video recording.

.17 The work shall include a CCTV inspection of the pipeline and the preparation of all video, digital, and written reports. A certified, trained, and competent CCTV operator shall be used to operate the inspection equipment and code the inspection.

.18 A fixed camera may be used for pipelines less than 300 mm in diameter. For pipelines equal to or greater than 300 mm, a pan and tilt camera shall be used. Each camera shall have an accepted sample submissions report prior to being used for inspection work. The camera lens shall be kept clean at all times during the inspection.

.19 Flow control measures as specified in the Contract Documents shall be implemented to ensure a minimum of 80 % of the height of the pipeline is visible for the entire inspection and shall be approved by the Owner.

.20 All fog shall be evacuated from the pipeline and the pipeline kept clear of fog during the inspection.

.21 At the start of each pipeline being surveyed, the length of pipeline from zero chainage up to the cable calibration point shall be recorded and reported in order to obtain a full record of one of the following:

.1 Pipe sewer length from the inside face of the maintenance hole to the inside face of the next maintenance hole or outlet end of the pipe sewer.
.2 Pipe culvert length from one end of the pipe culvert to the other; or
.3 water main length from the valve pit entry point to the valve pit exit point or termination of the cement mortar lining.

.22 The position metre-reading entered on to the data display at the cable calibration point shall allow for the distance from the start of the survey to the cable calibration point so that the metre-reading at the start of the survey is zero.

.23 In the case of surveying through a maintenance hole when a new header sheet is required, the metre- reading shall be set at zero with the camera focused on the outgoing pipe entrance.

.24 At the start of each maintenance hole length, a data generator shall electronically generate and clearly display on the viewing monitor and video recording, a record of data in alphanumeric form containing the following minimum information:

.1 Automatic update of the camera’s metre-reading position in the pipeline from adjusted zero.
.2 Pipeline dimensions.
.3 Maintenance hole and pipe length reference numbers.
.4 Date of survey.
.5 Road name and location.
.6 Direction of survey.
.7 Time of start of survey.
.8 Pipeline use.

.25 Once the survey of the maintenance hole length is underway, an automatic update of the camera’s metre-reading position in the pipeline from zero in metres and tenths of a metre shall be continually displayed.

.26 The camera shall be stopped when defects are being noted on the coding sheet. Defects in each pipeline length shall be coded according to the standard being used (i.e., CSA Plus 4012, NASSCO Canadian Edition of

the Pipeline and Assessment Certification Program (PACP), or WRc) or as specified in the Contract Documents. Any variation from the manual shall be noted in the survey report.

.27 The survey shall be restarted at the opposite end of the pipeline if a blockage or obstruction is encountered.

.28 Inspections shall be recorded in colour.

.29 Digital video recordings may be saved to a computer hard drive and transferred to a portable hard disk drive, compact disc, or digital video for submission.

.30 A digital format video recording of an inspection shall be produced in colour from a first generation recording by one of the following methods:

.1 A computer system and a video capture card shall be used to capture the recording continuously, regardless of the progression of the inspection. Prior to submission, the raw digital data shall be edited to remove pauses when the inspection progress was not continuous.

.2 A computer system and a video capture card shall be used to intermittently capture the recording. Prior to submission, the raw digital file shall be edited to form one continuous file.

.3 Specialized video recording equipment capable of pausing and resuming live recording shall be used to capture original recording. A single file is to be produced for submission.

.31 Video capture equipment shall be capable of capturing digital video from first generation recordings with no frame loss.

.32 Non-linear video editing software shall be used to edit digital videos. Edited digital files shall not be recompressed.

.33 The camera lens shall be positioned centrally in a circular pipeline and at two-thirds of the vertical dimension in a non-circular pipeline with a positioning tolerance of ±10 % of the vertical pipeline dimension. In all instances, the camera lens shall be positioned looking along the longitudinal axis of the pipeline.

.34 Position the centre of the camera lens in the centre of circular and egg-shaped sewers and maintenance hole risers.

.35 The travelling speed of the camera in the pipeline shall be limited to:

.1 0.1 m/s for pipeline of diameter less than 200 mm;

.2 0.15 m/s for diameters exceeding 200 mm but not exceeding 310 mm; and

.3 0.20 m/s for diameters exceeding 310 mm.

.36 A suitable metre-reading device shall be used that enables the cable length to be accurately measured to indicate the location of the camera. The metre-reading device shall be accurate to ±1 % of the length of the sewer being surveyed. The tolerance shall be demonstrated using one or both of the following methods in conjunction with a linear measurement audit form that shall be completed each day during the survey:

.1 Cable calibration device.
.2 Tape measurement of the surface distance between maintenance holes.

.37 If the accuracy of the measuring device fails, it is to be replaced. The Owner may require that the lengths of pipeline first inspected with the original measuring device be resurveyed using the new measuring device.

.38 Survey reports shall be submitted to the Owner in the following formats, with the noted number of copies, within 10 business days of the completion of the fieldwork:

.1 3 copies of the printed survey report.
.2 2 portable hard disk drives, other digital storage devices and software database as specified in the Contract Documents, each containing the identical survey report information as in the printed copies.
.3 2 copies of the digital video recording.

.39 Entire inspections shall be contained within one digital file on a digital storage device, as applicable. When possible, reverse set-up inspections shall be recorded immediately after the original inspection. Each digital file shall contain the file name, as specified by the Owner and may include the following:

.1 Tender number
.2 E <Entity number>
.3 F <From entity number>
.4 T <To entity number>
.5 Street Name
.6 M <Measured length>
.7 I <Inspected length>
.8 <Inspection direction: DS or US>
.9 <Letter designating inspection sequence> .MPEG

For example: 910-200 E5329 F5328 T5350 BERRY M100.0 I39.2 US B.MPEG indicates that this is the second or “B” partial inspection of this entity, 39.2 m long.

.40 All required header information fields shall be completed and verified for correctness. The software used to produce the survey report shall not

allow the operator to continue inputting information until the preceding field has been completed. The report shall be machine printed and presented according to the standard used.

.41 All dimensions in the survey report shall be metric.

.42 The survey report shall identify major defects and shall include photographs when the need for photographs is specified in the Contract Documents.

.43 One clean set of the Owner's drawings showing maintenance hole numbers that coincide with the coding sheets and videotapes shall be returned to the Owner on completion of the survey. The drawings shall be clearly annotated to show any discrepancies between the drawings and the survey report. Such discrepancies shall be brought to the attention of the Owner during the survey.

.44 Management of excess material shall be as specified in the Contract Documents.

4.9 QUALITY ASSURANCE

.1 Upon submission, printed and digital inspection reports, and digital MPEG video recordings, magnetic data files, and coding accuracy checks shall be reviewed to ensure compliance with the Contract Documents. The Owner may adjust the frequency of reviews based on the results of previous reviews.

.2 Submittals shall be reviewed by the Owner and their acceptance confirmed within 10 business days of submission. Only inspections with minimum accuracy for header information of 95 % and minimum detail accuracy for defects and features of 85 % will be accepted. Non-compliant submissions will be returned for correction. Corrected submissions shall be returned to the Owner for review within 5 business days.

.3 Operators failing to meet the coding accuracy requirements on two occasions shall not be permitted to code on the remainder of the Contract, unless they successfully re-attain NASSCO qualification based on the standard being used, that is to say the Canadian Edition of PACP or WRc.

.4 Re-perform sewer inspections where the Owner has determined the requirements of this specification have not been satisfied.

.5 Correct non-compliant inspection submissions and resubmit the corrected inspections to the Owner within 5 business days.

.6 Repeat the process until the inspection submissions are accepted by the Owner.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

.2 Payment will be made to the maximum of 90 % of the value of sewers, fittings and appurtenances until the system (or sections of the system, if payment approved by the Owner) has passed all tests. The 10 % retained shall be called the sewer test allowance.

.3 Infiltration and/or ex-filtration tests do not apply to corrugated storm sewer pipe unless otherwise specified.

This specification outlines the requirements for the supply and installation of a sanitary sewer outfall pipe.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

American Water Works Association (AWWA)

C104/A21.4	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
C150/A21.50	Thickness Design of Ductile-Iron Pipe
C151/A21.51	Ductile-Iron Pipe, Centrifugally Cast
C600	Installation of Ductile-Iron Mains and Their Appurtenances
C900	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4in Through 12in. (100mm Through 300mm), for Water Transmission and Distribution
C905	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14in Through 48in (350mm Through 1,200mm), for Water Transmission and Distribution

CSA Group

B137	Thermoplastic Pressure Piping Compendium
Z275.2	Occupational Safety Code for Diving Operations
Z275.4	Competency Standard for Diving, Hyperbaric Chamber, and Remotely Operated Vehicle Operations

PART 2 GENERAL

2.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Excavation, Trenching and Backfill: Section 02223

.2 Maintenance Holes, Catch basins, Ditch Inlets and Ditch Inlets: Section 02601

.3 Cast-In-Place Concrete: Section 03300

.4 Aggregates, General: Section 02226

2.2 SAMPLES

.1 At least 20 business days prior to commencing work, inform the Owner of proposed source of bedding materials and provide gradation analysis and other laboratory tests as directed by the Owner.

2.3 MATERIAL CERTIFICATION

.1 At least 20 business days prior to commencing work, submit manufacturer's test data and certification that pipe materials meet requirements of these specifications.

2.4 AS-BUILT DRAWINGS

.1 Provide data necessary to produce As-Built Drawings, including details of pipe material, invert elevations, and location of maintenance holes all in accordance with Section 01720.

2.5 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.

.2 Maintain existing sewage flows during construction.

.3 Submit schedule of expected interruptions to the Owner for approval and adhere to approved schedule.

2.6 MANUFACTURER'S INSTRUCTIONS

.1 Make available one electronic copy of manufacturer's installation.

2.7 MEASUREMENT FOR PAYMENT

.1 Excavation and backfill will be measured in accordance with Section 02223.

.2 Outfall sewer will be measured horizontally from maintenance hole to discharge invert in metres. Horizontal measurements will be made over the surface, through fittings and maintenance holes after the work has been completed.

.3 Tees, caps, plugs and other fittings will be measured by the number of units for each unit installed unless measurement is indicated to be included in the measurement of maintenance holes or other structures.

.4 Concrete bedding and encasement of pipes will be measured in cubic metres to the measurement limits shown or specified, unless noted otherwise in the MERX Schedule of Quantities and Prices.

.5 Concrete head blocks, cradles and supports will be measured by the number of units for each unit installed.

.6 Underwater Video and/or Photo Inspection will be measured by lump sum.

PART 3 PRODUCTS

3.1 PIPE AND FITTINGS

.1 Ductile Iron Pipe

.1 In accordance with ANSI/AWWA C150/A21.50 Pressure Class 350 for 2400 kPa for 100 to 300 mm diameter and as by design in accordance with ANSI/AWWA C150/A21.50 for 350 mm diameter and larger (as indicated in the MERX Schedule of Quantities & Prices Table). Cement mortar lined to ANSI/AWWA C104/A21.4.

.2 Joints

.1 Mechanical, rubber gaskets with plain tip, high strength heat treated cast-iron or alloy steel tie head bolts with hex nuts.

.2 Push-on joint with continuous rubber molded ring gasket.

.3 All other pipes and fittings to be as specified under Section 02702.

.3 Polyvinyl Chlorine Pressure Pipe:

.1 In accordance with AWWA C900, AWWA C905, DR 18, pressure class 150 or to CSA B137; (unless otherwise specified in the MERX Schedule of Quantities and Prices), 1MPa gasket bell end, cast iron outside diameter.

.4 Polyethylene Pressure Pipe:

.1 In accordance with CSA B137 (unless otherwise specified in the MERX Schedule of Quantities and Prices).

.2 HDPE to HDPE joints to be thermal butt fusion welded in accordance with CSA B137 or flanges with backing flanges when necessary.

3.2 PIPE BEDDING MATERIALS

.1 Concrete required for cradles, encasement, supports, in accordance with Section 03300, strength 25 MPa.

.2 Other bedding types to be as specified.

PART 4 EXECUTION

4.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation. Inspect materials for defects before installation. Remove defective material from site.

.2 Check profiles and confirm grades and depths with the Owner, prior to excavation.

.3 Establish location and extent of known service lines and complete any Work with or around existing underground services as per Section 1005.

4.2 TRENCHING AND BACKFILLING

.1 Do trenching and backfilling in accordance with Section 02223.

.2 Trench line and depth, as well as condition of trench bottom, require approval of the Owner prior to placing pipe.

.3 Do not backfill trenches until pipe grade and alignment have been checked and accepted.

4.3 CONCRETE BEDDING AND ENCASEMENT

.1 Do concrete work in accordance with Section 03300. Place concrete to details indicated or directed by the Owner.

.2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. Rigidly anchor or weight pipe to prevent flotation when concrete is placed if necessary.

.3 Do not backfill over concrete within 24 hours after placing.

4.4 PIPE INSTALLATION

.1 Lay pipes in accordance with AWWA C600.

.2 Join pipes in accordance with AWWA C600 and the Manufacturer's Instructions. Torque wrench to be used for all mechanical joint bolts.

.3 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends. Inspect pipes for defects whole, suspended above grade. If required by the Owner, place heavy, tightly woven canvas bag over each pipe end before lowering into trench and leave in place until ready to make joint.

.4 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and

replace defective pipe. Correct pipe that is not in true alignment or grade or pipe that shows undue settlement after installation. Remove all rejected pipe from site of the Works.

.5 Face bell ends of pipe in direction of laying. For mains on a grade of 2 percent (%) or greater, face bell ends upgrade.

.6 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.7 Keep jointing materials and installed pipe free of dirt, water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials. Bulkhead to remain in place until all water is removed from trench.

.8 Position and join pipes with approved equipment. Do not use excavation equipment to force pipe sections together.

.9 Cut pipes as required for special fittings or closure pieces, in a neat manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe. Flame cutting or burning of pipe not permitted.

.10 Align pipes carefully before jointing.

.11 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.12 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again. Use only manufacturer's gasket lubricant.

.13 Complete each joint before laying next length of pipe.

.14 Minimize deflection after joint has been made.

.15 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.16 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.17 Do not lay pipe on frozen bedding.

4.5 UNDERWATER VIDEO AND/OR PHOTO INSPECTION

.1 Safety

.1 The underwater diving and preparation operations are to meet all the safety codes for diving practices both for the Federal and Provincial governing bodies, including “The Occupational Health & Safety Regulations, 2012, NL” and the Occupational Safety Code for Diving Operations CAN/CSA - Z275.4 and the Competency Standard for Diving, Hyperbaric Chamber, and Remotely Operated Vehicle Operations CAN/CSA - Z275.2.

.2 All divers and attendants are to be certified by the applicable regulatory body.

.3 Diving Contractors are responsible for ensuring that all divers, employees and equipment are certified and capable of performing the work described herein.

.4 Prior to any diving inspection, the diving Contractor shall provide a safe work operating procedure & execution plan that shall be suitable to the Owner and applicable safety regulations.

.5 The safe work & execution plan shall include, but not be limited to:

.1 working around bodies of water;
.2 boating safety and operator shall hold a valid license;
.3 all worker(s) travel from shoreline to dive location;
.4 diver and boat positioning/communication plan while underwater;
.5 worker rescue & emergency response plan, including a plan to address the primary transport/rescue boat having mechanical issues during underwater operations;
.6 notification to the closest hyperbaric chamber facility to make the facility aware of the dive in the event of an emergency;
.7 dive tables;
.8 harbour/river traffic management plan;
.9 a dive schedule explaining the scope of the work;
.10 confirmation/certificates that all divers and attendants are certified by the applicable regulatory body;
.11 all equipment is calibrated, certified and capable of performing the work described herein;
.12 a water sample confirming the presence and quantity of, if any, fecal chloroforms if deemed necessary.

.6 Contractor shall also have their Job Hazard Analysis (JHA) for the site and specific task(s). The JHA shall be suitable to the Owner, work crew, and conform to all applicable safety regulations prior to commencing work.

.2 Inspection

.1 In general the diving Contractor shall provide the following:

.1 A colour video monitor and a clear two-way radio communication system that will enable the Owner to communicate with the divers during the inspection operation.

.2 A narrated colour video inspection of the above mentioned work. Marine growth shall be removed from the sample area and other areas where problems are suspected, prior to the video being taped at the Owner's discretion. The narration will clearly describe the location that the diver is inspecting. In particular, at locations where ice damage, scour, deterioration, corrosion, cracks, or any other distress exists in piling, pier caps, connections, concrete decking, or any other component of the structure, the location will be carefully and accurately recorded as the video is taken.

.3 Colour still photographs are required for all areas showing any signs of distress in the structure, such as ice damage, corrosion, cracks, pile uplift/deterioration, and scour or undermining of the foundations. Photographs shall be numbered and corresponding to the number of the defect on the "Defect Map" in the subsection below.

.4 A defect map showing all problem areas shall be provided showing the size, extent and location of the distress.

.5 One electronic and one paper copy of a detailed report pertaining to the inspection will be submitted no later than two (2) weeks after completion of the work to the Owner. Included with the report will be one electronic and one USB drive copy of the narrated color video and photos of the inspection. This report will contain plans with detailed measurements, tables, color still photographs, a detailed discussion of the condition of the structure and its components, and any other information deemed necessary by the Owner to produce a clear and concise report which thoroughly describes the condition of the structure.

.3 Diving Report format to be as follows:

.1 Cover sheet
.2 Index
.3 Preliminary data (location of inspection, climate and water conditions)
.4 Abstract
.5 Personnel
.6 Method of inspection
.7 Findings
.8 Summary
.9 Photographs with location plans

.10 Drawings/Attachments

.4 The Contractor shall submit a draft report for review by the Owner. Once the draft report is accepted by the Owner with no further changes, the report can be finalized and submitted as a final report.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for the supply and installation of foundation and underslab drainage.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

CSA Group

A23.1/A23.2	Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
B1800	Thermoplastic Non-pressure Piping Compendium
G401	Corrugated Steel Pipe Products

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 All work associated with the installation of foundation and underslab drainage will be measured as a lump item within a 1.5 metre perimeter outside the foundation or slab.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Coarse filter aggregate in accordance with CSA A23.1/A23.2, 20 to 5 mm.

.2 Fine filter aggregate in accordance with CSA A23.1/A23.2.

.3 Plastic pipe and fittings in accordance with CSA B1800.

.4 Perforated Corrugated steel pipe, couplers and fittings in accordance with CSA G401 with asphalt coating, inside diameter as indicated on the drawings.

PART 4 EXECUTION

4.1 INSPECTION

.1 Ensure graded subgrade conforms with required drainage pattern before placing filter bed material.

.2 Report to Owner improper slopes, unstable areas, areas requiring additional compaction or other unsatisfactory conditions.

.3 Begin installation of foundation drainage after deficiencies have been corrected.

.4 Ensure foundation wall, damp proofing and water proofing have been inspected and accepted.

4.2 INSTALLATION

.1 Pipe bedding: cut trenches in compacted sub-base and place 100 mm thickness minimum of coarse filter aggregate and tamp to grade.

