

# **City of Miramichi Engineering Department**

## **Revisions to Standard Municipal Specifications**

**February 2011**

The specification number listed is referenced to the 2010 City of Miramichi Standard Municipal Specifications, unless new specification has been included. Users of the document shall carefully review any changes, and forward any queries to the City of Miramichi Engineering Department.

### **SECTION 130 CONCRETE**

- 2.2.1.4 Modified Exposure Class to C-2
- 2.2.1.7 Modified Air content to 5 – 8 %
- 2.2.4 New clause for slip form curb machine

### **SECTION 250 WATERMAINS**

- 2.4.4 A new type of curb stop is now required
- 3.11.9 Corrected a mistake in the formula

### **SECTION 260 SEWERAGE FORCEMAIN**

- 2.5.4 Modified to eliminate the use of pre-cast thrust blocks
- 3.4.5 Modified to correct an error in the placement of the forcemain
- 3.5.1 Clarified the use of mechanical thrust blocks and cast in place thrust blocks
- 3.5.2 Eliminated the use of pre-cast thrust blocks

### **SECTION 290 HORIZONTAL PIPE DRILLING**

New specification

## **SECTION 340 ASPHALT PAVING**

1.3.9 Included a note to state "or as otherwise stated on the contract drawings"

2.1.3 Modified the micro deval requirements to be consistent with NBDOT including a new clause for rock that has a low micro deval for coarse aggregate but a high loss for fine aggregate.

2.4.1 modified the tack coat requirement to be consistent with NBDOT

## **SECTION 420 WASTE WATER LIFT STATION**

1.1.4 New clause inserted to refer to the pre-fabricated shelter standard drawing

2.1.4.7 Modified the specification for access cover

2.1.6.2 Modified the clause to delete the reference to the future

2.1.6.3.5 Modified to allow for normal operation to be controlled by the ultrasonic level controller

2.1.6.3.6 Modified to allow for the float system to be the back-up system in the event of a PLC failure

2.1.6.4.1 Modified to include the pre-fabricated shelter

2.1.6.4.7.1 Modified to delete the reference to the large steel cabinet, as a pre-fabricated shelter is now specified

2.1.6.4.7.11 Modified to include the programming requirement be compatible to RSLogix 500 Professional.

2.7.9 New clause for the allowance of an uninterrupted power supply (UPS)

2.8.2 Modified to state that the ultrasonic level controller shall control the system, and that the float system shall be a backup

## **STANDARD MUNICIPAL DETAIL DRAWINGS**

**The following drawings have been changed and are attached**

**Detail 52      Longitudinal Asphalt Joint – new detail**

## **PART I - GENERAL**

### **1.1 RELATED WORK**

Section 100: GENERAL  
110 General Requirements

Section 200: UNDERGROUND INFRASTRUCTURE  
210 Excavating, Trenching, Bedding & Backfilling of Pipelines  
220 Sanitary Sewers  
230 Storm Sewers  
240 Manholes, Catchbasins, & Sluice Boxes  
250 Watermains  
260 Sewage Forcemains

Section 300: STREETS & ROADWAYS  
330 Curbs, Gutters, & Sidewalks

### **1.2 REFERENCE STANDARDS**

.1 Do cast-in-place concrete work in accordance with CAN3-A23.1-M94, CAN3-A23.1S1-1986, CAN3-A23.1S2-86, and testing in accordance with CAN3-A23.2-M94, CAN3-A23.2S2-86, except where specified otherwise.

### **1.3 SAMPLES**

.1 At least 2 weeks prior to commencing work, inform Engineer of proposed source of aggregates and provide access for sampling.

### **1.4 CERTIFICATES**

- .1 Minimum 2 weeks prior to starting concrete work submit to Engineer manufacturer's test data and certification by qualified independent inspection and testing laboratory that the following materials will meet specified requirements:
- .1 Portland cement.
  - .2 Grout.
  - .3 Admixtures.
  - .4 Aggregates.
  - .5 Water.
  - .6 Joint filler.
- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN3-A23.1-M94, CAN3-A23.1S1-1986, CAN3-A23.1S2-86 and that mix design is adjusted to prevent alkali aggregate reactivity problems.
- .3 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CAN3-A23.1-M94, CAN3-A23.1S1-1986, CAN3-A23.1S2-86 and that mix design is adjusted to prevent alkali aggregate reactivity problems.

### **1.5 CONSTRUCTION QUALITY CONTROL**

.1 Submit proposed quality control procedures for Engineer's review.

## 1.6 MEASUREMENT FOR PAYMENT

- .1 No measurement will be made under this Section.

## PART II - PRODUCTS

### 2.1 MATERIALS

- .1 Portland cement: to CAN3-A5-M1993.
- .2 Supplementary cementing materials: to CAN/CSA-A23.5-M86 (R1992).
- .3 Water: to CAN3-A23.1-M94, CAN3-A23.1S1-1986, CAN3-A23.1S2-86.
- .4 Aggregates: to CAN3-A23.1-M94, CAN3-A23.1S1-1986, CAN3-A23.1S2-86. Coarse aggregates to be normal density.
- .5 Air entraining admixture: to ASTM Standard C260.
- .6 Chemical admixtures: to CAN3-A266.2-M78. Owner to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .7 Curing compound: to CAN3-A23.1-M94, CAN3-A23.1S1-1986, CAN3-A23.1S2-86 white and to ASTM C309-81, Ritecure/Sternsure white pigmented, or approved equal.
- .8 Expansion Joint Material:
  - .1 Premoulded bituminous impregnated cane fibre board: to ASTM D1751-83.
  - .2 "Flexicell" as manufactured by Sternson Limited or approved equal.
- .9 Moisture Proof Paper:
  - .1 Orange Label Fibereen as manufactured by Domtar or approved equal.
- .10 Oil for Protective Treatment; Boiled commercial linseed oil.
- .11 Thinner; Kerosene, turpentine or Varsol.
- .12 Insulation; Shall provide a minimum R value of 10.
- .13 Polyethylene; Shall be 6 mil.
- .14 Forms to conform to the requirements of CAN/CSA A23.1 and produce a final cross section in compliance with detail drawings.

### 2.2 CONCRETE MIXES

- .1 Proportion normal density concrete in accordance with CAN3-A23.1-M94, CAN3-A23.1S1-1986, CAN3-A23.1S2-86, Alternative 1 to give following properties: for all concrete as indicated.
  - .1 Cement: use Type 10 Portland cement.
  - .2 Minimum compressive strength at 28 days: 32 MPa.
  - .3 Minimum cement content: 410 kg/cu m of concrete.
  - .4 Class of exposure: C-2
  - .5 Nominal size of coarse aggregate: 20 mm.
  - .6 Slump at time and point of discharge: 75 mm  $\pm$  30 mm.
  - .7 Air content: 5-8%.
  - .8 Chemical admixtures: in accordance with ASTM Standard C494.
  - .9 Flyash content shall be limited to a maximum of 10% of cement content and shall not be permitted in the concrete mix after September 1<sup>st</sup> for concrete curb and gutter, sidewalk, or any other exterior flatworks.
- .2 Proportion concrete in accordance with CAN3-A23.1-M94, CAN3-A23.1S1-1986, CAN3-A23.1S2-86.
- .3 Do not change concrete mix without prior approval of Engineer.
- .4 When using a slip-form curb machine, the slump may be reduced.

## **PART III - EXECUTION**

### **3.1 WORKMANSHIP**

- .1 Provide 24 hour notice prior to placing of concrete.
- .2 Pumping of concrete is permitted only after approval of equipment and mix.
- .3 Ensure reinforcement (if required) is not disturbed during concrete placement.
- .4 Prior to placing of concrete obtain Engineer's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .6 Do not place load upon new concrete until authorized by Engineer.

### **3.2 FINISHING**

- .1 Finish concrete in accordance with CAN3-A23.1-M94, CAN3-A23.1S1-1986, CAN3-A23.1S2-86.
- .2 Rub exposed sharp edges of concrete with Carborundum to produce 6 mm radius edges unless otherwise indicated.

### **3.3 JOINT FILLERS**

- .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Engineer. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
- .2 Locate and form expansion joints as indicated. Install joint filler.
- .3 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.