.2 Pipe laying:

.1 Ensure pipe interior and coupling surfaces are clean before laying.
.2 Lay perforated pipe to a minimum slope of 1:100 or grade as indicated. Face perforations and coupling slots downward.
.3 Lay non-perforated pipe to grade as specified, from perforated pipe to disposal source. Make joints watertight.
.4 Do not use shims to establish pipe slope. Grade bedding to establish pipe slope.
.5 Use fittings recommended by manufacturer except where indicated otherwise.
.6 Install end plugs at ends of collector drains.
.7 Protect pipe ends from damage and ingress of foreign material.
.8 Connect pipe to storm drain or sump pit by appropriate adapters manufactured for this purpose.

.3 Filter bed backfill:

.1 Place filter bed backfill after pipe installation is approved.
.2 Place minimum of 150 mm thickness coarse filter aggregate on each side of perforated pipe and minimum of 300 mm thickness coarse filter aggregate over perforated pipe.
.3 Extend coarse filter aggregate to and along foundation wall minimum 300 mm above top of pipe. Place 150 mm thickness of fine filter aggregate over coarse filter aggregate.
.4 Place minimum of 150 mm thickness clean sand on each side and over non-perforated pipe.
.5 Place filter bed in 150 mm lifts. Consolidate tamping lightly. Prevent displacement of pipe.
.6 Place top seal of polyethylene or building paper to prevent surface infiltration of fine materials into coarse filter material, thereby blocking ground water infiltration.

.4 Provide flush clean-outs for systems where nature of filter material or ingress of deleterious material warrants maintenance.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for constructing water mains, service connections and appurtenances in open cut.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

American Association of State Highway and Transportation Offices (AASHTO)

M105	Standard Specification for Gray Iron Castings

ASME International

B16.1	Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

ASTM International

B62	Standard Specification for Composition Bronze or Ounce Metal Castings
B68/B68M	Standard Specification for Seamless Copper Tube, Bright Annealed
C478/C478M	Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3), Method D)
D2310	Standard Classification for Machine-Made “Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
D2992	Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings
D2996	Standard Specification for Filament-Wound “Fiberglass’ (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
F876	Standard Specification for Crosslinked Polyethylene (PEX) Tubing
F877	Standard Specification for Crosslinked Polyethylene (PEX) Hot- And Cold-Water Distribution Systems
F1282	Standard Specification for Polyethylene / Aluminum / Polyethylene (PE-AL-PE) Composite Pressure Pipe

F2023	Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Tubing and Systems to Hot Chlorinated Water

American Water Works Association (AWWA)

B300	Hypochlorites
B301	Liquid Chlorine
C104/A21.4	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
C110/A21.10	Ductile-Iron and Gray-Iron Fittings
C111/A21.11	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
C150/A21.50	Thickness Design of Ductile-Iron Pipe
C151/A21.51	Ductile-Iron Pipe, Centrifugally Cast
C153/A21.53	Ductile-Iron Compact Fittings
C207	Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
C219	Bolted, Sleeve-Type Couplings for Plain-End Pipe
C303	Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type
C500	Metal-Seated Gate Valves for Water Supply Service
C502	Dry-Barrel Fire Hydrants
C504	Rubber-Seated Butterfly valves, 3in. (75mm) Through 72in. (1,800mm)
C509	Resilient-Seated Gate Valves for Water Supply Service
C600	Installation of Ductile-Iron Mains and Their Appurtenances
C651	Disinfecting Water Mains
C800	Underground Service Line Valves and Fittings
C900	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4in Through 12in. (100mm Through 300mm), for Water Transmission and Distribution
C901	Polyethylene (PE) Pressure Pipe and Tubing, 1/2in. (13mm) Through 3in. (76mm), For Water Services
C904	Cross-linked Polyethylene (PEX) Pressure Pipe, 1/2 in (12mm) through 3 in (76mm), for Water Service

C905	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14in Through 48in (350mm Through 1,200mm), for Water Transmission and Distribution
C906	Polyethylene (PE) Pressure Pipe and Fittings, 4in. (100mm) Through 63in. (1,600mm), For Water Distribution and Transmission
C907	Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4in. through 12in. (100mm Through 300mm), for Water, Wastewater, and Reclaimed Water Service
C909	Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure pipe, 4 in Through 24in (100 mm Through 600 mm) for Water, Wastewater, and Reclaimed Water Service
M17	Manual Installation, Field Testing, and Maintenance of Fire Hydrants

CSA Group

A3000	Cementitious Materials Compendium
B64	Backflow Preventers and Vacuum Breakers
B137	Thermoplastic Pressure Piping Compendium
G30.18	Carbon Streel Bars for Concrete Reinforcement

Canadian General Standard Board (CGSB)

1-GP-12C	Standard Paint Colours

Underwriters Laboratories of Canada (ULC)

CAN-S520	Standard for Fire Hydrants

NSF International

NSF/ANSI Standard 14

NSF/ANSI Standard 61

Plastic Pipe Institute (PPI)

TR-4	Listing of Hydrostatic Design Basis, Hydrostatic Design Stress, Strength Design Basis, Pressure Design Basis, Minimum Required Strength Ratings for Thermoplastic Piping Materials or Pipe

PART 2 GENERAL

2.1 LOCATION OF CURB STOPS

.1 Unless otherwise designated by the Owner, curb stops will be installed by the Contractor within 1.5 m of the road right-of-way off the property line. Curb stops may be located on private property where special conditions exist upon approval of the Owner.

2.2 SUBMITTALS

.1 Submit complete shop drawings and construction schedule for water mains 600 mm diameter and larger. Include method for installation of water main.

.2 Inform Owner of proposed source of bedding materials and provide access for sampling at least four (4) weeks prior to commencing work.

.3 Submit manufacturer’s test data and certification that pipe materials meet requirements of this section at least four (4) weeks prior to beginning work. Include manufacturer’s drawings, information and shop drawings where pertinent.

.4 Pipe certification to be on pipe.

2.3 CLOSEOUT SUBMITTALS

.1 Provide data necessary to produce record drawings, including details of pipe materials, invert elevations, location of tees, bends, laterals and caps, valves, hydrants and end caps in accordance with Section 01720.

.2 Submit directions for operating valves, list of equipment required to operate valves, and details of pipe material,

.3 Submit operation and maintenance instructions.

2.4 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions for approval by the Owner and adhere to interruption schedule as approved by the Owner.

.3 Notify building occupants a minimum of 24 hrs. in advance of any interruption in service.

.4 Do not interrupt water service for more than 3 hrs. and confine this period between 10:00 and 16:00 hrs. local time unless otherwise authorized.

.5 Notify fire department of any planned or accidental interruption of water supply to hydrants.

.6 Provide and post “Out of Service” sign on hydrant not in use.

.7 Advise local police department of anticipated interference with movement of traffic.

.8 Schedule a meeting to discuss pressure testing, swabbing and disinfection a minimum of 24 hours before connection. The Operating Authority shall be invited to the meeting.

2.5 MEASUREMENT FOR PAYMENT

.1 Trenching and backfilling will be measured in accordance with Section 02223.

.2 Water mains will be measured in metres of each type, class, size, and insulation of pipe installed through valves and fittings, including hydrant leads, after the work has been completed. Measurement will be horizontally in metres over the centre line of the pipe when the grade of the pipe is less than 10 % and in metres along the slope length of the pipe when the grade of the pipe is 10 % or greater.

.3 For service connections, measurement will be made horizontally from the point of connection to the water main through curb valve and adjustable valve box to a point vertically above the end of the service connections.

.4 Hydrants, to the specified depth of bury in the MERX Schedule of Quantities and Prices, will be measured in units installed including the hydrant marker post and concrete support base as detailed.

.5 All fittings, sounding points/markers and appurtenances will be measured by units installed.

.6 Hydrant extensions will be measured by the units installed and shall include all fitting and bolting required to make the extension a functional part of the hydrant.

.7 If colour coded painting of hydrants is required, payment shall be made by the each as specified in the MERX Schedule of Quantities & Prices.

.8 Valves not in chambers will be measured in units installed including valves and valve boxes.

.9 Valve chambers will be measured in units installed complete including frames and covers, valves, piping, clamps and appurtenances.

.10 Granular bedding material will be measured in cubic metres of material incorporated into the work in accordance with Section 02223. No deduction for pipe up to and including nominal diameters of 300 mm will

be made. Calculation of deduction will be made for pipe end area, based on the nominal diameter, for pipes in excess of 300 mm nominal diameter.

.11 Concrete for bedding, thrust blocks, encasement of pipes, supports and cut-off walls will be measured in accordance with Section 03300.

.12 Joint restraints, combination air release – vacuum relief valves, valve box extensions, and adjustments to existing valve boxes to grade will be measured by the each.

.13 Swabbing of water main shall be measured by metre of line swabbed, and accepted by the Owner, for each size of pipe cleaned.

.14 Locating existing water main to be measured by the each.

.15 Connecting to existing water main to be measured by the each. This item shall include all fittings as necessary to join the new service to the existing service, removal of the existing curb stop/curb stop box and delivery to the Owner or Owner's depot, and any additional location and excavation after testing is complete and accepted by the Owner's Representative to make the connection to existing laterals. The cost of testing to make new water services connections to the existing service laterals is to be included in the item.

.16 Rigid insulation buried over or around the pipe will be measured by the linear metre for each detail type. Measurement will be horizontally in metres over the centre line of the pipe when the grade of the pipe is less than 10 % and in metres along the slope length of the pipe when the grade of the pipe is 10 % or greater.

PART 3 PRODUCTS

3.1 PIPE AND FITTINGS

.1 Ductile Iron Pipe shall be in accordance with ANSI/AWWA C150/A21.50 and manufactured in accordance with ANSI/AWWA C151/A21.51. All pipe shall be cement mortar lined and asphaltic seal coated in accordance with ANSI/AWWA C104/ A21.4. Pipe shall be supplied in minimum pressure class below, or to the pressure classes shown on the drawing:

Pressure Class	Pipe diameter (mm)
350	100–300
250	350–500
200	600
150	900 mm and larger

.1 Joints:

.1 Mechanical, rubber gaskets with plain tip, high strength heat treated cast-iron or alloy steel tie head bolts with hex nuts.
.2 Push-on joint with continuous rubber molded ring gasket in accordance with AWWA C111/ A21.11.

.2 Fittings in accordance with AWWA C110/A21.10 or AWWA C153/ A21.53 for pipe diameters larger than NPS 4. Restrained joint fittings must be rated to the same pressure rating as the pipe. Thrust blocks are not required on restrained joint fittings.

.2 Reinforced concrete pipe in accordance with AWWA C303.

.1 Pipe and fittings joints

.1 Bell and spigot steel joints with confined rubber gaskets.
.2 Flanged joints to conform in accordance with AWWA C-207.

.3 Polyvinyl chloride pressure pipe:

.1 In accordance with CSA B137 unless otherwise specified in the MERX Schedule of Quantities and Prices or AWWA C900 for pipe sizes 100 mm to 300 mm, Dr 18 (pressure class 150 psi) unless otherwise specified in the MERX Schedule of Quantities and Prices or in accordance with AWWA C905 for pipe sizes 350 mm to 900 mm, DR 18 (pressure class 235 psi) unless otherwise specified in the MERX Schedule of Quantities and Prices. All pipe shall be certified in accordance with CSA B137, shall be UL listed and FM approved, and shall be 1 MPa gasket bell end, cast iron outside diameter.
.2 In accordance with CSA B137, rated at 235 psi, unless otherwise specified in the MERX Schedule of Quantities and Prices or in accordance with AWWA C909 for pipe sizes 100 mm to 450 mm. All pipe shall be certified to CSA B 137, shall be UL listed and FM approved, and shall be 1 MPa gasket bell end, cast iron outside diameter.
.3 Composite epoxy impregnated fibreglass PVC pipe in accordance with ASTM D2996, class H. Unplasticized PVC core overwrapped with bonded fibreglass reinforced epoxy resin. Pressure class 300, 2.4 MPa with cast iron outside diameter and integral bell gasketed joints in accordance with ASTM D2992. Material in accordance with ASTM D2310 classification RTRP-11HZ-5001-PVC-13223.
.4 PVC Fittings in accordance with CSA B 137 or AWWA C907 for pipe sizes 100 mm to 300 mm and shall be UL listed and FM approved.

.5 Cast iron fittings in accordance with ANSI/AWWA C104/A21.4 for pipe larger than 300 mm.

.4 Polyethylene pressure pipe

.1 Polyethylene pressure pipe in accordance with CSA B 137 (unless otherwise specified in the MERX Schedule of Quantities and Prices).

.2 HDPE to HDPE joints in accordance with be thermal butt fusion welded in accordance with AWWA C207, AWWA C906 or flanged with backing flanges when necessary.

.3 Polyethylene fittings in accordance with CSA B137.

.5 Bolted, sleeve-type couplings in accordance with AWWA C219.

3.2 VALVES AND VALVE BOXES

.1 Gate valves in accordance with AWWA C500, standard iron body, bronze mounted, wedge double disc valves with non-rising stems, suitable for 1 MPa with mechanical joints or resilient seat in accordance with AWWA C-509.

.2 Resilient wedge valves greater than 400 mm in diameter shall be gear operated. All other valves 400 mm in diameter and greater shall be gear operated.

.3 Valves to open counter clockwise and to be supplied with a square-sided operating nut, 51 mm to the side, unless otherwise specified.

.4 Cast iron valve boxes: bituminous coated three piece, 125 mm diameter sliding type, adjustable over a minimum of 450 mm. Valve to have circular guide plate that fits over operating nut and prevents lateral movement of valve box. Guide plate not to interfere with operation of valve or key. Base to be large round type with minimum inside diameter of 234 mm. Top of box to be marked "WATER".

.5 PVC valve boxes to be as per manufacturer's recommendations.

.6 Air and vacuum release valves in accordance with CSA B64, heavy duty combination air release valves employing direct acting kinetic principle. Valves to be constructed of cast iron body and cover, with bronze trim, stainless steel floats with shock-proof synthetic seat suitable for 2 MPa working pressure. Valves to expel air at a high rate during filling, at a low rate during operation, and to admit air while line is being drained. Valve to be complete with a surge check unit. Ends to be flanged in accordance with ASME B16.1.

.7 Butterfly valves shall conform to the requirements of AWWA C504.

3.3 VALVE CHAMBERS

.1 Concrete and reinforcing steel in accordance with Section 03200 and 03300.

.2 Precast concrete sections in accordance with ASTM C478/C478M. Ladder rungs be cast integral with unit; field installation not permitted.

.3 Jointing materials:

.1 Manufacturer's rubber ring gaskets,
.2 Mastic joint filler,
.3 Cement mortar or,
.4 Combination of above types.

.4 Mortar: aggregate and masonry cement in accordance with CSA A3000.

.5 Ladder rungs for valve chambers: 20 mm diameter deformed rail steel bars in accordance with CSA G30.18, hot-dipped galvanized after fabrication in accordance with CSA A3000. Rungs are to be safety pattern.

.6 Valve chamber frames and covers: grey iron castings, minimum tensile strength 200 MPa to AASHTO M105 with two coats, shop applied, approved asphalt coating with a mass of approximately 215 kg per set. Design and dimensions to be as indicated. Cover to be marked WATER.

3.4 SERVICE CONNECTIONS

.1 The minimum size of a water service connection shall be 19 mm diameter.

.2 Copper tubing in accordance with ASTM B68/B68M, type K, annealed for service laterals up to 50 mm in diameter.

.3 Ductile iron pipe in accordance with AWWA C151/A21.51, pressure class 150, for service laterals 100 mm diameter or greater.

.4 Polyvinyl chloride pressure pipe in accordance with CSA B137, type 1120 series 160 unless otherwise specified in the MERX Schedule of Quantities & Prices.

.5 Polyethylene pipe in accordance with AWWA C901 pressure class 160 or in accordance with CSA B137, unless otherwise specified in the MERX Schedule of Quantities and Prices.

.6 Cross linked polyethylene pipe in accordance with CSA B137, ASTM F877, PP1 TR-4, NSF/ANSI Standard 14 and NSF/ANSI Standard 61, with co-extruded UV shield to allow exposure to natural sunlight for up to 1 year. The minimum degree of cross linking shall be 80 %.

.7 Crossed linked polyethylene pipe in accordance with AWWA C904, ASTM F876, ASTM F877, ASTM F2023, NSF/ANSI Standard 14 & 61, and CSA

B137. Pipe to have CTS outer diameter, with operating pressure of 160 psi at 23 ° C / 73.4 ° F, 100 psi at 82 ° C / 180 ° F, and 80 psi at 93 ° C / 200 ° F. Pipe to be marked with manufacturing date, and footage every five feet.

.8 Polyethylene/Aluminum/Polyethylene composite pipe in accordance with CSA B137 and ASTM F1282. Compression fittings to be as per manufacturers specifications and suitable for underground service (red brass).

.9 Copper pipe joints: to be flared or compression type suitable for 1 MPa working pressure.

.10 PVC joints: to be bell and spigot to manufacturer's specifications.

.11 Polyethylene pipe joints: to be thermal butt fusion welded or socket fusion welded.

.12 Joints for ductile iron pipe: to be push-on joints in accordance with AWWA C111/A21.11. Rubber gaskets in accordance with AWWA C111/A21.11.

.13 Brass corporation stops: red brass in accordance with ASTM B62 flared or compression type having threads in accordance with AWWA C800, pressure rated for 1050 kPa.

.14 Brass inverted key-type curb stops in accordance with ASTM B62 flared or compression type with drain (unless indicated otherwise in contract documents). Curb stops to have 1.5 to 1.8 m adjustable bituminous coated, cast iron service box with stem to suit depth of bury. Top of cast iron box marked "WATER". The top brass stem on curb stops must be capable of withstanding a 75 foot-pound torque test.

.15 Tappings of ductile iron may be threaded without service clamps. Double strap service connections with galvanized malleable iron body and neoprene gasket cemented in place may be used. Tappings to conform to following:

Pipe Diameter (mm)	Maximum Tap Without Clamp (mm)	Maximum Tap With Clamp (mm)
100	20	25
150	20	40
200	25	50
250	25	50
300	40	75

.16 PE tapping tees or multi-saddle tees: for PE pipe. Tees to be socket fused to pipe up to 150 mm NPS

.17 Service clamps for PE or PVC service connections to be of double strap-type, with confined "O" ring seal cemented in place. Clamps to be tapped with threads in accordance with AWWA C800.

.18 Tee connections: for services above 25 mm. Tee connections to be fabricated of same material and to same standards as specified pipe fittings and to have ends matching pipe to which they are joined.

.19 Copper couplings to be in accordance with AWWA C800.

3.5 HYDRANTS

.1 Hydrants shall conform to the requirements of AWWA C502, and shall be UL listed and FM approved.

.2 Post type hydrants in accordance with UL listed CAN-S520; designed for maximum working pressure of system with two 65 mm threaded hose outlets, one 100 mm steamer port, 150 mm riser barrel, 125 mm bottom valve and 150 mm connection for main. Hydrants to open counter clockwise, threads, outlets and operating nut to local standard unless otherwise specified in the MERX Schedule of Quantities and Prices. Minimum depth of bury to top of hydrant lead is 1800 mm unless otherwise specified in the Project Documents. *Post hydrants to be used in all locations where Fire Flows are not able to be obtained.*

.1 Provide key operated gate valve located 1 m from hydrant unless otherwise specified in the MERX Schedule of Quantities and Prices.