### **3.4 FIELD QUALITY CONTROL**

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Engineer in accordance with CAN3-A23.1-M94, CAN3-A23.1S1-1986, CAN3-A23.1S2-86. Sampling and testing program to be followed is illustrated in Section 110 General Requirements under Item 7 Quality Control.
- .2 City of Miramichi to pay for testing requirements as per section 110, General conditions
- .3 Engineer will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .4 Non-destructive Methods for Testing Concrete shall be in accordance with CAN3-A23.2-M94.
- .5 Inspection or testing by Engineer will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

- .6 Should testing, after a reasonable sampling program (Section 110) indicate faulty products, the Contractor will be notified and the costs of further tests until satisfactory results are obtained will be at the expense of the Contractor.

### **3.5 HOT WEATHER**

- .1 Concrete shall not be placed when the daily maximum outside air temperature is above 30 °C and rising.
- .2 Where daily maximum outside air temperature exceeds 27 degrees Celsius an initial period of continuous moist curing is required. Such initial curing period shall not be less than twenty-four (24) hours.
- .3 When the temperature is above 25 degrees Celsius, a set-retarding admixture may be used in the mix, as approved by the Engineer.

**END OF SECTION**

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## **PART I - GENERAL**

### **1.1 RELATED WORK**

Section 100: GENERAL  
110 General Requirements  
120 Topsoil, Seeding & Sodding  
130 Concrete

Section 200: UNDERGROUND INFRASTRUCTURE  
210 Excavating, Trenching, Bedding & Backfilling of Pipelines

### **1.2 MATERIAL CERTIFICATION**

.1 At least 2 weeks prior to commencing work, have available for submission manufacturer's test data and certification that pipe materials meet the requirements of this section. Include manufacturer's drawings, information and shop drawings where pertinent.

### **1.3 SHOP DRAWINGS**

.1 Submit complete shop drawings and construction schedule for water mains 600 mm diameter and larger, valves, hydrants, chambers and any special fittings.

### **1.4 SCHEDULING OF WORK**

- .1 Schedule work to minimize interruptions to existing services.
- .2 The Contractor shall coordinate all watermain interruptions with the City of Miramichi Public Works Department at least 48 hours in advance of any interruption. The Contractor shall submit a proposed plan, location, schedule and details of interruption to the Public Works Department. Written approvals shall be forwarded to the Engineer at least 24 hours in advance of the execution of the work.
- .3 Do not interrupt water service for more than 3 hours and confine this period between 10:00 and 16:00 h local time unless otherwise authorized.
- .4 Notify fire department of any planned or accidental interruption of water supply to fire hydrants.
- .5 Advise local police department, ambulance operators, and fire department of anticipated interference with movement of traffic.
- .6 DO NOT EXCAVATE NEAR ANY EXISTING WATERMAINS UNLESS THE EXACT LOCATION OF ALL SYSTEM VALVES HAVE BEEN DETERMINED AND THESE VALVES HAVE BEEN TESTED AND OPERATED BY THE OWNER'S REPRESENTATIVES.
- .7 They City of Miramichi Public Works Department shall be the sole authority to operate hydrants and valves.
- .8 The Contractor must make all arrangements with the city Public Works Department prior to connecting or locating existing watermains. The Contractor must also co-ordinate with the City regarding scheduled methods and procedures to be followed for isolating sections of the water system and connecting to these mains.

## 1.5 TEMPORARY WATERMAINS

- .1 Should a temporary by-pass be required, the contractor shall submit a detailed plan to the Public Works Department for review. The temporary plan shall be submitted as soon as possible upon tender award, and a minimum of 2 weeks prior to commencing with the temporary watermain work. Approvals from outside agencies are required and the timeframe may vary, depending on the nature of the work. The plan shall detail all connections, valves, temporary pipe connections, back flow prevention devices, and any other appurtenances that may be required. No alterations or connections to be made to the temporary waterline without prior written approval from the Public Works Department.
- .2 Protection and security of the temporary watermain shall be the sole responsibility of the contractor, and will be considered incidental to the work.
- .3 Temporary water main and lateral materials are to meet the requirements of NSF/ANSI Standard 61: Drinking Water System Components – Health Effects
- .4 Temporary piping is to be disinfected, flushed and tested for total coliforms and E. Coli according to AWWA standard C651 prior to line being put into service and as per subsection 3.12
- .5 Weekly samples are to be collected from each temporary water main network, and analyzed for total coliform and E. Coli. Contractor shall coordinate the collection of samples with the Public Works Department as per subsection 3.12
- .6 Fire Hydrants used for the purpose of supplying water to the temporary watermain network are to be equipped with certified backflow prevention assemblies
- .7 Backflow prevention devices shall be certified on a yearly basis. Confirmation of certification shall be submitted with the detailed plan.

## 1.6 MEASUREMENT FOR PAYMENT

- .1 Watermain including supply and installation of piping, fittings, trenching and backfilling, trench restoration, removal of existing watermain, granular bedding, tie backs, thrust blocks, flushing, testing, connections to existing water mains, chlorination, water sample testing and any incidentals will be measured in meters of each size of pipe installed. Watermain will be measured over the ground surface through valves and fittings, after work has been completed. Payment will be in lineal meters of watermain acceptably installed. The tender's list of materials and quantities will specify the watermain materials to be utilized.
- .2 Hydrants including tee, piping, valve, valve box, pumper connections, all fittings, backfilling, removal of existing hydrants and appurtenances, painting, reaction backing and any testing will be measured in units installed.
- .3 New curb stop (valve) connection to existing water service line including connections to existing main and service lateral and supply and installation of: piping, curb stop, curb boxes, all fittings, trenching, removal of existing curb stop and appurtenances, bedding, backfilling, and restoration will be measured in units serviced.
- .4 New service connection including connections to existing appurtenances and supply and installation of: mainstop, piping, all fittings, curb stop, trenching, removal of existing service connections and appurtenances, bedding, backfilling, insulation, restoration of lawns, curbs and roadways and will be measured horizontally over the ground surface from the centre line of the water main to the curb stop in lineal meters.

- .5 Watermain valves will be measured in units of each size installed including excavation and backfilling, adjustment, removal of existing valves and appurtenances, valves and valve boxes, mechanical tie back rods, fittings and thrust blocks.
- .6 Valve chambers including supply, installation of the structure, excavation, adjustment, removal of existing valve chambers and backfilling, bedding and restoration, and drain, will be measured in units installed as per the details.
- .7 Granular bedding material will not be measured but shall be considered as incidental to the watermain installation.
- .8 Concrete for bedding, encasement of pipes, supports, mechanical restraining systems and thrust blocks will be considered as incidental to the work.
- .9 Adjustment of all newly installed valve boxes, valve chambers, hydrants, curb stops or any special fitting will be considered incidental to the installation of the water main.
- .10 Adjusting tops of existing valve boxes, valve chambers, hydrants, curb stops or any special fitting will be measured by number adjusted with-in 600 mm. Beyond this adjustment, force account basis will be utilized.
- .11 All trench restoration including asphalt, topsoil & seeding, grading, crushed stone or driveway restoration shall be considered as incidental to the work.
- .12 Watermain insulation will be measured in square meters of insulation per 25mm thickness acceptably installed.
- .13 Payment for temporary watermains shall be on a lump sum basis. The lump sum price shall include all connections, temporary waterline, installation, road crossings, flushing, chlorination, maintenance, restoration, security, backflow prevention devices, protection, security and all other incidentals.

## **PART II - PRODUCTS**

### **2.1 PIPE, JOINTS AND FITTINGS**

- .1 Polyvinyl chloride pressure pipe: to AWWA C900, CSA 137.3M pressure class 150, 1 MPa, DR18, colour coded blue. Joints to be bell and spigot type with integral rubber gasket. The bell will be an integral part of the pipe joint.
- .2 Ductile Iron Pipe: to AWWA C151 pressure Class 350 with cement mortar lining to AWWA c104-185.
  - .1 Joints shall be push-on with continuous rubber molded ring gasket to AWWA C111.
  - .2 Rubber gasket for flange pipe joints 1.6mm thick to AWWA C111-80
  - .3 Bolts, nuts, hex head with washers to ASTM A307-84 heavy series.
  - .4 Conductivity wedges shall be installed
- .3 Fittings for all pipe material types:
  - .1 Mechanical joint ductile iron fittings 1725kPa NPS 3 and larger: AWWA C110 for short body fittings of ductile iron fittings meeting the requirements of AWWA C153, 1725 kPa class.
  - .2 PVC fittings to meet the requirements of AWWA C-907-91 and CSA B137.2 Class 150.
  - .3 Cast iron fittings to meet the requirements of AWWA C110 for 1725 kPa.

- .4 Joints for fittings will be mechanical type meeting the requirements of the latest AWWA Standard C111 for mechanical joints for pressure pipe and fittings. Fittings will be complete with components parts.
- .4 Ductile Iron Pipe shall be installed in the former Towns of Chatham and Newcastle. PVC pipe shall only be installed in other areas upon written approval from the City of Miramichi.

## 2.2 VALVES AND VALVE BOXES

- .1 Gate valves and valve boxes shall be McAvity or approved equal and must meet requirements of AWWA C500 or C509, standard iron body, double disc valves with non-rising stems, resilient seat, suitable for 1 MPa with mechanical joints. These shall have a 50mm square operating nut and centering wheel. Valves to open counter clockwise.
- .2 Cast iron valve boxes: bituminous coated sliding type adjustable over a minimum of 450 mm. Base to be large round type with minimum diameter of 350mm. Covers shall be Bibby VB-825 (112mm depth) and have suitable opening for removal by a pick axe. Top of box to be marked "water."

## 2.3 VALVE CHAMBERS

- .1 Pre-cast concrete sections to ASTM C478M. Refer to details and Section 240.
- .2 Jointing materials: shall be: Manufacturer's rubber ring gaskets, Mastic joint filler, or combination of above types.
- .3 Mortar: aggregate to CSA A82.56-M1976, masonry cement to CAN3-A8-M83.
- .4 Valve chamber frames and covers: gray iron castings, minimum tensile strength 200 MPa to AASHTO M105-76 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".

## 2.4 TAPING SLEEVES AND SERVICE CONNECTIONS

- .1 Service Piping: The type of service to be used shall be;
  - .1 For Ductile Iron Watermains - Copper tubing to ASTM B88 M, type K, annealed, minimum outside diameter shall be 19 mm.
  - .2 For PVC Watermains – Municipex blue (PEXa) to ASTM F887 and CSA standard B137.5, minimum outside diameter shall be 25 mm
- .2 Tubing joints: Compression type suitable for 1 MPa working pressure.
- .3 Bronze corporation main stops: Mueller H15217 (19mm). Product numbers shown are for 19mm only, check drawings for various service sizes.
- .4 Bronze Oriseal type curb stops: Mueller Stop H-15209 ad stop and drain H-15219 (19 mm) have adjustable bituminous coated cast iron service box with stem to suit depth of bury. These to have stainless steel rod with properly sized zinc anode, Mueller type A-276. Top of cast iron box marked "WATER". Product numbers shown are for 19 mm only, check drawings for various service sizes. Stainless steel liners shall be inserted into the ends of all Municipex tubing for all connections made to brass compression fittings.

- .5 For PVC pipes - Stainless steel type service clamps c/w saddle out for PVC pipe service connections. Service clamps to be of strap-type, with confined "O" ring seal cemented in place. Service saddles shall be Concord Daigle D-71 or Romac type. Clamps to be tapped with threads to AWWA C800. SERVICE SADDLES MUST BE USED ON ALL PVC WATERMAINS.
- .6 For Ductile Iron - Tapping sleeves shall be cast iron, ductile iron or stainless steel with full seals around the circumference of the pipe. Tapping sleeves to be Mueller H304 SS clamp, or Mueller H615, Mechanical joint type or approved Equal.
- .7 Tapping valves shall meet the requirements of AWWA C500 or C509 for gate valves. Tapping valves to be flanged to mechanical joint type Mueller T2360-19 open left or approved Equal.

## 2.5 HYDRANTS

- .1 Post type hydrants: To AWWA C502. Hydrants to be self draining compression type, designed for working pressure of 1000 kPa with two 65 mm threaded hose outlets, pumper connection 150 mm riser barrel, 125 mm bottom valve and 150 mm connection for main. Hydrants to open counter clockwise, thread pitch to conform to City of Miramichi standard for either the former Town of Chatham or Newcastle, as applicable. Depth of bury 2.0 m minimum.
  - .1 Provide key operated gate valve located 1 m minimum from hydrant.
  - .2 Colour hydrants to City of Miramichi standard.
  - .3 After installation, paint hydrants and barrels to the colours indicated by the City of Miramichi, use exterior enamel.
  - .4 Manufacturer to be McAvity M-67 Brigadeer or Canada Valve
  - .5 Mechanical Restrainers to be used for all hydrants, and a cast in place concrete thrust block to be installed at the bowl of the hydrant
  - .6 Hydrant shall have 100mm drain to storm sewer upon request of Engineer
  - .7 Drain plugs shall be left open at all times, unless requested to be plugged with brass plugs by the Engineer.

## 2.6 PIPE BEDDING MATERIALS

- .1 Granular bedding material shall be as per the requirements of Section 210.
- .2 Concrete required for cradles, encasement, supports, thrust blocks, all to Section 130 – Concrete.

## 2.7 RESTRAINING DEVICES

- .1 To ASTM A536 Grade 65-45-12 for 50mm to 600mm sizes ASTM A 36 structural steel for 550mm to 700mm sizes.
- .2 Restraining devices shall incorporate a series of machined serrations on the inside diameter to provide positive restraint, exact fit, 360° contact and support of the pipe wall. Bolts and connecting hardware shall be of high strength, low alloy material in accordance with ANSI/AWWA C111/A21.11.
- .3 Mechanical Joint restraints for PVC to be Clow Series 1350 Grip ring by Romac or Uni-flange Blockbuster 1300 or approved equal. Joint restraint for ductile iron pipe to be wedge type MEGAHOLDER as manufactured by IPEX or approved equal.

- .4 Concrete Thrust Blocks shall conform to the dimensions outlined on the details and shall be constructed of concrete. Concrete shall be in accordance with Section 130. USE OF PRECAST CONCRETE THRUST BLOCKS WILL NOT BE PERMITTED.

## **2.8 PIPE DISINFECTION**

- .1 Liquid chlorine to AWWA B301-92 to disinfect water mains.

## **2.9 PIPE INSULATION**

- .1 Styrofoam Insulation: to have a minimum compressive strength of 100 psi. A typical tensile strength of 125 psi. A typical shear strength of 50 psi. A typical flexural strength of 85 psi. Insulation to be DOW HI-100 or approved equal.

## **PART III - EXECUTION**

### **3.1 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.

### **3.2 TRENCHING AND BACKFILLING**

- .1 Do trenching and backfill work in accordance with Section 210 – Excavating, Trenching, Bedding and Backfilling of pipelines.
- .2 Trench depth to provide cover over pipe of not less than 1.8 m from finished grade or as indicated on the drawings.
- .3 Do not backfill trenches until installed work has been checked by Engineer.

### **3.3 CONCRETE BEDDING AND ENCASEMENT**

- .1 Do concrete work in accordance with Section 130-Concrete. Place concrete to details indicated.
- .2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation.
- .3 Do not backfill over concrete within 24 h after placing concrete.

### **3.4 GRANULAR BEDDING**

- .1 Place granular bedding materials to details indicated.
- .2 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. The use of blocking to support the pipe during the placement of bedding is not permitted.
- .3 Shape transverse depressions in bedding as required to make joints.
- .4 Compact full width of bed to at least 95% of maximum standard proctor dry density.
- .5 Fill any excavation below design elevation of bottom of specified bedding with crushed stone and compact at no expense to the Owner.