.2 Paint hydrants in accordance with the following colour code:

Flow Rate	Reflective Colour	CGSB 1-GP-12C Colour Chart
Under 38 L/s	RED	509-102
38 to 75 L/s	ORANGE	508-103
Over 75 L/s	GREEN	503-107

3.6 PIPE BEDDING MATERIALS

.1 Granular material in accordance with Section 02223, for granular bedding.

.2 Concrete required for cradles, encasement, supports, thrust blocks and cut-off walls all in accordance with Section 03300, strength 25 MPa.

3.7 PIPE DISINFECTION

.1 Sodium hypochlorite, calcium hypochlorite or liquid chlorine in accordance with AWWA B300 and AWWA B301 to disinfect water mains.

.2 Swab all lines before disinfecting.

3.8 TOOLS AND EQUIPMENT

.1 Supply as directed by the Owner:

.1 One service post wrench for curb stops.
.2 One tee-handle operating keys for valves.
.3 One wrench for operating fire hydrant operating nut.

PART 4 EXECUTION

4.1 PREPARATION

.1 Clean pipes, fittings, valves, hydrants and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

.2 Establish location and extent of known service lines and complete any Work with or around existing underground services as per Section 1005.

4.2 TRENCHING AND BACKFILL

.1 Do trenching and backfill work in accordance with Section 02223.

.2 Trench depth to provide minimum cover over pipe of 1.8 m from finished grade or as indicated.

.3 Trench alignment and depth require the Owner's approval prior to placing bedding material or pipe.

.4 Do not backfill trenches until installed work has been checked and accepted by the Owner.

.5 Sewer and Water Main Vertical Separation: When it is not practical to maintain a separate trench and a minimum horizontal separation distance of 3.0 m (minimum), the crown of the sewer should be at least 0.45 m below the invert of the water main and separated by in situ material or compacted backfill. Joints should be offset as much as possible between sewers and water mains.

.1 Where this vertical separation cannot be obtained, the sewers should be constructed of water main quality pipe, pressure tested in place at a pressure of 350 kPa (50 psi) without leakage in accordance with CSA B137.
.2 In rock trenches, drainage should be provided to minimize the effects of impounding of surface water and/or the leakage from sewers in the trench.

.6 Sewer and Water Main Crossings: Water mains should cross above sewers wherever possible. Whether the water main is above or below the sewer, a minimum vertical distance of 0.5 m between the outside of the water main and the outside of the sewer should be provided to allow for proper bedding and structural support of the water main and sewer pipes. Sufficient structural support for the sewer pipes should be provided to prevent excessive deflection of the joints and settling.

.1 The length of water pipe should be centred at the point of crossing so that joints in the water main will be equidistant and as far as possible from the sewer. The crossing should be perpendicular if possible.

.2 When it is impossible to obtain proper horizontal and vertical separation as stipulated above, one of the following methods should be specified:

.1 The sewer should be designed and constructed equal to the water pipe and should be pressure tested at 350 kPa (50 psi) to assure watertightness; or

.2 Either the water main or the sewer line should be encased in a watertight carrier pipe that extends 3 m (10 ft) on both sides of the crossing, measured perpendicular to the water main.

.7 Where possible, the above separation requirements shall be applied to service connections as well.

4.3 CONCRETE BEDDING, CUT-OFF WALLS AND/OR ENCASEMENT

.1 Do concrete work in accordance with Section 03300. Place concrete to details indicated or directed.

.2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.3 Do not backfill over concrete within 24 hrs after placing concrete.

4.4 GRANULAR BEDDING

.1 Place granular bedding materials to details indicated or directed.

.2 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.

.3 Shape transverse depressions in bedding as required to make joints.

.4 Compact full width of bed to at least 95 % maximum density in accordance with ASTM D698, Method D.

.5 Fill any excavation below level of bottom of specified bedding in accordance with Section 02223.

4.5 PIPE INSTALLATION

.1 Water service laterals shall terminate at the Right-of-Way or when specified to 1.5 metres outside the building wall. Cap or seal end of pipe and place temporary marker to locate pipe end.

.2 Lay and join ductile iron pipe in accordance with AWWA C600, manufacturer's standard instructions and specifications. Do not use blocks except as permitted in subsection 4.3.2 of this specification. Torque wrench to be used for all mechanical joint bolts.

.3 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.4 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe that is not in true alignment or grade or pipe that shows undue settlement after installation.

.5 Face bell ends of pipe in direction of laying and for mains on a grade of 2 % or greater, face bell ends upgrade.

.6 Do not exceed permissible deflection at joints as recommended by pipe manufacturer. Any deflection should be taken after the joint is assembled.

.7 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials. Bulkhead to remain in place until all water removed from trench.

.8 Position and join pipes with approved equipment.

.9 Remove all defective pipe from the site of the works.

.10 Cut pipes, as required, for special fittings or closure pieces, in a neat manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe. Flame cutting and burning of pipe not permitted. File smooth any sharp edges which might damage the gasket.

.11 Align pipes carefully before jointing.

.12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.13 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed,

cleaned, lubricated and replaced before joining is attempted again. Use only manufacturers recommended lubricant.

.14 Complete each joint before laying next length of pipe.

.15 Minimize deflection after joint has been made.

.16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations. Carefully follow all assembly instructions of manufacturer. Provide the Owner with a copy of these instructions.

.17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by the Owner. Backfill to prevent flotation or as directed by the Owner.

.18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.20 Do not lay pipe on frozen bedding.

.21 Protect hydrants, valves and appurtenances from freezing.

.22 Upon completion of pipe laying and after the Owner has inspected work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated or directed.

.23 Hand place granular material in uniform layers not exceeding 150 mm thick to minimum 300 mm over top of pipe. Dumping of material directly on top of pipe is not permitted.

.24 Place layers uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.

.25 Compact each layer to at least 95 % maximum density in accordance with ASTM D698, Method D.

.26 Surround and cover joints and fittings with granular material placed and compacted as specified herein. Backfill remainder of trench in accordance with Section 02223.

.27 Install HDPE pipe to manufacturer's recommendations.

4.6 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations indicated.

.2 Support valves located in valve boxes or valve chambers by means of concrete blocks, located between valve and solid ground. Bedding same as adjacent pipe. Minimum length of pipe on each end of valve shall be

one full pipe length or 1 m at stub connection at Tee. Valves shall not be supported by pipe.

4.7 VALVE CHAMBERS

.1 Use cast-in-place or precast units as indicated and approved by the Owner.

.2 Construct units as indicated, plumb and centred over valve nut, true to alignment and grade. Valve chambers shall not rest on pipe.

.3 Place reinforcing steel and miscellaneous metals required to be embedded in concrete to details indicated and in accordance with Section 03200.

.4 Cast base directly on undisturbed ground or when permitted by the Owner, set a precast concrete base on 150 mm minimum granular material compacted to 95 % maximum density in accordance with ASTM D698, Method D.

.5 Clean surplus mortar and joint compounds from interior surface of valve chamber as work progresses.

.6 Plug lifting holes with precast concrete plugs set in cement mortar, mastic compound or mortar as indicated or approved by the Owner.

.7 Set frame and cover to required elevation to frame with cement mortar, parge and trowel smooth and use concrete slab for setting frame and cover only if authorized in writing by the Owner. Water proof chambers in accordance with Section 02601.

.8 Place frame and cover on top section to elevation indicated. If adjustment is required use concrete ring.

.9 Clean valve chambers of debris and foreign materials; remove fins and sharp projections.

.10 Test chambers for infiltration and exfiltration in accordance with Section 02601.

4.8 SERVICE CONNECTIONS

.1 Install service connections before carrying out hydrostatic and leakage test of water main.

.2 Water service lines shall be installed to the right of sewer service lines when viewed from the position of the water main and facing the building.

.3 Employ only competent workers equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.

.4 Tap main at 2:00 o'clock or 10:00 o'clock position for services up to 32 mm. Do not tap pipe closer to a joint nor adjacent service connections than recommended by manufacturer, or 1 m, whichever is greater. Tap 40 and 50 mm services at 9:00 o'clock or 3:00 o'clock position to keep gooseneck below frost.

.5 Leave corporation stop valves fully open.

.6 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings or use fittings with built in liner.

.7 Install curb stop with corporation box on services 50 mm or less in diameter. Equip larger services with a gate valve and cast iron box. Set box plumb over stop and adjust top flush with final grade elevation. Leave curb stop valves fully closed.

.8 Place temporary location marker at ends of plugged or capped unconnected water lines. Each marker to consist of a 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade. Paint exposed portion of stake red with designation "WATER SERVICE LINE" in black.

.9 The location of existing water services shall be located as work progresses and new water service lines shall be installed with new curbs stops at property line or Owner’s road right-of-way boundaries and/or the appropriate tie in location to the existing line will be determined in the field, as identified by the Owner’s Representative on site. Following acceptance by the Owner of the water system, the new individual service lines are to be connected to the existing service lines and visually inspected for leakage by the Owner’s Representative prior to backfilling.

4.9 HYDRANTS

.1 Install hydrants at locations specified or directed in accordance with AWWA M17.

.2 Install gate valve and cast iron valve box on hydrant service leads as specified.

.3 Set hydrants plumb, with hose outlets parallel with edge of payment or curb line, with pumper connection facing roadway and with body flange set at elevation of 150 mm above final grade. When placed behind the curb no part of the hydrant shall be closer than 150 mm or farther than 300 mm from the gutter face of the curb or future curb. When between curb and sidewalk or on lawn behind sidewalk no part of the hydrant shall be closer than 150 mm, to the sidewalk.

.4 Place concrete thrust blocks as specified ensuring that drain holes remain unobstructed unless specified in the contract that drain holes should be plugged.

.5 Install drain plug in areas of high groundwater when directed by the Owner. After testing and prior to turn over to the owner, pump down water in barrels of plugged hydrants. To provide proper draining for each hydrant, excavate a pit measuring not less than 1 x 1 x 0.5 m deep and backfill with coarse gravel or crushed stone to a level 150 mm above drain holes.

.6 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction. Install hydrant marker post as detailed on the contract drawings.

.7 Disassembly or reassembly of hydrants may only be carried out by properly trained personnel. Hydrants that have been disassembled after leaving the manufacturer's facilities must be pressure tested after reassembly in accordance with AWWA M17.

4.10 THRUST BLOCKS

.1 Do concrete work in accordance with Section 03300.

.2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as specified or as directed by the Owner.

.3 Keep joints and couplings free of concrete.

.4 Do not backfill over concrete within 24 hours after placing.

.5 Install joint restraints with or without thrust blocks where indicated on the plans and specifications or where required by the Owner. Joint restraints shall be of the same pressure rating as the pipes to be joined and restrained. Installation of joint restraints shall be in accordance with the manufacturer's instructions for the types of pipes to be joined and restrained. All components of joint restraints shall be corrosion resistant or suitably protected from corrosion and be approved by the Owner.

4.11 PRESSURE TEST

.1 After the pipe has been laid and backfilled and following the installation of service pipes and fittings, all newly laid pipe, or valved section thereof, shall be subjected to a hydrostatic pressure of 150 % of normal operating pressure based on the elevation of the lowest point in the main and corrected to elevation at the test gauge location or a minimum of

1000 kPa, whichever is greater, for a period of 1 hour. Where hydrants are in the test section, the test shall be made against the closed hydrant valve.

.2 Each valved section of pipe shall be slowly filled with water and the test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Owner. The pump, pipe connection and all necessary apparatus shall be furnished by the Contractor.

.3 Before applying the test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points the Contractor shall install corporation cocks at such points so the air can be expelled, the corporation cocks shall be closed and the test pressure applied.

.4 The pressure test shall be of a duration of at least 2 hours and the pressure shall not vary by more than +/- 35 kPa.

.5 Pressure testing of PE pipe to be carried out as per Manufacturer's recommendations.

.6 Pressure testing of HDPE pipe.

.1 Water is to be used as the pressure medium. Testing can be done before or after the pipe is placed in the trench. If the pipe must be backfilled before it is tested, the mechanical joints may be exposed for visual inspection during testing.

.2 Pipe should be tested at a pressure of 1.5 times the rated pressure of the pipe (1.5 times series number) at the lowest point in the system. To compensate for initial pipe stretch, a period of 3 hours is required to pressurize the pipe plus 1 hour during which time the required pressure is maintained before the test period is started. Unless a high-volume high-pressure pump is used, it is sometimes difficult to raise the pressure within the allowable time.

.3 After the completion of the initial expansion stage, i.e. a total of four hours, the pressure should be at the required level and the test period should commence. This period should not exceed 3 hours. After the test period, a measured amount of make-up water should be added to return the pipe to the test pressure. The amount of make-up water should not exceed the allowance given in the following table:

Nominal Pipe Size		Allowance for Expansion (Litres/100 metres of pipe)		
mm	inches	1-hour test	2-hour test	3-hour test
75	3	1	2	4
100	4	2	4	5

Nominal Pipe Size		Allowance for Expansion (Litres/100 metres of pipe)		
mm	inches	1-hour test	2-hour test	3-hour test
150	6	4	7	11
200	8	6	12	19
250	10	10	16	26
275	11	12	25	37
300	12	14	29	42
350	14	17	35	52
400	16	21	41	62
450	18	27	53	81
500	20	35	68	99
550	22	43	87	130
600	24	56	111	168
700	28	68	138	209
800	32	87	178	267
900	36	112	224	335
1000	40	137	273	410
1200	48	186	335	534

.7 Under no circumstances should the total time under test exceed 8 hours at 2 times the pressure rating. If the test is not completed because of leakage or equipment failure, the test section should be permitted to "relax" for 8 hours prior to the next testing sequence.

.8 Testing for leakage can be done by developing the test pressure (described above) for a period of 4 hours and then dropping the pressure by 69 kPa (10 psi). If the pressure remains steady for one hour this indicates that there is no leakage in the system.

.9 All faulty or leaking connections shall be corrected at the Contractor's expense.

4.12 LEAKAGE TEST

.1 A leakage test shall be conducted concurrently with the pressure test. The Contractor shall supply all equipment necessary for the conducting of this test.

.2 "Leakage" shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof, to maintain pressure within +/- 35 kPa of the test pressure after the air in the pipeline has been expelled.

.3 No pipe installation will be accepted if the leakage is greater than the allowable leakage for joints plus the allowable leakage for closed metal seated valves.

.4 Allowable leakage for joints is calculated as follows:

$$L = \frac{NDP^{0.5}}{128}$$

Where:

L = the allowable leakage in L/hr
N = the number of joints in the length of pipeline tested
D = the nominal diameter of the pipe in metres
P = the average test pressure during the leakage test in kilopascals

.5 Allowable leakage for closed metal seated valves shall be 0.00121 L/hr/mm of nominal valve size.

.6 If any test of pipe discloses leakage greater than the allowable, the Contractor shall, at their own expense, locate and repair the defective joints until the leakage is within the specified allowance. All joints until the leakage is within the specified allowance. All visible leaks are to be repaired regardless of the amount of leakage.

4.13 FLUSHING AND DISINFECTING

.1 Flushing and disinfecting operations shall be witnessed by the Owner. Notify the Owner at least 4 business days in advance of proposed date when disinfecting operations will commence.

.2 Disinfection of water mains shall be done in accordance with AWWA C651.

.3 Prior to being chlorinated the mains shall be filled to eliminate air pockets and shall be flushed to remove particles. Flush with a sufficient flow to produce a velocity of 1.5 m/s, unless the Owner determines that conditions do not permit the required flow to be discharged, or until foreign materials have been removed and flushed water is clear.

.4 Flushing flows shall be as follows:

Pipe diameter (mm)	Minimum flow (L/s)
150 and below	38

Pipe diameter (mm)	Minimum flow (L/s)
200	75
250	115
300	150
350	200
400	250

.5 Water from existing distribution system, or other approved source of supply, shall be made to flow at a constant measured rate into the newly laid water mains and hydrant leads.

.6 At a point not more than 3 m downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate, such that the water will have not less than 25 mg/l free chlorine. To assure that this concentration if provided, measure the chlorine concentration at regular intervals.

.7 During the application of chlorine, valves shall be positioned so that the strong chlorine solution in the main being treated, will not flow into water mains in active service. Chlorine application shall not cease until the entire main is filled with heavily chlorinated water. The chlorinated water shall remain in the main for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24 hours period, the treated water in all portions of the main shall have a residual of not less than 10 mg/l free chlorine.

.8 After the final flushing and before the water main is placed in service, water samples shall be collected from the line and tested for bacteriological quality and shall show the absence of coliform organisms, disinfection shall be repeated until satisfactory samples have been obtained.

.9 The Contractor shall get approval of the governing agency or agencies before the heavily chlorinated water can be discharged into storm, sanitary or other receiving systems. If the heavily chlorinated water cannot be accepted by nearby storm, sanitary or other receiving systems, the water shall be discharged into tanks and disposed of at an approved site. The cost associated with disposing of heavily chlorinated water shall be borne by the Contractor.

4.14 SWABBING

.1 Appropriately sized and designed water main swabs shall be inserted into the main at as many locations as need be to ensure every section of water

main is swept by a swab when the water is first charged into the system. After main lines have been swabbed, hydrant leads will be thoroughly flushed, but not swabbed. Flushing shall be accomplished by opening and closing valves and hydrants several times using water, under expected line pressure, with flow velocities adequate to flush foreign material out of the valves and hydrants.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

.2 Payment will be made to the maximum of 90 % of the value of water mains, hydrants, valves, fittings and appurtenances until the system, or sections of the system if payment approved by the Owner, has passed all hydrostatic leakage tests. The 10 % retained shall be called the water testing allowances

This specification outlines the requirements for the construction of storm water and sanitary sewage force mains and associated appurtenances.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

American Water Works Association (AWWA)

C104/A21.4	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
C110/A21.10	Ductile-Iron and Gray-Iron Fittings
C150/A21.50	Thickness Design of Ductile-Iron Pipe
C151/A21.51	Ductile-Iron Pipe, Centrifugally Cast
C207	Steel Pipe Flanges for Water Service, Sizes 4in Through 144in (100mm Through 3,600mm)
C600	Installation of Ductile-Iron Mains and Their Appurtenances
C900	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4in Through 12in. (100mm Through 300mm), for Water Transmission and Distribution
C905	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14in Through 48in (350mm Through 1,200mm), for Water Transmission and Distribution
C907	Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4in Through 12in (100mm Through 300mm), for Water, Wastewater, and Reclaimed water Services

ASTM International

D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3)
D2310	Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber Reinforced Thermosetting-Resin) Pipe
D2992	Standard Practice for Obtaining Hydriplastic or Pressure Design basis For "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings
D2996	Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

CSA Group

B70	Cast Iron Soil Pipe, Fittings, and Means of Joining
B137	Thermoplastic Pressure Piping Compendium

I.T.T. Grinnell

Figure 167 size	Insulation Protection Shield
Figure 181 size	Roller Hanger

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Trenching and backfilling will be measured in accordance with Section 02223.

.2 Sewage force main will be measured through fittings and chambers after the work is completed. Measurement will be horizontally in metres over the centre line of the pipe when the grade of the pipe is less than 10 % and in metres along the slope length of the pipe when the grade of the pipe is 10 % or greater, for each size pipe and depth class supplied and installed.

.3 Granular bedding material will be measured in cubic metres of material incorporated into work in accordance with Section 02223.

.4 Concrete for bedding, encasement of pipes, supports and thrust blocks will be measured in accordance with Section 03300.