### 3.5 PIPE INSTALLATION

- .1 Building water service shall terminate at property line opposite point of connection to main. If plumbing is already installed, make connection, only if chlorination and disinfection tests have been completed and passed, otherwise cap or seal end of pipe and place temporary wooden marker post to locate pipe end.
- .2 Lay pipes to AWWA C600-82 AWWA C603-78 AWWA Manual of Practice M-9-1961 M-11-1974 and manufacturer's standard instructions and specifications. Do not use blocks except as permitted in 3.3.2.
- .3 Join pipes in accordance with AWWA C600-82 AWWA C602-83 AWWA C206-82 AWWA Manual of Practice M-9-1961 M-11-1974 and manufacturer's recommendations.
- .4 Handle pipe by approved methods. Contractor to provide and use proper implements, tools and facilities for safe and efficient execution of the work. Do not use chains or cables passed through pipe bore. Pipe or accessories must never be dropped or bumped into the trench.
- .5 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 which is not in true alignment or grade or pipe which shows undue settlement after installation.
- .6 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends up-grade.
- .7 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
- .8 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. Pipe lubricant must be acceptable for potable water applications.
- .9 Position and join pipes with equipment and methods recommended by manufacturer.
- .10 Cut pipes in an approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .11 Align pipes carefully before jointing.
- .12 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 jointing is attempted again.
- .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.
- .17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Engineer.

- .18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .19 Do not lay pipe on frozen bedding.
- .20 Protect hydrants, valves and appurtenances from freezing.
- .21 Upon completion of pipe laying and after Engineer has inspected work in place, surround and cover pipes with approved granular material placed to dimensions indicated.
- .22 Place granular material in uniform layers not exceeding 150 mm thick to minimum 300 mm over top of out pipe. Do not dump material directly on top of pipe.
- .23 Place layers of backfill material uniformly, at a maximum depth of 600mm. In areas within 600mm of top of pipe, place material simultaneously on each side of pipe to prevent lateral displacement of pipe.
- .24 Compact each layer to at least 95% maximum proctor density as outlined in ASTM D698-78.
- .25 It is the Contractor's responsibility to ensure that their operations do not contaminate the public water supply. If at any time, the water in the existing system becomes contaminated through actions by the Contractor, the Contractor shall be responsible for all costs associated with the contamination, including but not limited to Professional, testing and other expenses.

### **3.6 VALVE INSTALLATION**

- .1 Install valves to manufacturer's recommendations at locations indicated.
- .2 Support valves located in valve boxes or valve chambers with 20-40mm drainage stone, located between valve and solid ground. Minimum length of pipe on each end of valve shall be 1 m. Valves shall not be supported by pipe.
- .3 Install underground post-type indicator valves as indicated.
- .4 Set valve boxes on gate valves as indicated on the drawings. The valve box must be installed so as not to transmit stress to the valve and must be centered over the wrench nut of the valve by means of a centering wheel. Valve boxes to be set plumb to enable access to the valve nut. Boxes will not be required where valves are in chambers.
- .5 Set covers on valve boxes flush with the finish grade. On Gravel roadways lower valve boxes 100 mm after final inspection.

### **3.7 VALVE CHAMBERS**

- .1 Use precast units as approved by Engineer and as indicated on the drawings.
- .2 Set bottom section of precast unit in bed of compacted crushed stone minimum 150mm. This stone shall be the same as the pipe bedding.
- .3 Clean surplus mortar and joint compounds from interior surface of valve chamber as work progresses.
- .4 Plug lifting holes with precast concrete plugs set in cement mortar.

- .5 Place frame and cover on top section to elevation indicated. Adjust in accordance with Section 240.
- .6 Clean valve chambers of debris and foreign materials; remove fins and sharp projections.
- .7 Install chamber drains where indicated.

### 3.8 SERVICE CONNECTIONS

- .1 Terminate building water service at property line opposite point of connection to main. If plumbing is already installed, make connection, otherwise cap or seal end of pipe and place temporary wooden marker post to locate pipe end.
- .2 Construct service connections at right angles to watermain unless otherwise directed. Locate curb stops within 300mm of property line and place temporary wooden marker post to locate pipe end. Water service lateral to be placed in common trench with the sanitary lateral and storm service lateral.
- .3 Tappings on ductile iron pipe 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 must use the 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

- .4 All tappings on PVC pipe to have saddles made of bronze type service clamps, strap type with "O" ring seal cemented in place. See details.
- .5 Employ only competent workmen equipped with suitable tools to carry out tapping of mains and cutting and flarings of pipes.
- .6 Install single and multiple tap service connections on top half of main, between 45 and 90° measured from apex of pipe.
- .7 Tap main at 2:00 o'clock or 10:00 o'clock position only; not closer to a joint nor closer to adjacent service connections than recommended by manufacturer.
- .8 Install multiple corporation stops, 300° apart around circumference of pipe and a minimum of 300 mm apart along pipe. The minimum distance between a domestic tap and a fire service is 1500 mm.
- .9 Use corporation type connections on service laterals. Leave corporation stop valves fully open.
- .10 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.

- .11 Install curb stop with corporation box on services. Set box plumb over stop and adjust top flush with final grade elevation. Leave curb stop valves fully closed.
- .12 Place temporary location marker at curb stop. Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade. Paint exposed portion of stake blue with designation "WATER SERVICE LINE" in black.
- .13 Required Fittings for connection to existing plastic water service are to be determined upon excavation.
- .14 All service laterals to have minimum bury of 1.8m.
- .15 Insulation:
  - .1 For copper services, insulation shall be placed over the gooseneck at a width of 1.2 m
  - .2 For Municipex services, insulation shall be placed at a width of 1.2 m from the main to the curb stop.

### 3.9 HYDRANTS

- .1 Install hydrants at locations indicated as to cover a radius of not more than 122 m with normal spacing not to exceed 244m in light residential districts. Refer to fire underwriters for congested areas. A hydrant will be located at the end of dead end mains unless otherwise directed by the Engineer.
- .2 Install hydrants in accordance with AWWA Manual of Practice M-17-1970.
- .3 Install 150 mm gate valve and cast iron valve box on hydrant service leads as indicated. Hydrants must have a minimum burial depth of 2.0 meters.
- .4 Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation of 150 mm minimum or 300 mm maximum above final grade.
- .5 Ensure proper mechanical restraining devices have been installed. A cast in place thrust block shall be poured at the bowl of the hydrant. Care to be taken to avoid plugging drain holes. Precast concrete blocks are not acceptable.
- .6 Where indicated in plans or specifications, provide proper draining for each hydrant, by excavating a pit measuring not less than 1 x 1 x 0.5 m deep and backfill with drainage stone (20-40mm) to a level 150 mm above drain holes. From this pit install a 100 mm PVC storm sewer pipe to the nearest storm sewer main. Wrap geotextile fabric around the pit end of the hydrant drain. CONNECTION OF 100 mm PVC LEAD FROM DRAIN PIT TO A SANITARY SEWER PIPE OR COMBINED SEWER PIPE IS NOT PERMITTED.
- .7 Place the appropriate sign on installed hydrants indicating whether or not they are in service during construction.

### 3.10 MECHANICAL RESTRAINING SYSTEMS AND THRUST BLOCKS

- .1 Mechanical restraints must be installed for all valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings. Cast in place concrete thrust blocks to be installed at all tees, end caps, bowls of hydrants and bends larger than 22 ½ degrees.

- .2 Concrete for Thrust Blocks shall be in accordance with Section 130 Concrete. Joints and couplings are to be kept free of concrete and concrete is to extend from the appurtenance to undisturbed in-site ground. Do not backfill over concrete within 24 hours after placing. PRECAST CONCRETE THRUST BLOCKS ARE NOT PERMITTED.

### 3.11 HYDROSTATIC AND LEAKAGE TESTING

- .1 Provide labour, equipment and materials and Leakage Testing required to perform hydrostatic and leakage tests hereinafter described.
- .2 Notify Engineer at least 24 h in advance of all proposed tests. Perform tests in presence of Engineer.
- .3 Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least 5 days after placing concrete or 2 days if high early strength concrete is used.
- .4 Test pipeline in sections not exceeding 400 m in length, unless otherwise authorized by Owner. Test Valves, appurtenances and water service laterals installed in the test section of the water main in conjunction with the mains. The gauge recording the pressure must be installed at the top of the section being tested, or the test pressure will be increased to ensure that the minimum test pressure is exerted on all portions of the test section.
- .5 Trenches must be sufficiently backfilled to prevent movement of the pipe under the test pressure. Where requested, joints and fittings must be left exposed for inspection during testing. Install all permanent restraints on the test section prior to testing. Open/close valves as required to ensure proper testing.
- .6 Brace Exposed ends of main to prevent movement when test is applied. Expel air from main by slowly filling main with potable water. Install corporation stops at high points in main where no air-vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs.
- .7 Apply a leakage test pressure of 1000 kPa after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.
- .8 Define leakage as amount of water supplied from water storage tank meter in order to maintain test pressure for 2 hours.
- .9 Do not exceed allowable leakage as per the formula:

$$\frac{L=ND/P^{1/2}}{130000}$$

where L= allowable leakage in litres per hour;  
N= number of joints in the section under test  
D= nominal diameter of pipe in mm  
P= test pressure in kPa

- .10 Locate and repair defects if leakage is greater than amount specified. Visual leaks must be repaired regardless of test results.

.11 Repeat test until leakage is within specified allowance for full length of watermain.

.12 Following successful completion of the hydrostatic test, each fire hydrant will be tested by applying system pressure to the complete hydrant barrel for a minimum period of 15 minutes. Any leakage, except for minor leakage at the caps, will be cause for rejection.

### 3.12 FLUSHING AND DISINFECTING

.1 Flushing and disinfecting operations shall be under direct control of Engineer in conjunction with the Public Works Department. Notify Public Works at least 4 days in advance of proposed date when disinfecting operations will commence.

.2 Flush water mains through available outlets with a sufficient flow to produce a velocity of 1.5 m/s, within pipe for 10 min, or until foreign materials have been removed and flushed water is clear, as per AWWA C651

.3 Flushing flows shall be as follows:

Pipe Size NPS	Flow (L/s) Minimum
6 and below	38
8	75
10	115
12	150

.4 Provide connections and pumps as required.

.5 Open and close valves, hydrants and service connections to ensure thorough flushing.

.6 When flushing has been satisfactorily completed; the watermain shall be disinfected with liquid chlorine meeting the requirements of the latest AWWA standard B301-92. The dosage rate shall be 50 parts per million available chlorine.

.7 Disinfect watermains to AWWA C651.

.8 Rate of chlorine application shall be proportional to rate of water entering pipe.

.9 Chlorine application shall be close to point of filling water main and to occur at same time.

.10 Upon achieving a chlorine residual of not less than 25 ppm, leave system charged with chlorine solution for twenty four hours. At the end of the twenty four hour period, the treated water shall be tested. Should it contain less than 10 ppm of available chlorine, the disinfection procedure shall be repeated. Following the disinfection procedure, the watermain shall be flushed until the residual chlorine is reduced to less than 2 ppm. Chlorinated water shall be discharged into the sanitary sewer only.

.11 Measure chlorine residuals at extreme end of pipe-line being tested. Chlorine residual testing shall be completed by City of Miramichi Public Works Department during commissioning of any temporary and permanent watermains, and on a weekly basis for temporary watermains.

- .12 Upon successful completion of flushing and disinfection, The City of Miramichi shall take samples for bacterial testing at the beginning and end of each section, and a second set a minimum 24 hours apart. Samples shall be sent to an accredited lab for testing. Samples shall be collected from Monday to Thursday; should a test produce a failed result, the Contractor shall repeat flushing and chlorination as outlined herein. Two consecutive "pass" samples are required prior to commissioning of the line. The City of Miramichi will not entertain any claims associated with the processing of samples at the laboratory. Contractors shall provide adequate notice and become familiar with testing procedures of the City of Miramichi to avoid delays. The City of Miramichi shall pay for only the minimum required number of tests. Additional costs associated with retesting shall be borne by the Contactor, including all labour costs incurred by the City of Miramichi staff.

**END OF SECTION**

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## **PART 1- GENERAL**

### **1.1 RELATED WORK**

Section 100: GENERAL  
110 General Requirements  
120 Topsoil, Seeding & Sodding  
130 Concrete

Section 200: UNDERGROUND INFRASTRUCTURE  
210 Excavating, Trenching, Bedding & Backfilling of Pipelines  
220 Sanitary Sewers  
240 Manholes, Catchbasins, & Sluice Boxes

### **1.2 MATERIAL CERTIFICATION**

.1 At least 2 weeks prior to commencing work, submit manufacturer's test data and certification that pipe materials meet requirements of this section.

### **1.3 MEASUREMENT FOR PAYMENT**

- .1 Payment for sewage forcemain will be at the contract unit price for each size of pipe installed. Payment will include the supply and installation of sewage forcemain pipes including excavation, removal of existing sewage forcemain pipes, bedding, backfilling, dewatering, testing, support/restraint clamps, fittings, brackets, cleaning, flushing. Lawn, asphalt, roadway granular materials, curb gutter and sidewalk restoration, pipe fittings and adaptors and all incidents. Measurement to be made in metres of each size of pipe installed of actual length in place, through valves and fittings, after work has been completed.
- .2 Pipeline fittings, connections to manholes, specials and concrete for thrust blocks to be incidental to the work.
- .3 Sewage forcemain insulation will be measured in square meters of insulation per 25 mm thickness acceptably installed.
- .4 Removal of existing sewage forcemain shall be in lineal metres acceptably removed, including all excavation, backfilling, and restoration.

## **PART II -PRODUCTS**

### **2.1 PLASTIC PIPE**

- .1 To AWWA C900, CSAB 137.3-93 pressure Class 100, .69MPa, SDR26 color coded white. Joints to be bell and spigot type with integral rubber gasket. The bell will be an integral part of the pipe joint.
- .2 Fittings:  
.1 PVC Class 200 for SDR26, Class 160 NPS3 for short body fittings meeting the requirements of CSA B137.2-93. Push joint or mechanical joint ductile iron fittings meeting AWWA C153 shall be used or an approved equal.  
.2 Joints for fittings will be gasketed push-on type meeting the requirements of the latest AWWA Standard C900 for pressure pipe and fittings. Fittings will be complete with components parts.

## **2.2 PIPE BEDDING**

- .1 Granular material (0-20mm crushed stone) to the requirements of Section 320.

## **2.3 PIPE INSULATION**

- .1 Styrofoam Insulation: to have a minimum compressive strength of 100 psi. A typical tensile strength of 125 psi. A typical shear strength of 50 psi. A typical flexural strength of 85 psi. Insulation to be DOW HI-100 or approved equal.

## **2.4 BACKFILL MATERIAL**

- .1 Select excavated material in accordance with Section 210 - Excavating, Trenching, and Backfilling of Pipelines.

## **2.5 RESTRAINING DEVICES**

- .1 To ASTM A536 Grade 65-45-12 for 50mm to 600mm sizes ASTM A 36 structural steel for 550mm to 700mm sizes.
- .2 Restraining devices shall incorporate a series of machined serrations on the inside diameter to provide positive restraint, exact fit, 360 E contact and support of the pipe wall. Bolts and connecting hardware shall be of high strength, low alloy material in accordance with ANSI/AWWA C111/A21.11.
- .3 Mechanical Joint restraint for PVC to be Clow Series 1350 Grip ring by Romac or Uni-flange Blockbuster 1300 or approved equal. Joint restraint for ductile iron pipe to be wedge type MEGAHOLDER as manufactured by IPEX or approved equal.
- .4 Concrete Thrust Blocks shall conform to the dimensions outlined on the details and shall be constructed of concrete. Concrete shall be in accordance with Section 130. USE OF PRECAST CONCRETE THRUST BLOCKS WILL NOT BE PERMITTED

## **PART III -EXECUTION**

### **3.1 PREPARATION**

- .1 Clean pipe and fittings of accumulated debris and water before installation. Inspect materials for defects before installing. Remove defective materials from site.

### **3.2 TRENCHING AND BACKFILLING**

- .1 Do trenching and backfill work in accordance with Section 210 - Excavating Trenching and Backfilling of Pipelines.
- .2 Ensure trench line and depth are as specified prior to placing bedding material or pipe.
- .3 Do not backfill trenches until pipe grade and alignment have been checked by the Engineer.

### **3.3 PIPE BEDDING**

- .1 Granular material ( 0-20mm crushed stone) to the requirements of Section 210 shall be used.

- .2 Shape bed true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Do not use blocks when bedding pipe.