.5 Combination air release valve and vacuum valve and chamber to be measured in units for each installed, including all labour and materials including the connection to the force main.

.6 Fittings will be measured in units of each size installed.

.7 Force main connection to maintenance holes, including grouting flange and bends, will be measured by the unit.

.8 Swabbing of force main will be measured in metres of pipe swabbed for each size of pipe cleaned.

.9 Breaking into and connecting to existing maintenance holes to be measured by the each.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Ductile iron in accordance with AWWA C151/A21.51 Pressure Class 350 for 2400 kPa for 100 mm to 300 mm diameter (unless otherwise specified in the MERX Schedule of Quantities and Prices) and by design in accordance with AWWA C150/A21.50 for 350 mm diameter and larger (unless otherwise specified in the MERX Schedule of Quantities and Prices), cement mortar lined in accordance with AWWA C104/A21.4.

.1 Joints:

.1 Mechanical, rubber gaskets with plain tip, high strength heat treated cast-iron or alloy steel tie head bolts with hex nuts.

.2 Push-on joint with continuous rubber moulded ring gasket.

.2 Fittings in accordance with CSA B70, AWWA C110/A21.10 and cement mortar lined in accordance with AWWA C104/A21.4.

.2 Polyvinyl chloride (PVC) pressure pipe:

.1 In accordance with AWWA C900 for pipe size 100 mm to 300 mm and AWWA C905 for pipe size 350 mm to 900 mm, DR 18 (pressure class 150), (unless otherwise specified in the MERX Schedule of Quantities and Prices) 1 MPa gasket bell end, cast iron outside diameter.

.2 In accordance with CSA B137, PVC series 160, 1.1 MPa elastomeric gasket coupling.

.3 Composite epoxy impregnated fibreglass PVC pipe in accordance with ASTM D2996, class H. Unplasticized PVC core over wrapped with bonded fibreglass reinforced epoxy resin. Pressure class 300, 2.4 MPa with cast iron outside diameter and integral bell gasketed joints in accordance with ASTM D2992. Material in accordance with ASTM D2310 classification RTRP-11HZ-5001-PVC-13223.

.4 Cast iron fittings in accordance with AWWA C110/ A21.10 and for pipe diameters larger than NPS 4 cement mortar lined in accordance with AWWA C104/ A21.4.

.5 PVC fitting in accordance with CSA B137 or AWWA C907.

.3 Polyethylene pressure pipe in accordance with CSA B137 (unless otherwise specified in the MERX Schedule of Quantities and Prices).

.1 Polyethylene to polyethylene joints: to be thermal butt fusion welded in accordance with AWWA C207 or flanged with steel backing flanges.

.2 Polyethylene fittings in accordance with CSA B137 for pipe sizes NPS 4 and less.

.4 Pipe insulation to be rigid polyethylene foam factory applied, core density 32 to 48 kg/m^3, closed cell content 90 % minimum, water absorption p.024 gm/cm^3 per surface immersed 45 hours, 2.44 metre head of water, thermal conductivity 0.019 to 0.028 W/m·° C compressive strength 210 to 281 kg/m^2, tensile strength 527.3 kg/m^2, shear 2109 kg/m^2, maximum service temperature 121 ° C.

.5 Pipe metal jacket to be 0.889 mm galvanized steel formed from a continuous strip that is shaped and jointed in a spiral pattern using a pressure grooved, single lock, waterproof seam.

.6 Adjustable steel yoke pipe roll shall be as manufactured by I.T.T. Grinnell Figure 181 size “Roller Hanger” to match outside diameter of insulated pipe systems.

.7 Insulation protection shield shall be as manufactured by I.T.T. Grinnell Figure 167 size “Insulation Protection Shield” to match outside diameter of insulated pipe system.

3.2 PIPE BEDDING MATERIALS

.1 Granular bedding and backfill materials in accordance with Section 02223.

.2 Concrete for cradles, encasement, supports, thrust blocks in accordance with Section 03300, strength 25 MPa.

PART 4 EXECUTION

4.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

.2 Establish location and extent of known service lines and complete any Work with or around existing underground services as per Section 1005.

4.2 TRENCHING AND BACKFILL

.1 Do trenching and backfill in accordance with Section 02223.

.2 Trench alignment and depth require approval prior to placing bedding material or pipe.

.3 Do not backfill trenches between joints until pipe slope and alignment have been checked and accepted. Do not backfill at joints and valves until pressure and leakage test results are within limits specified. Provide a minimum 1.8 m cover unless otherwise specified.

4.3 BEDDING

.1 Place bedding material to details indicated and compact to minimum of 95 % of Corrected Maximum Dry Density in accordance with ASTM D698.

4.4 CONCRETE BEDDING AND ENCASEMENT

.1 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.2 Do not backfill over concrete within 24 hrs after placing concrete.

4.5 INSTALLATION

.1 Lay and join pipes in accordance with AWWA C600 for ductile iron pipe and manufacturer's recommendations. Torque wrench to be used for mechanical joint assembly. Avoid damage to machined ends of pipes in handling and moving pipe.

.2 Maintain grade and alignment of pipes. Align pipes carefully before jointing.

.3 Do not exceed maximum joint deflection recommended by pipe manufacturer unless directed in writing by the Owner. Use special bends where necessary to avoid joint deflection. Support pipe firmly over entire length, except for clearance necessary at couplings.

.4 Keep pipe and pipe joints free from foreign material. Avoid bumping gasket and knocking it out of position, or contaminating with dirt or other foreign material. Gaskets so disturbed to be removed, cleaned, lubricated and replaced before jointing is attempted. Use gasket lubricant as recommended by manufacturer.

.5 Support pipes by means of hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.6 Apply sufficient pressure in making joint to ensure that joint is complete to manufacturer's recommendations.

.7 Apply restraint to force main to ensure that joints when completed are held in place, by tamping fill material under and alongside pipe, or otherwise as approved by the Owner.

.8 Block pipe as directed when any stoppage of work occurs to prevent creep during down time.

.9 Do not lay pipe on frozen bedding. Insulated above ground high density polyethylene pipe to be installed in accordance with manufacturer's recommendations.

.10 Upon completion of pipe laying and after the Owner has inspected work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated or directed.

.11 Leave joints and fittings exposed for hydrostatic testing. If it is necessary to backfill sections of the force main prior to testing, take full responsibility and bear all costs for any additional excavation and backfill to expose pipe, fittings or joints that may be necessary.

.12 Hand place granular material in uniform layers not exceeding 150 mm thick to minimum 300 mm over top of pipe. Dumping material directly on top of pipe is not permitted.

.13 Compact each layer to at least 95 % maximum density in accordance with ASTM D698, Method D.

.14 When HDPE pipe is used, butt fusion to be carried out by a qualified technician.

4.6 THRUST BLOCKS

.1 Place concrete thrust blocks between bends, tees and fittings and undisturbed ground. Keep pipe couplings free of concrete.

.2 Bearing area of thrust blocks to be as indicated or specified by the Owner.

.3 Do not backfill over concrete within 24 hrs.

4.7 FIELD TESTING OF FORCE MAIN

.1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests. Testing of force main to be carried out under supervision of the Owner.

.2 Before testing, bed and cover pipe between joints to prevent movement of force main when test pressure is applied.

.3 Strut and brace caps, bends and tees, to prevent movement when test pressure is applied.

.4 Expel air from force main, by slowly filling main with water. High points to be drilled and tapped and suitable cocks installed to vent air and to be shut when pressure is applied. Remove cocks after satisfactory completion of test and seal holes with tight fitting plugs.

.5 Apply a hydrostatic test pressure of 150 % of the normal working pressure based on the elevation of the lowest point in the main and corrected to

elevation at the test gauge location or a minimum of 1000 kPa, whichever is greater, for a period of one hour.

.6 Apply pressure for 1 hour for pressure test and 2 hours for leakage test.

.7 Examine exposed pipe, joints and fittings while system is under pressure. Remove defective joints, pipe and fittings and replace with new sound material. Make leaking joints watertight.

.8 Test force main in sections not exceeding 300 m in length, unless otherwise authorized by the Owner.

.9 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 hours. The allowable leakage is 0.03 L/mm pipe diameter per 300 metres, per hour for a working pressure of 1000 kPa. For other working pressures test in accordance with AWWA C600.

.10 Locate and repair defects if leakage is greater than amount specified. Repeat test until leakage is within specified allowance for full length of force main.

4.8 SWABBING

.1 Appropriately sized and designed sewer swabs shall be inserted into the main at as many locations as need be to ensure every section of sewer main is swept by a swab when the system is first charged into the system.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

.2 Payment will be made to the maximum of 90 % of the value of force mains, fittings and appurtenances until the system (or sections of the system, if payment approved by the Owner) has passed all hydrostatic and leakage tests. The 10 % retained shall be called the force main testing allowance.

This specification outlines the requirements for the supply and installation of factory pre-insulated piping systems.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASME International

B16.1	Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

ASTM International

C272/C272M	Standard Test Method for Water Absorption of Core materials for Sandwich Constructions
C518	Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
D1000	Standard Test Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
D1621	Standard Test Method for Compressive Properties of Rigid Cellular Plastics
D1622	Standard Test Method for Apparent Density of Rigid Cellular Plastics
D1785	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120
D2842	Standard Test Method for Water Absorption of Rigid Cellular Plastics
D3034	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
D3574	Standard Test Methods for Flexible Cellular Materials - Slab, Bonded, and Molded Urethane Foams
D6226	Standard Test Method for Open Cell Content of Rigid Cellular Plastics
F714	Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter

CSA Group

B137	Thermoplastic Pressure Piping Compendium
C22.2 No. 130	Requirements for Electrical Resistance Trace Heating and Heating Device Sets

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Trenching and backfilling will be measured in accordance with Section 02223.

.2 Water main, hydrants, service connections, valves and valve chambers will be measured in accordance with Section 02713.

.3 Sanitary sewer will be measured in accordance with Section 02702.

.4 Sewage force main will be measured in accordance with Section 02724.

.5 For water main, hydrants, service connections, valves, valve chambers, sanitary sewer and sewage force main, specified insulation, heat tracing, and appurtenances will not be measured but considered incidental to work.

.6 Concrete for bedding, encasement of pipes, supports and thrust blocks will be measured in accordance with Section 03300.

.7 Granular bedding and surround material will be measured in cubic metres in accordance with Section 02223.

.8 Testing will not be measured for payment.

2.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with the General Conditions, GC 41 – Shop Drawings.

.2 Submit shop drawings for pre-insulated piping, insulation kits, heat tracing cables, controllers and appurtenances.

PART 3 PRODUCTS

3.1 CARRIER CORE PIPE AND FITTINGS

.1 Water mains and sewage force mains:

.1 Polyethylene pressure pipes in accordance with ASTM F714:

.1 Type PE 3408.
.2 Dimension Ratio: as indicated on contract drawings.

.2 Class 125 Cast Iron Flanged Fittings in accordance with ASME B16.1.
.3 Plain End Polyethylene Fitting in accordance with CSA B137.

.2 Sewer Mains:

.1 PVC Sewer Pipe and Fittings in accordance with ASTM D3034, CSA B137.

.1 Standard Dimension Ratio: as indicated on contract drawings.

.2 PVC pressure pipe in accordance with CSA B137, ASTM D1785.

.1 Dimension Ratio: as indicated on contract drawings.

3.2 FACTORY APPLIED INSULATION

.1 Pipes to be cleaned of surface dust or dirt and treated if necessary to assure positive bond of foam to entire pipe surface.

.2 Material: rigid polyurethane foam factory applied or factory applied rigid expanded polystyrene.

.3 Insulation thickness: 50 mm minimum.

.4 Density in accordance with ASTM D1622/D1622M, 0.032 to 0.048 gm/cm^3.

.5 Closed cell content in accordance with ASTM D6226, 90 % minimum.

.6 Water absorption in accordance with ASTM D2842, 4.0 gm/1000 cm^3, maximum 4.0 % by volume.

.7 System compressive strength in accordance with ASTM D1621 with 50 mil jacket, 150 kPa minimum.

.8 Thermal conductivity in accordance with ASTM C518, 0.020 to 0.026 W/m·° C maximum.

.9 Service temperature: minus 45 ° C to plus 85 ° C.

3.3 OUTER JACKET FOR BURIED APPLICATIONS

.1 Material: factory applied polyethylene tape jacket with enhanced cold weather properties, black in colour (UV inhibited) or factory applied polyurethane/urethane jacket, black in colour.

.2 PE tape.

.3 Sealant: Butyl rubber & resin.

.4 Jacket thickness: 1.27 mm minimum.

.5 Elongation in accordance with ASTM D1000, 300 % maximum 6 month test.

.6 Service temperature: minus 45 ° C to plus 85 ° C maximum.

.7 Water vapour transmission rate: 3 gm/m^2/24 hr average.

.8 Tensile strength: 6.8 kg/cm width minimum.

3.4 OUTER JACKET FOR ABOVE GROUND APPLICATIONS

.1 Material: factory applied galvanized lock seam, spiral steel outer jacket, 18 to 22 mm gauge minimum thickness spirally applied from continuous steel strip using lock seam, or;

.2 Factory applied polyethylene case, 0.38 mm thickness, black in colour.

3.5 INSULATED PIPE JOINTS FOR BURIED APPLICATIONS

.1 Material: rigid polyurethane half shells or rigid expanded polystyrene half shells, with properties in accordance with subsection 3.2 of this Section.

.2 A moisture proof seal shall be provided with mastic sealants in accordance with subsection 3.9 of this Section and with heat shrink sleeves or spray on polyurethane/urethane coating.

.3 Heat shrink sleeves: adhesive coated cross linked polyethylene sleeve.

.4 Sleeves: to cover entire exposed joint length plus overlap of 76 mm of pipe coating on either side.

.5 Spray on polyurethane/urethane coating, in accordance with subsection 3.3 of this Section, shall be applied by factory trained workers.

3.6 INSULATED PIPE JOINTS FOR ABOVE GROUND APPLICATIONS

.1 Material: rigid polyurethane half shells or rigid expanded polystyrene half shells, with properties in accordance with subsection 3.2 of this Section.

.2 A moisture proof seal shall be provided with silicone caulking circumferentially beaded around outer jacket of pipe 50 mm from pipe in accordance with subsection 3.9 of this Section and either:

.1 Adhesive coated cross linked polyethylene heat shrink sleeves to cover the entire exposed joint length plus overlap of 76 mm of pipe coating on either side and protected with rolled sheet steel 0.85 mm thick wrapped around and strapped into place to complete joint; or

.2 Spray on polyurethane/urethane coating to a minimum thickness of 3.25 mm with properties in accordance with subsection 3.3 of this Section.

3.7 INSULATION KITS FOR FITTINGS

.1 Material: rigid polyisocyanurate foam with polymer protective coating on all exterior surfaces including ends. Kits to be supplied complete with silicone caulking for seams, stainless steel attachment straps and clips, and heat shrink sleeves to seal between pipe and insulation cover.

.2 Rigid polyisocyanurate foam insulation:

.1 Density in accordance with ASTM D1622/D1622M, 0.027 gm/cm^3.
.2 Compressive strength in accordance with ASTM D1621, 131 kPa minimum.
.3 Closed cell content: 90 % minimum.
.4 Water absorption in accordance with ASTM C272/C272M, less than 0.7 % by volume.
.5 K Factor in accordance with ASTM C518, 0.027 W/m·° C.

.3 Polymer coating to ASTM D3574:

.1 Two component high density polyurethane coating, black in colour.
.2 Density: 1170 kg/m^2.
.3 Abrasion: durometer D scale: 60.
.4 Tensile strength: 11,000 kPa minimum.
.5 Tear strength: 26.5 N/mm minimum.
.6 Thickness: 1.9 mm outside surfaces, 0.51 mm inside surfaces.

3.8 INSULATION FOAMED IN PLACE

.1 Material: two component polyurethane Class 1 foam, supplied in portable, disposable, pressurized container.

.2 Density in accordance with ASTM 1622/D1622M, 0.035 to 0.039 gm/cm^3.

.3 Closed cell content in accordance with ASTM D6226, 90 % minimum.

.4 Thermal conductivity in accordance with ASTM C518, 0.022 to 0.024 W/m·° C.

.5 Compressive strength in accordance with ASTM D1621, 103 to 172 kPa at 10 % deflection, minimum.

.6 Water absorption in accordance with ASTM D2842, 4.25 % maximum by volume.

3.9 INSULATION ACCESSORIES

.1 Heat shrink tape for sealing insulation half shells against moisture adaptable to flexible installations:

- .1 Crosslinked polyolefin backing with a hot melt adhesive coating.
- .2 Backing thickness: 0.35 mm minimum.
- .3 Adhesive thickness: 0.51 mm minimum.
- .4 Service temperature: minus 40 to plus 60 °C maximum.
- .5 Tensile strength: 20 MPa minimum.

.2 Low density polyethylene tape for minor repair of the outer jacket or completion of straight insulation joints in field where irregular surfaces are not involved:

- .1 Adhesive backed tape protected by easily removed release liner.
- .2 Backing thickness: 0.178 mm average.
- .3 Adhesive thickness: 0.711 mm.
- .4 Service temperature: minus 34 to plus 85 ° C.
- .5 Tensile strength: 3.6 kg/cm width.
- .6 Colour: black.

.3 Asphalt mastic vapour barrier coating to waterproof exterior surfaces of half shells or sprayed in place foam:

- .1 Colour: black
- .2 Coverage: 3 – 5 L/m^2
- .3 Drying time to touch: 4 hr maximum
- .4 Drying time firm: 48 hr maximum
- .5 Service temperature: minus 40 to plus 125 ° C
- .6 Application temperature: 4 ° C minimum
- .7 Water vapour permeability: 0.018 perms at 3 cm

.4 Silicone caulking for joining faces of rigid urethane insulation:

- .1 Colour: black
- .2 Specific gravity: 1.02
- .3 Tensile strength: 8 kg/cm^2
- .4 Elongation: 400 %
- .5 Service temperature: 205 ° C maximum

3.10 ELECTRIC HEAT TRACING

.1 Heat tracing conduits:

- .1 To consist of extruded plastic moulding and to be applied to pipe prior to application of insulation.
- .2 To be securely fastened to pipe and sealed to prevent ingress of foam during insulation.

.3 Each conduit to be checked after insulating to ensure it is not plugged.
.4 Ends to be sealed prior to shipping to prevent foreign material from entering conduit while in transit or during installation.

.2 Parallel circuit type electric tracing cable:

.1 Resistive parallel circuit type in accordance with CSA C22.2 No. 130, constant watt, power rating and voltage as indicated on contract drawings.
.2 Fluoropolymer inner and outer insulation jackets, and suitable for cutting to length in field.
.3 Manufacturer to ensure that specified electric tracing cable and heat tracing conduit size are compatible, so that cable may be pulled in with relative ease.
.4 Standard of Acceptance: Urecon Thermocable or approved equal.

.3 Series type electric tracing cable:

.1 Resistive series circuit type in accordance with CSA approved, constant watt, power rating and voltage as indicated on contract drawings.
.2 Fluoropolymer inner and outer insulation jackets.
.3 Cable manufacturer to engineer cable for specific circuit length.
.4 Manufacturer to ensure that specified electric tracing cable and heat tracing conduit size are compatible, so that cable may be pulled in with relative ease.
.5 Standard of acceptance: Urecon SC Heatrace Series Type Heating Cables for Long Line Electric Tracing, or approved equal.