### 3.4 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 pipe bore.
- .3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.
- .4 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 downgrade (towards pumps)
- .6 Do not exceed maximum joint deflection recommended by pipe manufacturer.
- .7 Do not allow water to flow through pipe during construction, except as may be permitted by Engineer.
- .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 Pipe jointing:
  - .1 Install gaskets in accordance with manufacturer's recommendations.
  - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until pipe properly positioned.
  - .3 Align pipes carefully before joining.
  - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.
  - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.
  - .6 Complete each joint before laying next length of pipe.
  - .7 Minimize joint deflection after joint has been made to avoid joint damage.
  - .8 At rigid structures, install pipe joints not more than 1.2m from side of structure.
  - .9 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.
- .11 Make watertight connections to manholes. Use non-shrink grout when suitable gaskets are not available.
- .12 Upon completion of pipe laying, place specified granular material to dimensions indicated or directed and in accordance with Section 210.

### 3.5 MECHANICAL RESTRAINING SYSTEMS AND THRUST BLOCKS

- .1 Mechanical restraints must be installed for all valves, plugs, caps, and bends. Cast in place concrete thrust blocks to be installed at all bends.
- .2 Concrete for thrust blocks shall be in accordance with Section 130 Concrete. Joints and couplings are to be kept free of concrete and concrete is to extend from the appurtenance to undisturbed in-situ ground. Do not backfill over concrete within 24 hours after placing. PRECAST CONCRETE THRUST BLOCKS ARE NOT PERMITTED.
- .3 Bearing area of thrust blocks to be sufficient to prevent any pipe movement when maximum test pressure applied to forcemain.

### 3.6 FIELD TESTING

- .1 Prior to testing, the Contractor shall ensure the forcemain will be sufficiently backfilled to hold lines in place.
- .2 All necessary bracing and blocking of bends, caps, tees, etc., shall be installed before testing.
- .3 Expel all air from forcemain, by slowly filling 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 hole with a tight fitting plug.
- .4 Each line shall be tested at a static pressure of 690kPa (100 psi).
- .5 The measured leakage of water permitted in any section tested shall be the maximum amounts described by the following formula:

$$\frac{ndp^{1/2}}{130\ 000}$$

Where:

n= number of joints in section under test

d= nominal diameter in mm

p= test pressure in kPa

- .6 The minimum duration for testing shall be two hours unless otherwise specified by the Engineer.
- .7 All sections which do not meet above testing criteria shall be repaired and retested until satisfactory results are achieved.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 DESCRIPTION**

- .1 This specification shall cover work necessary to install pipe by horizontal drilling. This includes instances, where required, to avoid excavation in paved surfaces, sensitive restoration areas, where traffic congestion is prevalent or when specifically requested by authority having jurisdiction. The newly installed pipe is a new Polyethylene pipe of the same size or larger size pipe where the old pipe existed, and then is followed by the reconnecting the existing storm sewer connections and video inspection of the completed Polyethylene pipe.

### **1.2 REFERENCES**

- .1 ASTM D1248, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.
- .2 ASTM F714, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- .3 CAN/CSA B182.11, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

### **1.3 MATERIAL CERTIFICATION**

- .1 Submit manufacturer's test data and certification at least 2 weeks prior to commencing work.

### **1.4 QUALIFICATIONS**

- .1 Where horizontal directional drilling equipment is used, the equipment operator shall have been trained by an instructor qualified by the manufacturer. The Contractor shall provide adequate proof of operator training when requested by the Owner. Where such work is subcontracted, the subcontractor shall also meet these requirements.
- .2 Polyethylene pipe jointing shall be performed by personnel trained in the use of butt-fusion equipment and recommended methods for new pipe connections. Personnel directly involved with installing the new pipe shall receive training in the proper methods for handling and installing the polyethylene pipe. Training shall be performed by qualified representative.

### **1.5 SUBMISSION REQUIREMENTS**

- .1 Submit the following Contractor's drawings:
  - .1 Shop drawings, catalog data, and manufacturer's technical data showing complete information on material composition, physical properties, and dimensions of new pipe and fittings. Include manufacturer's recommendations for handling, storage and repair of pipe and fittings damaged.
- .2 Method of construction and restoration of existing storm sewer service connections. Contractor will make available to Engineer, one (1) copy of the manufacturer's installation instructions. This shall include:
  - .1 Detail drawings and written descriptions of the entire construction procedure to install pipe, bypass sewage flow and re-connection of sewer service connections.
- .3 Certification of workmen training for installing pipe.
- .4 Television inspection reports and videotapes made after new pipe installation.

## 1.6 SCHEDULING OF WORK

- .1 Schedule work to minimize interruptions to existing services and to maintain existing flow during construction.
- .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

## 1.7 DELIVERY, STORAGE AND HANDLING

- .1 Transport, handle and store pipe and fittings as recommended by manufacturer.
- .2 If new pipe and fittings become damaged before or during installation, it shall be repaired by the manufacturer or replaced as required by the Engineer at the Contractor's expense, before proceeding further.
- .3 Deliver, store and handle other materials as required to prevent damage.

## 1.8 MEASUREMENT FOR PAYMENT

- .1 All work of this Section, including excavation for launch and retrieval points and restoration, shall be considered to be included in the unit price outlined in the Tender Quantity Form.
- .2 For the purpose of evaluating and valuing changes in the Work under GC 12, measurement of the following will apply:
  - .1 The inserted sewer pipe will be measured for payment by the lineal metre acceptably installed by horizontal drilling methods for the specified pipe diameter and location specified and shall include installation of the new pipe, furnishing and placing of all materials, labour, tools, equipment, lubricants, cleaning and preparation of the existing pipe to receive the new linear, all pipe bedding, backfill material, annulus sealing material, launching pits, restoration and any other items necessary to complete the work. Locating and reconstruction of services and re-connection of all services to the new airside catch basins shall be incidental for each connection made, including all fittings and pipe.
  - .2 Video inspection of final installed pipe shall be considered incidental to the cost per lineal metre of new pipe installed.
  - .3 The cost of any necessary dewatering or by-pass pumping shall be considered incidental to the cost of the pipe installation.

## PART 2 - PRODUCTS

### 2.1 POLYETHYLENE PLASTIC PIPE

- .1 Polyethylene Plastic Pipe shall be high density polyethylene pipe and meet the applicable requirements of ASTM F714. Based on outside diameter, ASTM D1248.
  - .1 Sizes of the insertions to be used shall be such to renew the sewer to its original or greater than flow capacity.
  - .2 All pipe shall be made of virgin material. No network except that obtained from the manufacturer's own production of the same formulation shall be used.
  - .3 The pipe shall be homogenous throughout and shall be free of visible cracks, holes, foreign material, blisters or other deleterious faults.
  - .4 Dimension Ratios: The minimum wall thickness of the polyethylene pipe shall meet the following:

Depth of Cover (feet)	Minimum SDR of Pipe
0-16.0	17
> 16.1	17

- .5 Material color shall be white, black or whatever is specified with interior of pipe having a light reflective color to allow easier/better viewing for television inspection.

## 2.2 TESTS

- .1 Tests for compliance with this specification shall be made as specific herein and in accordance with the applicable ASTM specification. A certificate with this specification shall be furnished, upon request, by the manufacturer for all material furnished under this specification. Polyethylene plastic pipe and fittings may be rejected to meet any requirements of this specification.

## 2.3 EQUIPMENT

- .1 The horizontal drilling unit shall be designed and manufactured to force its way through existing ground and pipe material as it progresses. See manufacturers specifications for what size tool should be used in what diameter of pipe.

## PART 3 - EXECUTION

### 3.1 PREPARATION - BYPASSING SEWER FLOW

- .1 By-pass pumping: The Contractor, when and where required shall provide diversions for the horizontal pipe drilling process. The pumps and by-pass lines shall be of adequate capacity and size to handle all flows. All costs for by-pass pumping, required during installation of the pipe shall be incidental to the horizontal pipe drilling item.
- .2 The Contractor shall be responsible for continuity of sanitary sewer service to each facility connected to the section of sewer during the execution of the work.
- .3 If flow backup occurs and enters buildings, the Contractor shall be responsible for clean-up, repair, property damage cost and claims. Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Engineer.

### 3.2 CONSTRUCTION METHOD

- .1 Equipment used to perform the work shall be located away from buildings so as not to create noise impact. Provide a silent engine compartment with the winch to reduce machine noise as required to meet local requirements.
- .2 The Contractor shall obtain in advance of horizontal drilling, stakeouts for all buried utilities. For bores less than 30 meters in length, minimum horizontal and vertical clearances shall be maintained from other utilities. Clearance shall be measured from the nearest edge of the largest cutter or back reamer, to the nearest edge of utility. Utility exposure holes are mandatory when crossing all buried utilities, (i.e. opening of utility covers) and is not within a 1 meter radius of the bore path, utility exposure holes are optional.
- .3 Where horizontal drilling in lengths greater than 30 meters is performed, minimum clearances from other utilities shall be increased. A minimum of 450mm horizontal and 150mm vertical clearance shall be maintained. Clearance shall be measured from the nearest edge of the largest cutter or backreamer to the nearest edge of utility.
- .4 The Contractor shall provide special care to ensure no damage occurs to pipe where it is pulled into bore holes. Where soil conditions warrant sand bags, rollers or other approved

- supports shall be used and spaced at sufficient distance to prevent pipe from coming in contact with the ground.
- .5 Pipes pulled through bore holes shall be fitted with a cap to prevent foreign matter from entering the pipe. Pipe shall be pulled by means of a Kellems Grip, Clevis fitting, or approved equivalent. The leading end of the pipe being pulled shall be fitted with a swivel fitting to prevent rotational torque from being transferred to the pipe.
  - .6 The Contractor shall utilize equipment with steering capabilities complete with profile and location tracking. Equipment requiring calibration shall be done at the beginning of each work day to ensure accurate alignment and cover. The maximum horizontal and vertical deviation permitted from a defined path shall be 100mm.
  - .7 Where horizontal directional drilling equipment requires the use of grounding mats, they shall be used.
  - .8 The Contractor shall expose the bore head as close as practicable to the first 50 meters into the bore to confirm alignment and cover. Utility exposure holes can be used for this purpose. Any misalignment greater than that permitted in clause 3.3.6 shall be corrected.
  - .9 For pipelines 100mm and smaller, the final back reaming pass shall be sized a minimum 50mm greater and 50% larger in diameter than the pipe being installed. For pipelines 150mm and greater, the final back reamer pass shall be a minimum of 150mm larger than the pipeline.
  - .10 The Contractor shall install all pulleys, rollers, bumpers, alignment control devices and other equipment required to protect existing manholes, and to protect the pipe from damage during installation. Lubrication may be used as recommended by the manufacturer. Under no circumstances will the pipe be stressed beyond its elastic limit.
  - .11 The installed pipe shall be allowed the manufacturer's recommended amount of time, but not less than four hours, for cooling and relaxation due to tensile stressing prior to any reconnection of service lines, sealing of the annulus or backfilling of the insertion pit. Sufficient excess length of new pipe, but not less than four inches, shall be allowed to protrude into the manhole to provide for occurrence. Restrain of pipe ends shall be achieved by means of Central Plastics Electrofusion couplings (800)654-3872. The Electrofusion couplings shall be slipped over pipe ends against manhole wall and fused in place. Installation of Electrofusion couplings shall be done accordance with the manufacturers recommended procedures.
  - .12 Following the relaxation period, the annular space may be sealed. Sealing shall be made with material approved by the Engineer and shall extend a minimum of eight inches into the manhole wall in such a manner as to form a smooth, uniform, watertight joint. The terminating pipe ends in manholes shall be connected by Central Plastics Electrofusion couplings to eliminate ground water infiltration. Installations of Electrofusion couplings shall be done in accordance with the manufacturer's recommended procedures.

### 3.3 PIPE JOINING

- .1 The polyethylene pipe shall be assembled and joined at the site using the butt-fusion method to provide a leak proof joint. Threaded or solvent-cement joints and connections are not permitted. All equipment and procedures used shall be used in strict compliance with the manufacturer's recommendations. Fusing shall be accomplished by personnel certified as fusion technicians by a manufacturer of polyethylene pipe and/or fusing equipment.

- .2 The butt-fused joint shall be true alignment and shall have uniform roll-back beads resulting from the use of proper temperature and pressure. The joint shall be allowed adequate cooling time before removal of pressure. The fused joint shall be watertight and shall have tensile strength equal to that of the pipe. All joints shall be subject to acceptance by the Engineer prior to insertion. All defective joints shall be cut out and replaced at no cost to Owner. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent of the wall thickness, shall not be used and must be removed from the site. However, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above. In addition, any section of pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the Engineer shall be discarded and not used.
- .3 Terminal sections of pipe that are joined within the insertion pit shall be connected with Central Plastics Electrofusion Couplings or connectors with tensile strength equivalent to that of the pipe being joined.
- .4 The PVC pipe (Royal Cobra Lock, TerraBrute CR, or equivalent) shall be joined as per manufacturer's installation procedures.

### **3.4 FIELD TESTING**

- .1 After the existing sewer is completely replaced, internally inspect with television camera and videotape as required. The finished tape shall be continuous over the entire length of the sewer between two manholes to be free from visual defects.
- .2 Defects which may affect the integrity or strength of the pipe in the opinion of the Engineer shall be repaired or the pipe replaced at the Contractor's expense.

### **3.5 PREPARATION - TELEVISION INSPECTION**

- .1 Television inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by closed circuit color television. Television inspection shall include the following:
  - .1 Videotapes (post) to be submitted to Owner.
  - .2 Video tapes to remain property of Owner; Contractor to retain second copy for his use.
  - .3 All flows tributary to reach of sewer being inspected are to be completely by-passed around the reach during inspection if necessary and required by Owner.
  - .4 Post construction videotape upon completion of reconstruction of each reach of sewer with the voice description, as appropriate with stationing of services indicated. Data and stationing to be on video.
  - .5 Should any portion of the inspection tapes be of inadequate quality of coverage, as determined by Owner, the Contractor will have the portion re-inspected and videotaped at no additional expense to Owner.

### **3.6 RESTORATION**

- .1 Restore surfaces (landscape or asphalt) to original condition.

### **3.7 ENVIRONMENTAL**

- .1 The Contractor shall take any and all necessary precautions to minimize environmental damage through the set-up and use of horizontal drilling equipment.

- .2 The Contractor shall abide by all applicable environmental requirements of the authority granting permission for the bore.
- .3 Bentonite and polymers shall be the only approved lubricants permitted for horizontal directional drilling. Any additives used shall be chemically inert, biodegradable and non-toxic. No petroleum based additives shall be permitted. No detergent additives shall be permitted where polyethylene pipe is installed.
- .4 Upon request, the Contractor shall furnish to the Owner, copies of Material Safety Data Sheets for drilling lubricants.
- .5 The Contractor shall contain drilling lubricants where there is a possibility of ponding or runoff into watercourses, ditches, drains or sewers. Acceptable methods of containment include:
  - .1 Sand bags and polyethylene sheets.
  - .2 Containment rings or absorbent booms.
  - .3 Vacuum trucks.
  - .4 Site re-grading (berms).
- .6 Where leakage of drilling lubricants occur along the bore path, the Contractor shall take any and all necessary steps to minimize the impacts such as:
  - .1 Reducing the pressure of slurry flow.
  - .2 Reducing the speed of drill rotation.
  - .3 Reducing the speed of drill rod advancement.
  - .4 Moving the drill location.

The Constructor shall be responsible for any settlement and heaving damage along the bore path.
- .7 The Contractor shall be responsible for the disposal of drilling lubricants. Disposal shall be in accordance with all applicable government agency requirements. The Owner reserves the right to randomly test drilling lubricants for contamination.
- .8 Contaminated lubricants shall be disposed of at an approved hazardous waste site. Non-contaminated lubricants shall be disposed of at an approved landfill site or an alternate approved site as arranged by the Contractor.