.4 Solid state controller:

.1 On-off control with ° C temperature differential for accurate control.
.2 Load switch:

.1 30A, 120/240V controllers - mechanical relay switch.
.2 15-60A, 575V controller – mechanical contactor.

.3 Low temperature sensor control to be factory preset at 3 ° C for water or sewer, and 10 ° C for fire protection water.
.4 High temperature sensor control to be attached to active zone of heat tracing cable and to serve as high temperature cut-out, factory preset at 65 ° C.
.5 Rating: as indicated on contract drawings.
.6 Resistance temperature detectors (RTD): as indicated on contract drawings.

.7 Indicator lamps to be mounted on front of controller to indicate status of system.

.8 Alarms: controllers on main lines to be equipped with remote alarm contacts to activate an audible alarm and flashing red light for the following alarm conditions:

.1 Low temperature.
.2 High temperature.

Alarm system to shut down once system conditions return to normal.

.9 Standard of Acceptance: Urecon Temperature Controllers or approved equal.

.5 Terminal end seal kits to be certified for installation in damp conditions in accordance with CSA C22.2 No. 130 and to consist of:

.1 Constant watt:

.1 90 cm of Teflon tape.
.2 Adhesive-lined heat shrink end cap.
.3 Adhesive-lined heat shrink tubing.

.6 Power connection kits to connect to pipe and in accordance with CSA C22.2 No. 130 as indicated.

.1 Constant watt:

.1 Flexible conduit.
.2 Adhesive-lined heat shrink end cap.
.3 Adhesive-lined heat shrink tubing.
.4 Power Splice.

.2 Self-regulating

.1 Base.
.2 Top.
.3 Sealing gasket.
.4 Terminal block.
.5 Locknuts.

PART 4 EXECUTION

4.1 UNLOADING AND HANDLING OF PRE-INSULATED PIPE

.1 Unload from trucks or containers by hand or by lifting apparatus with fabric slings. Do not use cables or chains.

.2 Once removed, store on smooth surface. Lay pipes flat. Where sleepers are desired use several lengths of wide planks to provide broad bearing surface.

.3 Lift, do not drag, insulated pipes from storage area to job site.

4.2 REPAIRING DAMAGED PRE-INSULATED PIPE

.1 Repair any damage to outer jacket by applying heat shrink sleeve to approval of Company's Representative or cover using heated HDPE UV resistant adhesive backed tape or cover with spray on polyurethane/urethane in accordance with subsection 3.3 or 3.4 of this Section.

4.3 TRENCHING AND BACKFILLING

.1 Do trenching and backfilling work in accordance with Section 02223.

4.4 GRANULAR BEDDING AND SURROUND

.1 Place bedding and surround material as indicated on contract drawings and in accordance with Section 02223.

4.5 PIPE INSTALLATION

.1 Install pipe in accordance with Section 02713, Section 02702, Section 02704, or Section 02724.

4.6 INSULATION OF PIPE JOINTS

.1 Complete installation of rigid polyurethane, or rigid expanded polystyrene, halves on joints after laying pipe in trench and after successful pressure testing of pipe.

.1 Trim half shells to required length with handsaw to provide tight-fit in insulation gap between ends of factory insulation.

.2 No seam to exceed 3 mm in width at any joint. Match outer surface of shell with outer surface of insulation on pipe with tolerance of plus or minus 6 mm. Shave off any sharp edge with rasp or sharp knife.

.3 Hold half shells in place with masking tape while installing heat shrink sleeve.

.2 Install heat shrink sleeves using large broad flame propane torch to produce 600 mm flame.

.1 Peel back release liner 12 cm from end, centre sleeve over joint and press firmly down. Wrap sleeve around pipe, removing release liner as it is wrapped. If corner on underlap is not precut, then cutoff about 25 mm from each corner.
.2 Before completing overlap wrapping, warm underlap area approximately 12 cm until adhesive starts to appear at edge. Smooth out any wrinkles with gloved hand.
.3 Remove remaining release liner and complete wrapping.
.4 Remove release paper from closure seal, prewarm adhesive slightly, centre seal cover overlap and press down until well bonded. Heat closure seal, and press down with gloved hand to remove any bubbles and wrinkles.
.5 With torch, start at centre of sleeve and shrink it all around joint. Keep torch moving using broad circumferential strokes to avoid burning. Continue shrinking sleeve toward one end until about 50 mm is left. Then aim torch inward towards centre and shrink edges. Repeat this operation on other end of sleeve. Finish off by applying long horizontal strokes of torch all around sleeve.
.6 Pay special attention to sleeve overlap area, ensuring no void remains along underlap edge. Use roller, or gloved hand to firmly and thoroughly press down along underlap edge. Start in centre and work outwards.
.7 Allow joint and sleeve to cool for at least 30 min before lowering pipe into trench.

4.7 INSULATION OF FITTINGS

.1 Cut pipes as required to accommodate fittings and fitting insulation kits without damaging pipe insulation or its jacket. Leave smooth end at right angles to pipe axis.

.2 Cracks larger than 6.4 mm to be filled with insulation foamed-in-place in following manner:

.1 Use strip of thin galvanized sheet metal wide enough to overlap both insulation kit and pipe by at least 8 cm and long enough to wrap around pipe leaving 2.5 cm opening on top.
.2 Hold metal in place with two tension metal or nylon straps, one at either end.
.3 Spray foam through opening on top into cavity.
.4 Spray until cavity is almost half-filled on both sides of pipe. Foam will rise to complete filling.
.5 Allow curing for 10 to 15 min.

.6 Trim top and apply waterproofing sealant asphalt mastic, HDPE tape or heat shrink tape or sprayed on polyurethane/urethane to the appropriate thickness.

4.8 ELECTRIC TRACING

.1 Install electric heat tracing, controllers, and appurtenances in accordance with manufacturer's recommendations.

.2 At fittings and flanged joints seal heat trace channel with silicone caulking.

4.9 TESTING

.1 Flush, disinfect, and test water mains for leakage in accordance with Section 02713.

.2 Leakage test sewage force mains in accordance with Section 02724.

.3 Field test sanitary sewers for infiltration and exfiltration in accordance with Section 02702.

.4 After completion of repair work, redo leakage, infiltration and exfiltration tests.

.5 Electric heat tracing to be tested in accordance with cable suppliers instructions.

.6 Protect piping from freezing if testing at temperatures lower than 0 ° C.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

.2 Payment will be made to the maximum of 90 % of the value of water mains, sewer mains, force mains, hydrants, valves, fittings and appurtenances until the system, or sections of the system if payment approved by the Owner, has passed all specified tests. The 10 % retained shall be the specified testing allowances.

This specification outlines the requirements for drilling, development and pump testing of drilled wells to a depth authorized by the Owner in accordance with the Well Drilling Regulations, 2003, under the Water Resources Act (O.C. 2003-221).

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

American Water Works Association (AWWA)

A100	Water Wells
C654	Disinfection of Wells

ASTM International

B124/B124M	Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes

CSA Group

A3000	Cementitious Materials Compendium

Other

Government of Newfoundland and Labrador, Department of Environment and Climate Change, Water Resources Management Division, Aquifer Testing Guidelines

Government of Newfoundland and Labrador, Department of Environment and Climate Change, Water Resources Management Division, Guidelines for Sealing Groundwater Wells

Government of Newfoundland and Labrador Regulation 63/03, Well Drilling Regulations, 2003 Under the Water Resources Act (O.C. 2003-221)

PART 2 GENERAL

2.1 REPORTS

.1 On completion of work, submit to the Owner a report containing documents in accordance with the Well Drilling Regulations, 2003 under the Water Resources Act (O.C. 2003-221). These will generally include, but not be limited to:

.1 Well maintenance instructions
.2 Log of well drilling
.3 As-built drawing of well including:

.1 Elevations
.2 Size and length of each casing section installed
.3 Grouting details
.4 Description of screen
.5 Gravel packing details

.4 Final pumping test results.
.5 Results of chemical and bacteriological tests on water samples.
.6 Recommendations on water treatment or tests required to determine treatment necessary.
.7 Type and size of permanent well pump recommended.

2.2 MEASUREMENT FOR PAYMENT

.1 Drilling in unconsolidated and consolidated formations will be measured in metres of each size hole drilled.

.2 Supply and installation of casing will be measured in metres of each type and size of casing permanently installed.

.3 Supply and install of drive shoes will be measured by the number of each size installed.

.4 Supply and installation of screen will be lump sum if size listed in MERX Schedule of Quantities or to be negotiated after screen selection if size not specified.

.5 Gravel packing will be measured in kilograms of gravel installed in well.

.6 Grouting will be measured as number of 40 kg bags of Portland cement used in grouting.

.7 Well development will be measured in hours during which Contractor is actually engaged in well development.

.8 Disinfection of well will be lump sum.

.9 Test pumping will be measured in hours during which pump is in operation to successfully complete a test.

.10 Well seals and caps by the number of each size supplied and installed.

.11 Water quality testing will be lump sum.

PART 3 PRODUCTS

3.1 PERMANENT WELL CASING

.1 Use new material only.

.2 Casing in accordance with AWWA A100, 150 mm diameter casing unless otherwise specified in the MERX Schedule of Quantities and Prices, internal diameter 150 mm and wall thickness 9 mm.

.3 Use pipe fittings of same standard as pipe casing.

.4 Joints shall be welded or threaded couplings as shown on drawings.

.5 A Drive Shoe shall be welded to the bottom of the well casing.

3.2 SCREEN

.1 To the Owner's approval after analysis of the aquifer.

.2 Pipe size well screen to following requirements:

.1 Material; Stainless steel in accordance with ASTM B124/B124M, Alloy 7.
.2 Type: as indicated on drawings or as directed by the Owner.
.3 Openings: as indicated or directed by the Owner and free of jagged edges or other irregularity.

.3 The screen shall be provided with such fittings as are necessary to seal tightly the top to the casing and to close the bottom.

.1 If the screen is installed inside the casing, figure K-Packer seal shall be used at the top which shall be located so that there is a 300 mm overlap of the well casing and screen.
.2 If the screen is attached to the casing, a suitable coupling shall be provided, or the screen shall be welded to the casing.
.3 All fittings, except plugs and seals, but including couplings, where required for joining sections of the screen, shall be constructed of the same material as the screen sections of casing over 1.5 m. in length used to connect sections of screen shall not be considered as fittings.

.4 The screen shall have adequate strength to resist external forces applied to it after installation and to minimize the likelihood of damage during installation. The screen must have no change of alignment at any joint after installation. If required by the Owner, the contractor shall submit for approval drawings and other information showing the design and method of construction of the screen.

3.3 WELL SEAL

The well shall be sealed with a vermin proof sanitary seal sized to fit the well casing with a 32 mm hole or a well cap sized to fit the casing as directed by the Owner.

PART 4 EXECUTION

4.1 DRILLING

.1 Notify the Owner 48 hours before commencement of drilling.

.2 Use drilling equipment and methods approved by the Owner.

.3 Drill in locations and to depths indicated or directed. Drill holes round, plumb and true to line. Dispose of drill cuttings as directed. Ensure drilling methods do not impair production for aquifers encountered.

.4 Prevent foreign matter from entering borehole and prevent contaminated water or other objectionable fluids from reaching aquifer through borehole.

.5 Take measures as necessary to prevent tampering with borehole and to eliminate dangerous conditions for persons or animals in area.

.6 Maintain log of all boreholes including following information:

- .1 Depth of changes in formation.
- .2 Description of formations encountered.
- .3 Elevations at which aquifers are encountered, sudden changes in water level, loss of drilling mud or other indications of permeable strata.

.7 In unconsolidated formations, obtain duplicate soil samples from each 3 m of depth drilled and at least one set of duplicate samples from each formation encountered. Submit samples to the Owner with identification data on drill hole and depth.

.8 In consolidated formation, obtain one rock sample from each 6 m of depth drilled.

.9 Conduct pumping tests and obtain clear water samples as directed. Be prepared to shut off and seal a hole should flowing artesian water or gas be encountered.

.10 Seal abandoned holes in accordance with subsection 4.10 of this Section.

.11 At no cost to the Owner, redrill holes lost due to caving or abandoned due to loss of drilling equipment.

4.2 SCREEN INSTALLATION

.1 When aquifer material has been sampled and analyzed, the Owner will advise on type and size of screen required.

.2 Install screen by approved methods and to manufacturer’s recommendations.

4.3 PERMANENT CASING INSTALLATION

.1 Clean casing pipe and fittings prior to installation.

.2 Install permanent well casing to sizes and depths as indicated or directed by the Owner.

.3 Centre casing by use of centring brackets spaced not more than 15 m apart and install so that variance from vertical does not exceed two thirds internal diameter of casing per 30 m of depth.

.4 Prove alignment by lowering into casing a straight section of pipe 12 m long with outside diameter not more than 12 mm smaller than internal diameter of casing being tested. If plumb fails to move freely through casing to lowest anticipated pumping level, correct alignment to satisfaction of and at no cost to the Owner.

.5 After grouting is completed, cut off casing squarely and neatly 450 mm above ground level and cover with screwed or flanged cap satisfactory to the Owner.

.6 Maintain accurate records of casing lengths and sizes installed.

4.4 GRAVEL PACKING

.1 Gravel used for gravel packing shall be clean, rounded, water washed quartz or granite gravel free of silt, clay, and other deleterious materials. Gradation will be decided by the Owner after analysis of aquifer samples.

.2 Place gravel packing by approved methods to details indicated or as directed.

4.5 GROUTING

.1 Grout shall be a mixture of type 10 Portland cement in accordance with CSA A3000 with 3 % by volume bentonite clay added and not more than 880 L of water per cubic metre of cement.

.2 Grout annular space around casing to details indicated or as directed by the Owner.

.3 Place grout from bottom up by approved methods. Place grout in one continuous operation with entire amount placed before initial set occurs.

.4 Use retainer, packer or plug at bottom as necessary to ensure grout does not leak into wall.

.5 When further drilling is required after grouting, do not drill until 72 hr after complete placement of grout.

4.6 DISINFECTION

.1 Thoroughly clean the well to remove foreign substances, including tools, timbers, rope, cement, oil, grease, joint dope and scum. Thoroughly swab casing pipe using alkalis if necessary to remove oil, grease or joint dope.

.2 Disinfect well in accordance with AWWA C654.

.3 During final test pumping, obtain two samples of water for bacteriological analysis and a sample for chemical analysis one-half hour after start of test pumping and again during last 15 min of test pumping. Total of six (6) samples. Submit samples to the designated laboratory, as approved by the Owner.

4.7 TEST PUMPING

.1 Test pumping equipment requirements:

.1 Pump with variable pumping rate up to capacity as indicated or directed and capable of operating a minimum of 54 hours or more without interruption. Equip with tachometer to measure pump motor speed.

.2 Discharge piping of sufficient size and length to conduct water being pumped during test to an approved point of discharge where it will not recharge aquifer, damage property or create nuisance and equipped with valve close to pump.

.3 Apparatus to measure rate of pump discharge shall be an orifice plate with transparent tube to measure water head upstream of plate, or a suitable water meter.

.4 Apparatus to measure pumping level shall be an electric sounder (or calibrated air line).

.2 Conduct interim test pumping during construction as directed by the Owner.

.3 Final test pumping shall be as follows:

.1 Pumping rate as directed.

.2 Testing time of 72 hours or as directed.

.3 After pumping commences record water level in well at following intervals: every minute for first 10 min, every 2 min for next 10 min, every 5 min for next 40 min, every 10 min for next 1 hour, every 30 min for next 3 hours, every hour for next 5 hours and every 2 hr to end of test.

.4 After test pumping has ceased, record water level at same time intervals as in subsection 4.7.3.3 of this specification until static water level is reached.

.5 Take temperature of water discharged from well during test pumping at intervals of 1 hour.

.4 When test pumping is to be conducted after disinfection, swab with strong chlorine solution all parts of test pump coming into contact with well water prior to start of test pumping.

.5 Should test pump fail during pump test, allow water to reach static level prior to recommencing test. No payment will be made for pump time prior to such failure.

.6 Do not allow pumping level to fall below an elevation 2 m above top of well screen.

4.8 WELL DEVELOPMENT

.1 The contractor shall furnish all necessary pumps, compressors, plungers, bailing or other needed equipment that shall be necessary to effectively extract from the water bearing formation, the maximum practical quantity of sand, drilling mud and other fine materials in order to bring the well to maximum yield per foot of drawdown and to a sand-free condition. Compressed air, surge plungers, high velocity jetting equipment and pumps may be used for the development work. This work must be done in a manner that does not cause undue settlement and disturbance of the strata above the water-bearing formation nor disturb the natural seal affected around the well casing and thereby reduce the sanitary protection otherwise affected by such seal.

.2 Development of the well shall be continued until water pumped from the well at the maximum test pumping rate is clear and free of sand. The water shall be considered sand-free when no samples, taken during test pumping, contain more than 5 parts per million of sand by weight.

.3 Pumping or Bailing Method

.1 Development process shall be carried out by surging and bailing the well. The surging shall be done by a single or double solid (or valved) surge block. Surging shall start at the bottom of the lowest screen in the well and proceed upwards.

.4 Hydraulic Jetting Method

.1 Development shall be accomplished by simultaneous high-velocity, horizontal-jetting and pumping. The outside diameter of the jetting tool shall be one inch less in diameter than the screen inside diameter. The minimum exit velocity of the jetting fluid at the jet nozzle shall be 46 m/s. The tool shall be rotated at a speed less than 1 rpm. It shall be positioned at one level for not less than two

minutes and then shall be moved to the next level which shall be no more than 6 inches vertically from the preceding jetting level.

.2 The jetting shall proceed form the bottom of the screen to the top. Pumping from the well shall be at a rate of 5 to 15 percent more than the rate at which water is introduced through the jetting tool. Water to be used for jetting must contain less than 1 ppm suspended solids.

.5 Air Development Method

.1 Development shall be done by the utilization of single pipe air pumping system using the casing or the borehole itself as the eductor line. The compressors, air lines, hoses, fittings, etc., shall be of adequate size to pump the well by the air lift principle at 1½ to 2 times the design capacity of the well. The Contractor shall initially pump the well with air until the well is developed to the point that it yields clear, sand-free water. They shall then shut off the air and allow water in the well to return to a static condition. They shall then re-open the valve and re-introduce air into the well until water is again brought to the surface by the air lift, at which time they will close the air valve and allow the water to drop back down the well and return to a static condition. They shall repeat this lifting and dropping of the column of water until the water in the well becomes turbid at which time they will continuously pump the well with air until it again yields clear sand-free water. The Contractor shall repeat the above operations until the well no longer produces fine material when it is surged and backwashed as described above.

.2 The bottom of the air line shall be placed at different levels in order to facilitate development of all intake areas and multiple water-producing zones, and the process repeated until all zones yield water free of turbidity when surged and backwashed.

.6 Sand Content Testing

.1 The sand content shall be determined by averaging the results of five (5) samples collected at the following times during the intermediate pumping test:

.1 15 minutes after start of the test,
.2 after one quarter (1/4) of the total planned test time has elapsed,
.3 after one half (1/2) of the total planned test time has elapsed,
.4 after three quarters (3/4) of the total planned test time has elapsed,
.5 near the end of the pumping test.

.2 The minimum volume of water sample collected for testing for sand content shall be the test rate of flow in gpm multiplied by 0.05.

.3 Sand content shall be determined in the following manner. When the circular orifice meter is used to measure flow rate, the sample shall be withdrawn from a measuring flow rate. On wells of a lower production rate, a sample may be collected directly from the full and open discharge. The sample shall be allowed to settle not less than 10 minutes before the liquid is decanted. The sand content as determined above shall not be greater than 5 ppm.

.4 Record of Measurement

.1 A record shall be made showing time, type of operation, pumping rate, and the sand content measured and recorded. These records shall be submitted to the Owner or their representative.

4.9 AQUIFER TEST

.1 Aquifer Test shall be as recommended in the Department of Environment and Climate Change, Water Resources Management Division, Aquifer Testing Guidelines.

.2 Perform bacteriological and chemical water quality testing as required in the Department of Environment and Climate Change, Water Resources Management Division, Aquifer Testing Guidelines.

4.10 SEALING WELLS

.1 Seal abandoned wells in accordance with the Department of Environment and Climate Change, Water Resources Management Division, Guidelines for Sealing Groundwater Wells.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for the supply and installation of chain link security fence and gates.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

A90/A90M	Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
A53/A53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
A121	Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
A392	Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric

CSA Group

CAN/CSA G164	Hot Dip Galvanizing of Irregularly Shaped Articles
CSA A23.1/A23.2	Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete

Canadian General Standard Board (CGSB)

CAN/CGSB-138.1	Fabric for Chain Link Fence
CAN/CGSB-138.3	Installation of Chain Link Fence
CAN/CGSB-138.4	Gates for Chain Link Fence
CAN/CGSB-1.181	Ready-Mixed Organic Zinc-Rich Coating

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Supply and install of chain link fence will be measured in metres installed and shall include the length of brace panels. Gate openings shall not be measured.

.2 Supply and install of barb wire and brackets will be measured in metres.

.3 Supply and install of chain link fence gates will be measured as units, regardless of the size and type of gate erected.

.4 Posts will not be measured but considered incidental to the work.

.5 The cost to repair any damage to the zinc coating shall be deemed to be included in the contract price of the appropriate tender item listed above.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Concrete:

1. In accordance with Section 03300 and CSA A23.1/A23.2.
2. Concrete mix design to produce 30 MPa a minimum compressive strength at 28 calendar days containing 20 mm maximum size coarse aggregate with water/cement ratio and Air Category in accordance with CSA A23.1/A23.2, for Class "C2" exposure and 60 mm slump at time and point of deposit. Air entrainment in accordance with CSA A23.1/A23.2.

.2 Chain-link fence fabric in accordance with CAN/CGSB-138.1.

1. Type 1, Class A, medium style.
2. Height of wire: as indicated.
3. Steel wire fabric shall conform to the requirements of ASTM A392.
4. The fabric shall be 1829 mm wide with a uniform 50 mm diamond pattern chain link mesh closed at one edge by knuckling and at the other edge by twisting to form a barb. The wire shall be 3.5 mm diameter.

.3 Posts and rails: to CAN/CGSB-138.1. All posts shall be fitted with waterproof caps so designed as to fit and fasten securely over the posts and carry the top rail.

.4 Bottom tension wire: single strand, galvanized, steel wire, 5 mm diameter as indicated.

.5 Tie wire fasteners: single strand, aluminum wire conforming to requirements of fence fabric, 5 mm diameter.

.6 Tension bar: 5 x 20 mm minimum galvanized steel.

.7 Tension bar bands: 3 x 20 mm minimum galvanized steel or 5 x 20 mm minimum aluminum.

.8 Gates in accordance with CAN/CGSB-138.4. Gates shall be in sizes defined as the distance between the inside faces of the gate posts.

.9 The fabric and other components used on gates shall match those of the fence and shall be subject to the same quality requirements.

.10 Gate frames in accordance with ASTM A53/A53M, galvanized steel pipe, standard weight 42.9 mm O.D. pipe for outside frame, 31.8 mm O.D. pipe for interior bracing.

1. Fabricate gates as indicated with electrically welded joints, and hot-dip galvanized or painted with zinc pigmented paint with welding.
2. Fasten fence fabric to gate with twisted selvage at top.
3. Furnish gates with galvanized malleable iron hinges, latch and latch catch with provision for padlock that can be attached and operated form either side of installed gate.
4. Furnish double gates with chain hook to hold gates open and centre rest with drop bolt for closed position.

.11 Fittings and hardware: cast aluminum alloy, galvanized steel or malleable or ductile cast iron. Post caps to provide waterproof fit, to fasten securely over posts and to carry rail. Overhang tops to provide waterproof fit, to hold top rails and an outward project to hold barbed wire overhang (when indicated on drawings). Provide project with clips or recesses to hold 3 strands of barbed wire spaced 100 mm apart. Project of approximately 300 mm long to project from fence at 45 degrees above horizontal. Turnbuckles to be drop forged.

.12 Organic zinc rich coating: to CAN/CGSB-1.181.

.13 Barbed wire: 2 mm diameter galvanized steel wire in accordance with ASTM A121, 4 point barbs 125 mm spacing.

3.2 FINISHES

.1 Galvanizing:

1. For chain link fabric: 490 g/m^2 minimum in accordance with CAN/CGSB-138.1.
2. For pipe: 550 g/m^2 minimum in accordance with ASTM A90/A90M.
3. For barbed wire in accordance with ASTM A121, Class 2.
4. For other fittings in accordance with CAN/CSA G164-M92.

.2 Aluminum coating:

1. For barbed wire in accordance with ASTM A121, Class 2.

.3 Vinyl coating:

1. 1.8 mil dry film thickness minimum.

PART 4 EXECUTION

4.1 GRADING

.1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts. Provide clearance between bottom of fence and ground surface neither less than 30 mm nor more than 50 mm.

4.2 ERECTION OF FENCE

.1 Erect fence along lines indicated or as directed, and in accordance with CAN/CGSB-138.3.

.2 Excavate post holes to dimensions indicated on contract drawings. Bulb bottom of holes for corner, end and gate posts and for intermediate posts at every 60 m along fence line.

.3 Space line posts 3 m apart, measured parallel to ground surface.

.4 Space straining posts at equal intervals not exceeding 150 m if distance is greater than 150 m between end or corner posts on straight continuous lengths of fence over reasonably smooth grade.

.5 Install additional straining posts at sharp changes in grade and where directed.

.6 Install corner post where change in alignment exceeds 10 degrees.

.7 Install end posts at end of fence and at buildings. Install gate posts on both sides of gate openings.

.8 Place concrete in post holes then embed posts into concrete to depths indicated. Extend concrete 50 mm above ground level and slope to drain away from posts. Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.

.9 Do not install fence fabric until concrete has cured a minimum of 5 calendar days.

.10 Install brace between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface. Install braces on both sides of corner and straining posts in similar manner.

.11 Install overhang tops and caps.

.12 Install top rail between posts and fasten securely to terminal posts and secure waterproof caps and overhang tops.

.13 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.

.14 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals. Knuckled selvedge at bottom. Twisted selvedge at top.

.15 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450 mm intervals. Give tie wires minimum two twists.

.16 Install barbed wire strands and clip securely to lugs of each bracket.

4.3 INSTALLATION OF GATES

.1 Install gates in locations indicated or where directed.

.2 Set gate bottom approximately 40 mm above ground surface.

.3 Determine position of centre gate rest for double gate. Cast gate rest in concrete. Dome concrete above ground level to shed water.

.4 Install gate stops where indicated.

4.4 TOUCH UP

.1 Repair damaged galvanized surfaces. Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas.

.2 Pre-treat damaged surfaces according to manufactures' instructions for zinc-rich paint.

4.5 CLEANING

.1 Clean and trim areas disturbed by operations. Dispose of surplus excavated material and replace damaged sod as directed.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

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This section covers the requirements for the supply and installation of wildlife wire fences, posts and gates.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

A53/A53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
A121	Standard Specification for Metallic-Coated Carbon Steel Barbed Wire

CSA Group

O80	Wood Preservation
CSA A23.1/A23.2	Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete

Canadian General Standard Board (CGSB)

CAN/CGSB-1.69-98	Aluminum Paint
CAN/CGSB-1.212-95	Chromate and Lead Free Marine Primer, for Steel and Light Alloy Surfaces

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Supply and erection of wire fence will be measured in metres installed.

.2 Supply and erection of wire gates will be measured in units of each regardless of variance in size of gates.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Wire fence:

.1 Farm-field type: Bel-Air Ltd style 948, class III or approved equal.

.2 Barbed wire: to ASTM A121.

.1 Galvanized steel.

.3 Wire size; 2 mm diameter.

.4 Barbs; 4 point at 125 mm spacing.

.2 Gates:

.1 Frame: to ASTM A53/A53M, galvanized steel pipe, standard weight, 25 mm O.D.
.2 Size: as indicated.
.3 Joints: electrically welded.

.3 Wood components: pressure-treated wood unless indicated otherwise.

.4 Wood posts:

.1 Sound, straight, round or square sawn square at bottom and at 45 degree at top as indicated.
.2 Intermediate posts: 2.5 m long and 100 mm x 100 mm.
.3 Corner, end, gate and anchor posts to be 2.7 m long and minimum 150 mm x 150 mm.
.4 Posts to be treated in accordance with CSA O80.
.5 Cleats for anchoring corner, gate, end and anchor posts: 38 x 140 x 910 mm.
.6 Braces for end, corner and gate posts: 89 x 89 mm x 3 m long.

.5 Steel posts:

.1 Corner, end, gate and intermediate posts, projection arm with clips, corner and gate post braces, gate posts as indicated.
.2 Galvanizing: zinc coating not less than 92 g/m2 of surface area.
.3 Paint: to CAN/CGSB-1.69-98, CAN/CGSB-1.212-95
.4 Concrete: to Section 03300 and CSA A23.1/A23.2.
.5 Concrete mix design to produce 30 MP a minimum compressive strength at 28 calendars days and containing 20 mm maximum size coarse aggregate with water/cement ratio and Air Category to CSA A23.1/A23.2, Table 8 for Class "C2" exposure and 80 mm slump at time and point of deposit. Air Entrainment to CSA A23.1/A23.2, Table 10.
.6 Ground rod: 16 mm diameter copperweld rod 3 m in length.

PART 4 EXECUTION

4.1 GRADING

.1 Level contours of ground along fence line in order that bottom wire of fence between posts can be maintained at not more than 150 mm above ground.

4.2 ERECTION OF FENCE

.1 Erect fence along lines indicated or as directed by the Owner.

.2 Excavate post holes to dimensions indicated.

.3 Installation of posts:

.1 Space intermediate posts at 2.5 m unless otherwise directed.
.2 Space corner, end and gate posts 2.5 m from adjacent post.
.3 Locate and erect gate posts as indicated.
.4 Install posts true to line and plumb with 1.5 m of post projecting above ground.

.4 Fencing with wood posts:

.1 Slant of post tops to be perpendicular to fence line and facing outward.
.2 Install cleats for anchoring at corner, gate, end and anchor posts as indicated.
.3 Backfill around posts and compact to same density as surrounding ground. Dispose of surplus excavated material as directed by the Owner.
.4 Install braces at end, corner and gate posts as indicated. Join braces into posts and spike securely.
.5 Erect wires and stretch to have uniform tension. Splice wires with standard wire splices.
.6 Attach top wires to posts with minimum two stapes. Fasten other wires to posts and cross braces with at least one staple. Staple wires securely at end, anchor and gate posts.
.7 Stretch two stands of barbed wire along tops of posts and double staple on posts.

.5 Fencing with steel posts:

.1 "Bulb" bottom part of holes when excavating holes for corner, end and gates posts. "Bulb" holes also for intermediate posts every 60 m along fence line.
.2 Space intermediate posts at 3 m and corner, end and gate posts at 3 m from adjacent post.
.3 Install posts true to line and plumb with a minimum of 1.5 m of post projecting above ground.
.4 Set following posts in concrete:

.1 End, corner and gate posts.
.2 Intermediate posts adjacent to end, corner and gate posts.
.3 Intermediate posts every 60 m along fence line.
.4 Ends of braces for corner, end and gate posts.

.5 Drive line posts into ground.
.6 Concrete: in accordance with Section 03300.
.7 Brace corner, end and gate posts as specified.
.8 Clamp a studded steel projection arm to each post as specified.
.9 Erect woven and barbed wire as specified.
.10 Stretch wires to have uniform tension. Splice wires with standard wire splices.

.11 Attach wires to posts and projection arms with approved metal clips.

.12 Paint post, braces and projection arms with coating adequate to protect against rust.

4.3 INSTALLATION OF GATES

.1 Install gates in locations indicated or where directed.

.2 Install gates on previously erected posts, in a manner to prevent over-stress on gate posts when gates are open. Install with ground clearance of 100 mm.

.3 Determine location of anchor pipe for drop bolt and drive pipe flush with road surface.

4.4 GROUNDING

.1 Install grounding rods as indicated or as directed by the Owner.

4.5 TOUCH UP

.1 Repair damaged galvanized surfaces. Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of approved pigmented paint to damaged areas.

4.6 CLEANING

.1 Clean and trim areas disturbed by operations. Dispose of surplus excavated material and replace damaged sod as directed.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for supply and installation of synthetic filter fabric (Geotextiles) to be used for separation membranes, reinforcing membranes and hydraulic filters.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

D1777	Standard Test Method for Thickness of Textile Materials
D3776/D3776M	Standard Test Methods for Mass Per Unit Area (Weight) of Fabric

Canadian General Standard Board (CGSB)

Methods of Testing

148.1	Methods of Testing Geotextiles and Complete Geomembraines

PART 2 GENERAL

2.1 APPROVAL

.1 Obtain written approval of the Owner for filter fabric before installation of material in work.

2.2 SHIPPING AND STORAGE

.1 The geotextile shall be protected at all times against exposure from the sun, and contamination from dirt, dust, and any other deleterious materials until it is used. The bales or rolls of geotextile shall be wrapped in a protective covering. The material shall be protected from temperatures higher than 60 °C.

2.3 MEASUREMENT FOR PAYMENT

.1 Filter fabric will be measured in square metres of material incorporated into work.

.2 Payment at the contract price shall be full compensation for all labour, equipment, and materials necessary to supply and install the geotextile to locations specified in the Contract Documents.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Synthetic fibre: rot proof, unaffected by action of oil or salt water and not subject to attack by insects or rodents.

.2 Geotextiles meeting the requirements of Class I are suitable for application where the main stresses imposed on the geotextile are a result of hydrostatic pressures. Geotextiles that meet the requirements of Class II are suitable, where the stresses governing the design are the result of earth pressures.

.3 When the Contract specifies a particular thickness, the geotextile shall be evaluated using the standard test procedure in CAN/CGSB-148.1 No. 3-M85. Alternatively, the standard test procedure in ASTM D-1777 may be used.

.4 When the Contract specifies a particular mass, the geotextile shall be evaluated using the standard test procedure in CAN/CGSB-148.1.2. Alternatively, the standard test procedure in Option C of ASTM D3776/D3776M may be used.

.5 When fabric sections are factory joined, seam strength shall not be less than 90 % of the tensile strength of the unaged geotextile in any principal direction.

.6 Seams of the geotextile shall be sewn with thread of a material having the same chemical requirements, or shall be bonded by cementing or by heating.

.7 The plastic fibre or yarn shall be composed of at least 85 % by mass of polypropylene, polyethylene, polyester, polyamide, or other synthetic polymers, and shall contain stabilizers or inhibitors added to the base plastic, if necessary, to make the filaments resistant to deterioration by ultra-violet and heat exposure. Filtration geotextiles shall be fixed so that the fibres or yarns will retain their respective position with respect to each other. The edge of the geotextile shall be finished to prevent the outer yarn from pulling away from the geotextile.

PART 4 EXECUTION

4.1 INSTALLATION

.1 Place material by unrolling onto graded surface and retain in position with securing pins or fine sand.

.2 Protect fabric from displacement or damage until and during placement of overlaid material layers.

.3 Place fabric on sloping surfaces in one continuous length from toe of slope to upper extent of fabric.

.4 Overlap each successive strip of fabric 600 mm over previously laid strip.

.5 Remove and replace fabric damaged or deteriorated as directed by the Owner.

.6 Do not permit passage of any vehicle directly on filter fabric at any time.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

DIVISION 3

03100 CONCRETE FORMWORK AND FALSEWORK

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
2.2 SUBMITTALS
PART 3 PRODUCTS
3.1 MATERIALS
PART 4 EXECUTION
4.1 ERECTION
4.2 REMOVAL AND RESHORING
PART 5 BASIS OF PAYMENT

03200 CONCRETE REINFORCEMENT

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
2.2 SUBMITTALS
PART 3 PRODUCTS
3.1 MATERIALS
3.2 FABRICATION
3.3 SOURCE QUALITY CONTROL
PART 4 EXECUTION
4.1 FIELD BENDING
4.2 PLACING REINFORCEMENT
PART 5 BASIS OF PAYMENT

03300 CAST-IN-PLACE CONCRETE

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
2.2 SUBMITTALS
2.3 SOURCE QUALITY CONTROL
2.4 QUALITY ASSURANCE
2.5 DELIVERY, STORAGE AND HANDLING
2.6 SITE CONDITIONS
PART 3 PRODUCTS
3.1 MATERIALS
3.2 MIXES
PART 4 EXECUTION
4.1 PREPARATION
4.2 INSTALLATION / APPLICATION
4.3 WATERSTOPS

4.4 JOINT FILLERS
4.5 DAMP PROOF MEMBRANE
4.6 SURFACE TOLERANCE
4.7 FIELD QUALITY CONTROL
4.8 DEFECTIVE WORK
4.9 CLEANING
PART 5 BASIS OF PAYMENT

03306 UNDERWATER CONCRETING

PART 1 REFERENCES
PART 2 GENERAL
2.1 DEFINITIONS
2.2 MEASUREMENT FOR PAYMENT
2.3 ADMINISTRATIVE REQUIREMENTS
2.4 ACTION AND INFORMATIONAL SUBMITTALS
2.5 DELIVERY, STORAGE, AND HANDLING
PART 3 PRODUCTS
3.1 MATERIALS
3.2 CONCRETE MIXES
3.3 ADMIXTURES
PART 4 EXECUTION
4.1 EXAMINATION
4.2 PREPARATION
4.3 INSTALLATION
4.4 UNDERWATER VIDEO AND/OR PHOTO INSPECTION
4.5 SAMPLING AND TESTING
4.6 CLEANING
PART 5 BASIS OF PAYMENT

03345 CONCRETE FLOOR FINISHES

PART 1 REFERENCES
PART 2 GENERAL
2.1 MEASUREMENT FOR PAYMENT
2.2 SUBMITTALS
PART 3 PRODUCTS
3.1 PERFORMANCE REQUIREMENTS
3.2 GENERAL
3.3 CHEMICAL HARDENER
3.4 SEALING COMPOUNDS
3.5 CURING COMPOUNDS
3.6 CONCRETE STAINS
3.7 WET CURE

3.8 MIXES
PART 4 EXECUTION
4.1 EXAMINATION
4.2 PREPARATION OF EXISTING SLAB
4.3 CONCRETE STAINING
4.4 APPLICATION FINISH
4.5 TOPPINGS
4.6 PROTECTION
PART 5 BASIS OF PAYMENT

This specification outlines the requirements for the supply and installation of concrete formwork and falsework.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

American Concrete Institute (ACI)

347R	Guide to Formwork for Concrete

CSA Group

A23.1/A23.2	Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete
O121	Douglas Fir Plywood
O151	Canadian Softwood Plywood
O153	Poplar Plywood
S269.1	Falsework and Formwork

Underwriters Laboratories of Canada (ULC)

CAN/ULC-S701.1	Standard for Thermal Insulation, Polystyrene Boards

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 No measurement will be made under this Section. Include costs in items of work for which Concrete Formwork and Falsework is required.

2.2 SUBMITTALS

.1 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework and formwork drawings.

.2 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.

.3 For concrete pours above 1.5 metres in height or with spans greater than 3 metres calculations of formwork shall be provided.

.4 Indicate sequence of erection and removal of formwork/falsework as directed by Owner.

.5 Each shop drawing submission shall bear stamp and signature of qualified professional engineer licensed in the Province of Newfoundland and Labrador, Canada.

.6 Acceptance of these drawings will be for conformance with the design and shall not relieve the Contractor of any responsibility for the safe design, and installation of the false work and for adherence to all applicable standards.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA O121.
.2 For concrete with special architectural features, use formwork materials to CSA A23.1/A23.2.
.3 Rigid insulation board: to CAN/ULC-S701.1

.2 Falsework materials: in accordance with CSA S269.1.

.3 Form release agent: Proprietary, non-volatile material not to stain concrete or impair subsequent application of finishes or coatings to surface of concrete, derived from agricultural sources, non-petroleum containing, non-toxic, biodegradable, low VOC, colourless mineral oil, with viscosity between 15 to 24 mm/s at 40 °C, flash point minimum 150 °C, open cup.

.4 Pan forms: as indicated, free of bends, dents, and residual concrete; having a high potential for reuse as indicated.

.5 Tubular column forms: round spirally wound laminated fibre forms, internally treated with release material. Spiral of form must not show in hardened concrete.

.6 Form ties:

.1 For concrete not designated ‘Architectural’: removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface. All such devices shall be so arranged that when the forms are removed no permanently embedded tie metal shall be less than 15 mm from the form face.
.2 For Architectural concrete; snap ties complete with plastic cones and light grey concrete plugs.

.7 Form liner:

.1 Plywood: medium density overlay Douglas Fir in accordance with CAN/CSA O121, Canadian Softwood Plywood in accordance with CSA O151, and Poplar in accordance with CAN/CSA O153, T and G thickness as indicated.

PART 4 EXECUTION

4.1 ERECTION

.1 Verify lines, levels and column centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.

.2 Obtain the Owner's approval for use of earth forms framing openings not indicated on drawings. Obtain the Owner's permission before framing openings not indicated in concrete joists, beams or columns.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Fabricate and erect falsework in accordance with CAN/CSA S269.1.

.5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.

.6 Unless indicated otherwise form ply shall be used on all exposed faces.

.7 Do not place shores and mud sills on frozen ground.

.8 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.9 Fabricate and erect formwork in accordance with CAN/CSA S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerance required by CAN/CSA A23.1/A23.2, ACI 347R.

.10 Align form joints and make watertight. Keep form joints to minimum.

.11 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.

.12 Use 25 mm chamfer strips on external corners and 25 mm fillets at interior corners, joints, beams, and columns unless specified otherwise.

.13 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.14 Construct forms for architectural concrete, and place ties as indicated and as directed.

.1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.15 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

.1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.16 Line forms for following surfaces with material only as approved by the Owner:

.1 Outer face of outside girders beams and vertical edge of bridge sidewalk slab.
.2 Soffit of girders and underside of bridge decks if exposed.
.3 Exposed faces of abutments, wingwalls, piers and pylons. Do not stagger joints of form lining material. Align joints to obtain a uniform pattern.
.4 Secure lining taut to formwork to prevent folds.
.5 Pull down lining over edges of formwork panels.
.6 Ensure lining is new and not reused material.
.7 Ensure lining is dry and free of oil when concrete is poured.
.8 Application of form release agents on formwork surface is prohibited where drainage lining is used.
.9 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.
.10 Cost of textile lining is included in price of concrete for corresponding portion of Work.

.17 Clean formwork in accordance with CAN/CSA A23.1/A23.2.

.18 Slip forming may be approved by the Owner subject to evaluation of procedures and mechanical equipment proposed for use.

4.2 REMOVAL AND RESHORING

.1 Leave formwork in place for following minimum periods of time after placing concrete.

.1 7 calendar days for walls and side of beams.
.2 14 calendar days for columns
.3 14 calendar days for beam soffits, slabs, decks and other structural members.
.4 4 calendar days for footings and abutments.

.2 Remove formwork when concrete has reached 70 % of its 28 day design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.4 Space reshoring in each principal direction at not more than 3000 mm apart.

.5 Re-use formwork and falsework subject to requirements of CSA A23.1/A23.2

PART 5 BASIS OF PAYMENT

.1 No separate or direct payment will be made for work specified in this specification. Costs of all work specified is deemed to be included in the lump sum and unit prices quoted in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for materials and placement of concrete reinforcement.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

American Concrete Institute

SP-66	ACI Detailing Manual

ASTM International

A641/A641M	Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
A1064/A1064M	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

CSA Group

A23.1/A23.2	Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete
A23.3	Design of Concrete Structures
G30.18	Carbon Steel Bars for Concrete Reinforcement
G40.20/G40.21	General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
W186	Welding of Reinforcing Bars in Reinforced Concrete Construction

Reinforcing Steel Institute of Canada (RSIC)

RSIC, Reinforcing Steel Manual of Standard Practice

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 No measurement will be made under this section. Include costs in items of concrete work for which reinforcement is required.

2.2 SUBMITTALS

.1 Submit shop drawings stamped and signed by professional engineer registered or licensed in the Province of Newfoundland and Labrador.

.1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and SP-66.

.2 Indicate placing of reinforcement and:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.4 Sizes, spacing, locations of reinforcement and mechanical splices if approved by Owner, with identifying code marks to permit correct placement without reference to structural drawings.

.5 Indicate sizes, spacing and locations of chairs, spacers and hangers.

.3 Detail lap lengths and bar development lengths to CAN/CSA A23.3, unless otherwise indicated.

.4 Indicate position and size of openings in slabs and walls. Coordinate with trades requiring openings.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Substitution of different size bars permitted only upon written approval of the Owner.

.2 Reinforcing steel: billet steel, deformed bars in accordance with CSA G30.18 unless indicated otherwise.

.3 Reinforcing steel: weldable low allow steel deformed bards to CSA G30.18.

.4 Cold-drawn annealed steel wire ties in accordance with ASTM A1064/A1064M.

.5 Deformed steel wire for concrete reinforcement in accordance with ASTM A1064/A1064M.

.6 Welded steel wire fabric in accordance with ASTM A1064/A1064M. Furnish in flat sheets for wire with cross-section area of 21 mm^2 or greater.

.1 Finish as indicated:

.1 Galvanized: having Class A coating in accordance with ASTM A641/A641M.

.2 Epoxy Coated: Epoxy coated after welding in accordance with ASTM A 884/A 884M, Class A coated <175 µm, Type 1 intended for use in concrete or masonry, colour contrasting with rust.

.7 Chairs, bolsters, bar supports, spacers in accordance with CSA A23.1/A23.2.

.8 Mechanical splices subject to the approval of the Owner.

.9 Tie wire: 1.5 mm diameter annealed wire.

.10 Plain round bars: to CSA G40.20/G40.21

3.2 FABRICATION

.1 Fabricate reinforcing in accordance with CSA A23.1/A23.2, SP-66, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada and to the following tolerances:

.1 Sheared length: plus or minus 25 mm.
.2 Stirrups, ties and spirals: plus or minus 12 mm.
.3 Other bends: plus or minus 25 mm.
.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar list.

.2 Obtain the Owner's approval for locations of reinforcement splices other than shown on steel placing drawings.

.3 Upon approval of Owner, weld reinforcement in accordance with CSA W186.

.4 Ship bundles of bar reinforcement, clears identified in accordance with bar bending details and lists.

3.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Owner with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing work.

.2 Upon request inform Owner of proposed source of material to be supplied.

PART 4 EXECUTION

4.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by the Owner.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars that develop cracks or splits.

4.2 PLACING REINFORCEMENT

.1 Cutting or puncturing vapour retarder is not permitted; repair damage and reseal vapour retarder before placing concrete.

.2 Place reinforcing steel as indicated on approved shop drawings and in accordance with CSA A23.1/A23.2. Tie reinforcing where spacing in each direction is:

.1 Less than 300 mm: Tie at alternate intersection.
.2 300 mm or more: Tie at each intersection.

.3 Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.

.4 Prior to placing concrete, obtain the Owner's approval of reinforcing steel and placement.

.5 Maintain cover to reinforcement during concrete pour.

.6 Protect coated portions of bars with covering during transportation and handling.

PART 5 BASIS OF PAYMENT

.1 No separate or direct payment will be made for work specified in this specification. Costs of all work specified is deemed to be included in the lump sum and unit prices quoted in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for the supply and placement of cast-in-place concrete.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

C260/260M	Standard Specification for Air-Entraining Admixtures for Concrete
C332	Standard Specification for Lightweight Aggregates for Insulating Concrete
C494/C494M	Standard Specification for Chemical Admixtures for Concrete
D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension, Die “C” Method
D624	Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers, Die “B” Method
D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
D1752	Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

Canadian General Standards Board (CGSB)

37.2	Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings
51.34	Vapour Barrier, Polyethylene Sheet for Use in Building Construction

CSA Group

A23.1/A23.2	Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete
A283	Qualification Code for Concrete Testing Laboratories
A3001	Cementitious Materials for Use in Concrete

Others

Atlantic Concrete Association (ACA)

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Cast-in-place concrete will be measured in cubic metres calculated from dimensions specified or authorized in writing by the Owner. Concrete placed beyond dimensions specified will not be measured.

.2 No deductions will be made for volume of concrete displaced by reinforcing steel, structural steel, or piles.

.3 No deductions will be made for volume of concrete less than 0.1 m^3 in volume displaced by individual drainage openings.

.4 Cast-in-place concrete in structures where specified in the MERX Schedule of Quantities and Prices will not be measured but be paid for as a fixed price item for that structure.

.5 Heating of water and aggregates and providing cold weather protection will not be measured but considered incidental to work.

.6 Supply and installation of anchor bolts, nuts and washers, and bolt grouting, will not be measured but considered incidental to work.

.7 Supply and installation of waterstops will be considered incidental to the work unless specified otherwise.

.8 Reinforcing steel rebar, fibreglass reinforcing and mats will not be measured and considered incidental to the work, unless otherwise specified.

.9 Concrete for pipe bedding, encasement of pipes, supports, thrust blocks and cut off walls will be measured in cubic metres within measurement limits specified.

2.2 SUBMITTALS

.1 At least four (4) weeks prior to commencing work, inform Owner of proposed source of aggregates and provide access for sampling.

.2 Submit testing results and reports for review by Owner and do not proceed without written approval when deviations from mix design or parameters are found.

.3 Certificates:

.1 Minimum four (4) weeks prior to starting concrete work submit to Owner manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:

.1 Portland cement.
.2 Blended hydraulic cement.
.3 Supplementary cementing materials.
.4 Grout.
.5 Admixtures.
.6 Aggregates.
.7 Water.
.8 Waterstops.
.9 Waterstop joints.
.10 Joint filler.

.2 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1/A23.2.

.3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1/A23.2.

.4 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in Field Quality Control of this specification section.

.5 Concrete hauling time: provide for review by Owner deviations exceeding maximum allowable time of 120 minutes for concrete delivered to site of Work and discharged after batching.

2.3 SOURCE QUALITY CONTROL

.1 Have all concrete produced and delivered by a ready-mix plant that is a member of the Atlantic Concrete Association (ACA) and holds a current “Certificate of Ready Mixed Concrete Production Facilities” issued by the Association. Submit a copy of this certificate to the Owner for approval.

2.4 QUALITY ASSURANCE

.1 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures in accordance with Section 01400.for Owner approval for following items:

.1 Falsework erection.

.2 Hot weather concrete.
.3 Cold weather concrete.
.4 Curing.
.5 Finishes.
.6 Formwork removal.
.7 Joints.

2.5 DELIVERY, STORAGE AND HANDLING

.1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.

.1 Modifications to maximum time limit must be agreed to Owner and concrete producer as described in CSA A23.1/A23.2.
.2 Deviations to be submitted for review by Owner.
.3 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

.2 Waste Management and Disposal:

.1 Divert unused concrete materials from landfill to local facility approved by Owner.
.2 Provide an appropriate area on the job site where concrete trucks can be safely washed.
.3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Owner.
.4 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
.5 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial and National regulations.

2.6 SITE CONDITIONS

.1 Placing concrete during rain or weather events that could damage concrete is prohibited.

.2 Protect newly placed concrete from rain or weather events in accordance with CSA A23.1/A23.2.

.3 Cold weather protection:

.1 Maintain protection equipment, in readiness on Site.

.2 Use such equipment when ambient temperature below 5 °C, or when temperature may fall below 5 °C before concrete cured.

.3 Placing concrete upon or against surface at temperature below 5 °C is prohibited.

.4 Hot weather protection:

.1 Protect concrete from direct sunlight when ambient temperature above 27 °C.

.2 Prevent forms of getting too hot before concrete placed. Apply accepted methods of cooling not to affect concrete adversely.

.5 Protect from drying.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Portland cement in accordance with CSA A3001.

.2 Blended hydraulic cement in accordance with CSA A3001.

.3 Portland-limestone cement in accordance with CSA A3001

.4 Cementitious hydraulic slag as a Supplementary Cementitious Material (SCM) in accordance with CSA A3001.

.5 Water in accordance with CSA A23.1.

.6 Aggregates in accordance with CSA A23.1/A23.2.

.7 Coarse aggregates to be normal density to CSA A23.1/A23.2.

.8 Low density aggregate for insulating concrete in accordance with CSA A23.1/A23.2 and ASTM C332 group I or group II.

.9 Air entraining admixture in accordance with ASTM C260/260M.

.10 Chemical admixtures in accordance with ASTM C494/494M water reducing type WRA. The Owner to approve accelerating or set retarding admixtures during cold and hot weather placing.

.11 Superplasticing admixtures in accordance with ASTM C494/494M.

.12 Shrinkage compensating grout: premixed compound consisting of metallic or non-metallic aggregate as specified, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2, of pouring consistency, capable of developing compressive strength as specified, net shrinkage as specified.

.13 Non premixed dry pack grout: composition of non-metallic aggregate Portland cement with sufficient water for the mixture to retain its shape

when made into a ball by hand and capable of developing compression strength as specified.

.14 Post-Tensioning ducts in accordance with CSA A23.1/A23.2.

.15 Curing compound in accordance with CSA A23.1/A23.2.

.16 Ribbed water stops: extruded PVC of sizes indicated with shop welded corner and intersecting pieces with legs not less than 500 mm long.

.1 Tensile strength: to ASTM D412 Die "C" method, minimum 11.4 MPa.
.2 Elongation: to ASTM D412, Die "C" method, minimum 275 %.
.3 Tear resistance: to ASTM D624, Die "B" method, minimum 48 kN/m.

.17 Labyrinth waterstops: extruded PVC of sizes indicated with shop welded corner and intersecting pieces with legs not less than 500 mm long:

.1 Tensile strength in accordance with ASTM D412, Die "C" method, minimum 8.3 MPa.
.2 Elongation in accordance with ASTM D412, Die "C" method, minimum 250 %.
.3 Tear resistance in accordance with ASTM D624, Die "B" method, minimum 30 kN/m.

.18 Pre-moulded joint fillers:

.1 Bituminous impregnated fibreboard in accordance with ASTM D1751.
.2 Sponge rubber in accordance with ASTM D1752, Type I.

.19 Weep hole tubes: purpose made plastic.

.20 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.

.21 Membrane adhesive: as recommended by membrane manufacturer.

.22 Damp proof membrane:

.1 Kraft/polyethylene membrane:

.1 Plain: polyethylene film of specified thickness, bonded to asphalt treated creped kraft.
.2 Reinforced: two polyethylene films of specified thickness, bonded each side of asphalt treated creped kraft paper, reinforced with 13 x 13 mm fibreglass scrim.
.3 Membrane adhesive: as recommended by membrane manufacturer.

.2 Bitumen impregnated protection board as specified.

.3 Cavity drainage board as specified.

.23 Damp proofing: emulsified asphalt, mineral colloid type, unfilled in accordance with CGSB 37.2.

.24 Polyethylene film in accordance with CGSB 51.34 and to thickness specified.

.25 Concrete Bonding Agents as specified.

3.2 MIXES

.1 Proportion normal density concrete in accordance with CSA-A23.1/A23.2,

.1 Cement:

.1 Type GU Portland cement.
.2 Minimum compressive strength at 28 days: for structural design.
.3 Minimum cement content: 300 kg/m3 of concrete.
.4 Class of exposure: N.
.5 Nominal size of coarse aggregate: 20 mm.
.6 Slump at time and point of discharge: 75 to 100 mm.
.7 Air content: 5 to 8 % except for pile concrete, levelling, mass and tremie concrete which shall be 4 to 7%.
.8 Chemical admixtures: admixtures in accordance with ASTM C494/C494M.

PART 4 EXECUTION

4.1 PREPARATION

.1 Obtain the Owner's approval before placing concrete. The Contractor should provide a minimum of 24 hours notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03200.

.3 During concreting operations:

.1 Development of cold joints not allowed.
.2 Ensure concrete delivery and handling facilitate placing with minimum of re-handling, and without damage to existing structure or Work.

.4 Pumping of concrete is permitted only after approval of equipment and mix.

.5 Ensure reinforcement and inserts are not disturbed during concrete placement.

.6 Prior to placing of concrete obtain the Owner's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.7 Protect previous Work from staining.

.8 Clean and remove stains prior to application for concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, workability, air content, temperature and test samples taken.

.10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels and pack solidly with non-shrink grout to positively position and anchor dowels.

.11 Do not place load upon new concrete until the specified compressive strength is attained and as authorized by the Owner.

4.2 INSTALLATION / APPLICATION

.1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2

.2 Sleeves and inserts:

.1 Set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 mm x 100 mm not indicated on structural or civil drawings must be approved by the Owner.

.2 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where expressly detailed on structural or civil drawings or approved by the Owner.

.3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from the Owner before placing of concrete.

.4 Check locations and sizes of sleeves and openings shown on structural and civil drawings with architectural, mechanical and electrical drawings.

.5 Set special inserts for strength testing as indicated and as required by Non-Destructive Method of Testing Concrete.

.3 Anchor bolts:

.1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.

.2 With the Owner's approval, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be at least 100 mm in diameter. Drilled holes to be minimum 25 mm larger in diameter than bolts used or to manufacturer’s recommendations.

.3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
.4 Set bolts and fill holes with non-shrink grout.
.5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to temperature at time of erection.

.4 Drainage holes and weep holes:

.1 Form weep holes and drainage holes in accordance with Section 03100. If wood forms are used, remove them after concrete has set.
.2 Install weep hole tubes and drains as indicated.

.5 Dovetail anchor slots:

.1 Install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.
.2 Install continuous vertical anchor slots at 800 mm o.c. where concrete walls are masonry faced.

.6 Grout underside of steel column and beam bearing plates with non-shrinking grout to manufacturer's instructions or dry packing. Place grout to cover steel shims left in place.

.7 Finishing and curing:

.1 Finish concrete in accordance with CSA A23.1/A23.2.
.2 Use procedures noted in CSA A23.1/A23.2 or as reviewed by Owner to remove excess bleed water. Ensure surface is not damaged.
.3 Cure concrete in accordance with CSA A23.1/A23.2. If required, use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete as specified. Provide written declaration of compatibility of compounds used.
.4 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise detailed.
.5 All concrete surfaces, unless specified otherwise, that will be visible on completion of the work shall be rubbed finish.
.6 The Contractor shall take special care during the planning, forming, concrete placing, curing, and stripping phases to ensure defect-free surfaces. Should remedial measures be required, they shall be carried out by personnel expert in this aspect of concrete work.
.7 The surface shall be uniform in colour and texture when viewed from a distance of 15 m.
.8 Rubbed Finish

.1 Immediately following the removal of forms, all fins and irregular projections shall be removed from all surfaces except from those that are not to be exposed or are not to be waterproofed. On all surfaces, the cavities produced by form ties and all other holes, honeycombs, spots, broken corners or edges and other defects shall be cut back to sound concrete and thoroughly cleaned. No feather edging is permissible. If reinforcing steel is exposed, concrete shall be cut back for at least 50 mm around the reinforcement.

.2 After having been kept saturated with water for a period of not less than three (3) hours, the cavities shall be carefully pointed and trued with a mortar of cement and fine aggregate mixed in the proportions used in the grade of the concrete being finished or an approved product. The mortar patches shall be placed and cured as specified by the manufacturer. No mortar shall be placed when the air temperature is forecasted to fall below 5 °C within 24 hours. All construction and expansion joints in the completed work shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its full length with clean and true edges. The resulting surfaces shall be true and uniform.

.3 After removal of forms, the rubbing of concrete shall be started as soon as its condition will permit. However, before starting this work the concrete shall be kept thoroughly saturated with water for a minimum period of three (3) hours but sufficient time shall have elapsed before the wetting down to allow the mortar used in the pointing of rod holes and defects to thoroughly set. Surfaces to be finished shall be rubbed with a medium coarse carborundum stone.

.4 When insufficient cement paste can be drawn from the concrete from rubbing, use a small amount of mortar on its face. The mortar shall be composed of extra cement and fine sand mixed in proportions such as to match existing concrete verified by a patch test. Rubbing shall be continued until all form marks, projections and irregularities have been removed, all voids filled, and a uniform surface has been obtained. The paste produced by this rubbing shall be left in place at this item.

.5 After all concrete above the surface being treated has been cast, the final finish shall be obtained by rubbing with a fine carborundum stone and water. This rubbing shall be continuous until the entire surface is of a smooth texture and uniform colour. After the final rubbing is completed and the

surface has dried, it shall be rubbed with burlap to remove loose powder and shall be left free from all unsound patches, paste, powder and objectionable marks.

4.3 WATERSTOPS

.1 Install waterstops to provide continuous water seal.

.2 Do not distort or pierce waterstop in such a way as to hamper performance.

.3 Do not displace reinforcement when installing waterstops.

.4 Use equipment to manufacturer's requirements to field splice waterstops.

.5 Tie waterstops rigidly in place.

.6 Use only straight heat sealed butt joints in field.

.7 Use factory field welded corners and intersections unless otherwise approved by Owner.

4.4 JOINT FILLERS

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by the Owner.

.2 When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form isolation and expansion joints as indicated.

.4 Install joint filler.

.5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

4.5 DAMP PROOF MEMBRANE

.1 Install damp proof membrane under concrete slabs-on-grade inside building.

.2 Lap damp proof membrane minimum 150 mm at joints and seal.

.3 Seal punctures in damp proof membrane before placing concrete.

.4 Use patching material at least 150 mm larger than puncture and seal.

4.6 SURFACE TOLERANCE

.1 Concrete slab tolerances in accordance with CSA-A23.1/A23.2, F-number Method, FF =25, FL = 20.

.2 Finish all interior exposed concrete slabs to a tight consistent steel trowel appearance without burnishing the surface.

4.7 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Owner in accordance with CSA A23.1/A23.2, and Section 01400.Ensure testing laboratory certified to CSA A283.

.2 The Owner's authorized representative will approve, and the Owner shall pay for, services of Testing Laboratory outside of this contract.

.3 Owner will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete that they represent.

.4 Non-destructive Methods for Testing Concrete shall be in accordance with CSA A23.1/A23.2.

.5 Inspection or testing by Owner will not augment or replace Contractor quality control nor relieve them of their contractual responsibility.

4.8 DEFECTIVE WORK

.1 Repairs and classification of unacceptable concrete to be in accordance with CAN/CSA-A23.1.

.2 Remove defective concrete and embedded debris and repair as directed by Owner.

.3 Remove to bare concrete curing compounds detrimental to application of specified finishes.

.4 Concrete to be supplied at the minimum strength requirement at 28 days. Tests indicating strengths lower than specified will necessitate further testing as required by the Owner. Cost for such testing to be at the Contractor's expense. Should further tests confirm low values, the Owner has the right to require strengthening of the affected area or removal and replacing of the weak concrete all to the Contractor's expense.

.5 Repair all shrinkage cracks in the completed slab-on-grade to remain exposed employing a suitable epoxy injection technique acceptable to Owner to completely seal all such cracks, all to the Contractor's expense.

4.9 CLEANING

.1 Clean in accordance with 01710.

.2 Divert unused concrete materials from landfill.

.3 Provide appropriate area on job site where concrete trucks can be safely washed.

.4 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Departmental of Environment and Climate Change.

.5 Disposal of unused admixtures and additive materials, concrete, concrete washwater, or cleaning materials and residues into sewer systems, into lakes, streams, onto ground or in other location to pose health or environmental hazard is prohibited.

.6 Prevent admixtures and additive materials from entering drinking water supplies or streams.

.7 Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal.

.8 Dispose of waste in accordance with applicable local, Provincial and National regulations.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for supply and placement of concrete underwater by tremie, pumped concrete, bottom dump bucket, or bagged concrete method.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

CSA Group

A23.1/A23.2	Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
A3000	Cementations Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)

PART 2 GENERAL

2.1 DEFINITIONS

.1 Tremie concrete is placed underwater through a tube called a tremie pipe.

.2 Tremie pipe has a hopper at upper end and may be open ended or may have a foot valve, plug or travelling plug to control flow of concrete. Pipe has diameter of 200 mm minimum, constructed from sections with flange couplings fitted with gaskets.

.1 Concrete is placed in hopper and a sufficient head of concrete is maintained in tremie pipe to provide desired rate of flow.

.3 Pumped concrete method of placing concrete underwater uses a concrete pump with a discharge line used in a similar manner to a tremie pipe.

.4 Bottom-dump bucket method of placing concrete underwater requires use of a bucket designed to discharge from bottom after it has contacted foundation or surface of previous placed concrete.

.5 Bagged concrete method of placing underwater concrete consists of a diver placing bags partially filled with concrete mix.

2.2 MEASUREMENT FOR PAYMENT

.1 Concrete placed underwater will be measured in cubic metres to specified pay limits unless otherwise specified.

.2 In accordance with subsection 2.2.1 of this specification pay limits may be up to theoretical volume plus 10 %, as verified.

.3 Underwater Video and/or Photo Inspection will be measured by lump sum.

2.3 ADMINISTRATIVE REQUIREMENTS

.1 Concrete pre-placement meeting; conduct pre-placement meeting 5 business days minimum before tremie operation.

.1 Ensure meeting includes as minimum attendees as follows:

.1 General contractor.
.2 Ready-mix concrete supplier.
.3 Admixture supplier.
.4 Placing/formwork sub-contractor.
.5 Reinforcing sub-contractor.
.6 Testing agency representative.
.7 Structural engineer.
.8 Owner’s Representative.

.2 Distribute to attendees copies of concrete mix designs, aggregate physical properties, placing schedule, rate of delivery, testing program, and contingency plan for delay and breakdown.

2.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01340.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for concrete and include product characteristics, performance criteria, physical size, finish and limitations.

2.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01015 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect concrete from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Material requirements for production of concrete shall be in accordance with Section 03300, except as specified otherwise herein.

.2 Type GU Portland cement in accordance with CSA A3000, unless otherwise specified.

.3 For placing bagged concrete, use bags made of coarsely woven material to allow concrete to bond between bags.

3.2 CONCRETE MIXES

.1 Use 42 to 45 % fine aggregate by weight in concrete mix for workability.

.2 Use not less than 385 kg/m^3 of cement.

.3 Air Content 4-7 %

.4 For tremie concrete, produce a mix with a slump of 190 ± 40 mm and a water cement ratio of not more than 0.45.

.5 For pumped concrete and bottom-dump bucket concrete produce a mix with a slump and fill bags to not more than 0.45.

.6 For bagged concrete, thoroughly mix a very dry mix concrete of zero (0) to 25 mm maximum slump and fill bags to not more than 80 % full just before placing.

.7 Produce concrete with a minimum compressive strength of 25 MPa at 28 calendar days unless otherwise specified.

3.3 ADMIXTURES

.1 Admixtures will be subject to approval of the Owner. Admixtures will only be permitted to correct deficiencies in mix or to improve placement of concrete.

.2 Owner may withdraw prior approval of admixture if conditions encountered during course of work indicate unsatisfactory performance.

.3 Do not use calcium chloride or materials containing calcium chloride.

.4 Submit admixtures to produce self-consolidating calcium chloride to Owner for review.

PART 4 EXECUTION

4.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for concrete placement installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of the Owner.
- .2 Inform the Owner of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Owner.

4.2 PREPARATION

.1 Where concrete must bond to existing concrete surfaces, rock surfaces, piling, sheet piling or anchor rods, clean thoroughly just prior to starting concrete placement.

- .1 Use water jets and when quantities of silt or mud or rock cuttings are present, remove by air lift.

4.3 INSTALLATION

.1 Do concrete work in accordance with Sections 03300 and 03200, CSA A23.1/A23.2 and as specified herein. Testing for concrete to CSA A23.1/A23.2.

.2 Where concrete placement extends above water surface, protect concrete from direct contact with air at temperature below 5 ° C for Owner’s specified number of days.

.3 Place concrete in one continuous operation to full depth required.

- .1 Provide sufficient supply of concrete to complete pour without interruption and supply complete equipment for every phase of operation.

.4 Tremie Method

- .1 To prevent segregation, concrete shall be carefully placed in a compact mass, in its final position, by means of a tremie tube or other approved method. Still water shall be maintained at the point of deposit and the forms underwater shall be watertight. Precautions shall be taken to prevent the loss of concrete by washing action of the water.

.2 No concrete shall be spread at any greater distance than 3 m from the discharge end of the tremie tube. When large areas are to be covered tremie tubes at maximum 6 m centres shall be used and concrete placed simultaneously.

.3 If the tremie operation is unavoidably interrupted below water level, the surface laitance shall be removed by jetting one day after placing and removed by pumping.

.4 Provide a tremie pipe that is watertight and sufficiently large to allow free flow of concrete. Diameter of tremie pipe to be minimum 200 mm and minimum eight (8) times maximum size of coarse aggregate, constructed in sections having flanged couplings fitted with gaskets and must be watertight.

.5 Provide a hopper at top of tremie pipe and means to raise and lower tremie.

.6 Provide plug or foot valve at end of tremie pipe to permit filling pipe with concrete initially.

.7 Provide a minimum of one tremie pipe for every 30 m^2 of pour plan area. Do not move tremie pipes laterally by dragging through concrete.

.8 Start pour with tremie pipe full of concrete and keep bottom of pipe buried in freshly placed concrete at least 300 mm. Control rate of flow by increasing or decreasing depth of end in concrete.

.9 If seal is lost, allowing water to enter pipe, withdraw pipe immediately. Refill pipe, and continue placing as specified.

.10 If tremie operation is interrupted so that a horizontal construction joint has to be made, cut surface laitance by jetting, within 24 to 36 hours and remove loose material by pumping or air lifting before placing next lift.

.11 Do not place concrete in flowing water when current exceeds 3 m/min. Do not vibrate, disturb or puddle concrete after it has been placed.

.5 Pumped Concrete Method

.1 Follow procedures as for tremie method in placing concrete using discharge line from concrete pump as a tremie pipe.

.6 Bottom-Dump Bucket Method

.1 Completely fill bucket with concrete, cover top surface and lower slowly through water to prevent backwash.

.2 Discharge concrete only when bucket is in contact with surface on which concrete is to be deposited.

.3 Withdraw bucket slowly until it is well above concrete to maintain as nearly as possible still water at point of discharge to approval of the Owner.

.4 Do not place concrete in flowing water when current exceeds 3 m/min.

.7 Bagged Concrete Method

.1 Use bags made of coarsely woven material to allow concrete to bond between bags.
.2 Fill bags not more that 80 % full before placing.
.3 Place each concrete bag individually so that bag is stable and securely resting on foundation material or previously placed bags.

4.4 UNDERWATER VIDEO AND/OR PHOTO INSPECTION

.1 Underwater video and/or photo inspection as per Section 02704.

4.5 SAMPLING AND TESTING

.1 The Contractor shall co-operate fully with the Owner's Representative in enabling quality assurance tests to be carried out. Samples for quality testing purposes will normally be taken from concrete as delivered to the site (at the point of discharge from the delivery equipment). However, depending on the method of placement, random sampling of the concrete as incorporated into the structure shall also be performed to verify the above specified properties. This process shall entail the sampling of fresh concrete as close to the point of deposit in the structure as is practicable. Coring of the in-place hardened concrete may also be performed to verify the specified air void system. The Department reserves the right to designate the point of acceptance, with prior notice given to the Contractor.

.2 Field quality assurance testing will be carried out by an Owner's Representative in accordance with CSA A23.2.

.3 Quality assurance tests carried out by the Department shall conform to the following guidelines:

.1 Air & Slum Tests: Each load until 5 consecutive batches meet the requirements then test every third load thereafter.
.2 Strength & Temperature Tests: At least 1 set of Laboratory cylinders per 100 cubic metres, minimum 1 set per day plus 1 set of field cures per category of concrete if required by the Owner's Representative.
.3 Additional strength tests will be required when early indications of strength are required such as before prestressing, girder transport, removal of falsework, backfilling structure, etc.
.4 If either the measured slump, air content or temperature fall outside the limits specified, a repeat test shall be made. Failure to meet the

contract requirements shall result in rejection of the concrete. Acceptance of the concrete will depend on the results and consistency of all of the above test's results being satisfactory.

4.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01710.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01710

.3 Waste Management: separate waste materials for reuse and recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 5 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this specification and as included in the MERX Schedule of Quantities and Prices.

This specification outlines the requirements for the materials and finishing procedures for concrete floor finishes.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International (ASTM)

C171	Standard Specification for Sheet Materials for Curing Concrete

Canadian General Standards Board (CGSB)

CAN/CGSB-25.20	Surface Sealer for Floors

CSA Group

A23.1/A23.2	Concrete Materials and Methods of Concrete Construction/ Test Methods and Standard Practices for Concrete

PART 2 GENERAL

2.1 MEASUREMENT FOR PAYMENT

.1 Finishing, sealing, placement of hardeners and coloration are considered incidental to the work specified in Section 03300 and will not be measured.

2.2 SUBMITTALS

.1 Submit submittals in accordance with Section 01340.

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS Safety Data Sheet (SDS) in accordance with Section 01720

.3 Include application instructions for concrete floor treatments.

PART 3 PRODUCTS

3.1 PERFORMANCE REQUIREMENTS

.1 Product quality and quality of work in accordance with Section 01600.

.2 Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.

3.2 GENERAL

.1 Concrete materials in accordance with Section 03300 and reinforcement in accordance with Section 03200.

.2 Premixed Metallic or non-metallic floor hardener: as specified in contract documents.

.3 Wax: concrete floor buffing compound.

.4 Colouring agent: metallic type concrete colouring pigments.

3.3 CHEMICAL HARDENER

.1 Sodium silicate, magnesium fluosilicate, or zinc fluosilicate blend as indicated.

.2 Water: potable

3.4 SEALING COMPOUNDS

.1 Surface sealer: to CAN/CGSB-25.20, Type 2 - water based.

.2 Surface sealers may not be manufactured or formulated with aromatic solvents formaldehyde halogenated solvents mercury lead cadmium hexavalent chromium and their compounds.

3.5 CURING COMPOUNDS

.1 Waterborne membrane forming curing membrane to ASTM C 309, specified, Class B.

.1 Verify compatibility with subsequent finishes.

3.6 CONCRETE STAINS

.1 Select low VOC, water-based concrete stains.

3.7 WET CURE

.1 Clear polyethylene film to ASTM C171, minimum thickness 0.15 mm.

3.8 MIXES

.1 Mixing, ratios and application in accordance with manufacturer’s instructions.

PART 4 EXECUTION

4.1 EXAMINATION

.1 Verify that slab surfaces are ready to receive work and elevations are as indicated on drawings by manufacturer.

4.2 PREPARATION OF EXISTING SLAB

.1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.

.2 Saw cut control joints to CSA-A23.1/A23.2, 24 hours maximum after placing of concrete.

.3 Use mechanical stripping and/or strong solvent to remove chlorinated rubber or existing surface coatings.

.4 Use protective clothing, eye protection, and respiratory equipment during stripping of chlorinated rubber or existing surface coatings.

4.3 CONCRETE STAINING

.1 Coordinate with Section 03300 for wet curing. Liquid curing compounds not permitted under staining.

.2 Cure concrete for minimum 60 days.

.3 Clean and prepare concrete in accordance with manufacturers written instructions.

.4 Apply two (2) coats of chemical stain materials in accordance with manufacturers written instructions; obtain Owner’s acceptance after application of both first and second coats.

.5 Apply recommended cure/seal materials in accordance with manufacturer's written instructions, in number of coats to achieve required floor lustre.

4.4 APPLICATION FINISH

.1 Apply concrete finishing floor hardener in accordance with manufacturer's instructions. Cure to manufacturers recommendations.

.2 Finish concrete in accordance with CSA A23.1/A23.2 Class A.

.3 Do not sprinkle dry cement or dry cement and sand mixture over concrete surfaces.

.4 Saw cut crack-control joints in accordance with CSA A23.1/A23.2 24 hours maximum after placing of concrete.

.5 Apply concrete floor treatment in accordance with Sealer manufacturer's instructions.

.6 Cure concrete in accordance with CSA A23.1/A23.2except where specified otherwise.

.7 Clean over spray: Clean sealant from adjacent surfaces.

4.5 TOPPINGS

.1 Place dividers, edge strips, reinforcing mesh, expansion joint assemblies, and other cast-in items as specified.

.2 Apply cement grout to base slab in accordance with CSA A23.1/A23.2.

.3 Apply bonding adhesive to base slab in accordance with manufacturer's instructions.

.4 Apply concrete topping of 30 MPa minimum compressive strength in accordance with CSA A23.1/A23.2.

4.6 PROTECTION

.1 Protect finished installation in accordance with manufacturer's instructions.

PART 5 BASIS OF PAYMENT

All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in Measurement for Payment subsection of this specification and as included in the MERX Schedule of Quantities and Prices.