**END OF SECTION**

## **PART I - GENERAL**

### **1.1 DESCRIPTION**

- .1 This item deals with the supply and placement of hot mixed asphalt concrete. Throughout this specification reference is made to the New Brunswick Department of Transportation (NBDOT) Standard Specifications, particularly Item 260. For consistency with the NBDOT specification, the City of Miramichi has assigned its streets the following designations:
  - .1 Type I - Arterial and Collector Streets.  
Type II - Residential and Local Streets.
- .2 The for each Type the following mix designations will apply:
  - .1 Hot mixed asphalt concrete base mix - B
  - .2 Hot mixed asphalt concrete surface mix - C
  - .3 Hot mixed asphalt concrete surface mix - D

### **1.2 RELATED WORK**

Section	100 - GENERAL
	110 - General Requirements
	120 - Topsoil, Seeding and Sodding
Section	300 - STREETS TO ROADWAYS
	310 - Roadway Excavation, Embankment & Compaction
	320 - Crushed Rock Base and Sub Base Materials
	340 - Asphalt Paving

### **1.3 MEASUREMENT FOR PAYMENT**

- .1 Asphalt paving will be measured in tonnes of asphalt concrete placed where indicated in the Form of Tender including tack coat, milling of keys, asphalt cutting and all incidentals.
- .2 Adjustments shall be measured in accordance with Section 240.
- .3 Final grading shall be considered incidental to the placement of the asphalt.
- .4 Sweeping of the existing surface and placement of tack shall be considered incidental to the work. All milled and aged surfaces shall be tackcoated at the rates specified in subsection 2.4
- .5 Asphalt patching will be measured in square meters placed including tack coat, granular base and all other preparatory work.
- .6 Asphalt cold milling shall be measured for payment by the number of square metres of asphalt concrete acceptably removed, hauled and stockpiled. In accordance with this specification.
- .7 Asphalt restoration of driveways due to grade adjustment during street reconstruction shall be measured in square meters placed including asphalt cutting, asphalt removal, placement of granular materials and all preparatory work. This shall consist of a 65 mm lift of type C.
- .8 Asphalt patching or spreading in driveways, or roadways or in other areas for restoration of a pipe installation or installation of curb or sidewalk will not be measured but considered incidental to the work.

.9 Minimum compacted asphalt thickness shall consist of the following:

			<u>Type B</u>	<u>Type D</u>	<u>Type C</u>
Type I	Arterial Collector	/	100 mm	38 mm	----
Type II	Residential Collector	/	50 mm	38 mm	----
Type II	Local Streets		50 mm	38 mm	
	Driveways / Parking Lots		-----	-----	65 mm

Or as otherwise stated on the contract drawings.

.10 Existing thickness shall be matched if they are greater than depths outlined in section 1.5.8.

.11 All transverse asphalt keys to be a minimum of 1.2 meters in width to match into existing surfaces and shall accommodate a smooth transition into existing surfaces. A temporary asphalt ramp shall be installed if the joint will be left exposed overnight. Said provisions shall be maintained by the contractor until such time as paving is completed. And will not be measured for payment and will be considered incidental to the work.

#### 1.4 ASPHALT DENSITY PAYMENT REDUCTION

.1 Compaction testing shall be based on a lot average method, with 4 cores taken per lot.

.2 Cores not to be taken within 1.0 m of any structure such as curb & gutter, manholes, and valve boxes, and cores to be a minimum of 30 m apart.

.3 Cores will be located by the Engineer or his representative, and the contractor's representative.

.4 Sidewalks, Patches, Driveways, cross-cut reinstatements and tie-ins shall be exempt from core testing.

.5 The percent compaction of the lot shall be determined by comparing the average of the core densities with the average of the Theoretical Maximum Relative Density of the loose samples.

.6 A single compaction result less than 89 % may be cause for rejection of the lot.

.7 Lots shall be determined at the pre-construction meeting. Lots will be separated by phases, types, and streets, and shall be a minimum of 500 tonnes unless otherwise noted in the contract documents.

- .8 The unit price for asphalt shall be reduced by the following table for each applicable item:

% of Theoretical Maximum Relative Density	Unit Price Adjustment
Lot Average	\$ per tonne
> 92.5	0.0
92.4	-0.1
92.3	-0.2
92.2	-0.3
92.1	-0.4
92.0	-0.5
91.9	-0.6
91.8	-0.7
91.7	-0.8
91.6	-0.9
91.5	-1.0
91.4	-1.2
91.3	-1.4
91.2	-1.6
91.1	-1.8
91.0	-2.0
90.9	-2.4
90.8	-2.8
90.7	-3.2

% of Theoretical Maximum Relative Density	Unit Price Adjustment
Lot Average	\$ per tonne
90.6	-3.6
90.5	-4
90.4	-4.4
90.3	-4.8
90.2	-5.2
90.1	-5.6
90.0	-6
89.9	-7
89.8	-8
89.7	-9
89.6	-10
89.5	-11
89.4	-12
89.3	-13
89.2	-14
89.1	-15
89.0	-16
< 89.0	reject

## PART II - PRODUCTS

### 2.1 MATERIALS

- .1 All materials shall be supplied by the Contractor and must meet or exceed the requirements of the latest revision of the New Brunswick Department of Transportation (NBDOT), Standard Specification Item 260, except as otherwise specified herein:
- .1 Asphalt Cement: Performance grade (PG) asphalt binder 58-28. Submittals as per Section 3.5.3.
  - .2 Asphalt Concrete: To NBDOT requirements (Item 260, Standard Specifications latest revision) except as otherwise specified herein; with the following gradations and physical requirements.
  - .3 Physical Requirements for Aggregates: See below:

**Type I Mixes  
 Physical Requirements for Coarse Aggregates  
 (Retained 4.75 mm sieve)**

Test	Standard	Requirement	
		Surface Mixes	Base Mixes
Petrographic Number (Maximum)	MTO LS609	180	230
Crushed Particles (Min. % by wt., one face)	MTO LS607	95	95
(Min. % by wt., two face)	MTO LS617	80	80
Flat and Elongated Particles (Max. % @ 4:1)	MTO LS608	15	20
Micro-Deval (Max. % loss)	MTO LS618	15	18
Freeze/Thaw (Max. % loss)	MTO LS614	12	14
Absorption (Max. % by wt., retained)	ASTM C127	1.75	2.00

**Type II Mixes  
 Physical Requirements for Coarse Aggregates  
 (Retained 4.75 mm sieve)**

Test	Standard	Requirement	
		Surface Mixes	Base Mixes
Petrographic Number (Maximum)	MTO LS609	200	250
Crushed Particles (Min. % by wt., one face)	MTO LS607	65	55
Flat and Elongated Particles (Max. % @ 4:1)	MTO LS608	20	25
Micro-Deval (Max. % loss)	MTO LS618	16	20
Freeze/Thaw (Max. % loss)	MTO LS614	14	16
Absorption (Max. % by wt., retained)	ASTM C127	1.75	2.00

**Physical Requirements for Fine Aggregates  
 (Passing 4.75 mm sieve)**

Type I Mixes

Test Property	Test Method	Surface Mixes	Base Mixes
Micro-Deval (Max % loss)	MTO LS619	17	20

Type II Mixes

Test Property	Test Method	Surface Mixes	Base Mixes
Micro-Deval (Max % loss)	MTO LS619	18	22

Note: The allowable Micro-Deval surface Fine Aggregate shall be Max % Loss =19, if the Micro-Deval on Coarse Aggregate is  $\leq 12.0$  provided that the Coarse Aggregate is from the same source

.4 Grading Requirements for Aggregates

Combined Aggregate % passing each sieve (washed)\*

ASTM Sieve Size	Mix Designation			
	B	C	D	E
25.0 mm	100	-	-	-
19.0 mm	84-94	-	-	-
16.0 mm	72-90	100	-	-
12.5 mm	60-83	88-98	100	-
9.5 mm	51-75	68-90	76-98	100
6.3 mm	41-66	54-77	60-84	-
4.75 mm	34-60	46-69	52-77	91-100
2.36 mm	22-50	28-58	36-65	66-84
1.18 mm	12-42	20-50	25-55	48-70
600 Fm	6-32	13-40	16-44	31-56
300 Fm	3-20	7-27	8-26	19-43
150 Fm	2-8	3-10	4-12	10-25
75 Fm	2-6	2-7	2-7	4-10
	Base	Base or Surface	Surface	Sand Seal

\* includes hydrated lime if required.

## 2.2 MIX DESIGN

- .1 The Contractor shall engage a Professional Engineering service and a qualified testing Laboratory to assess the aggregate materials proposed for use and to carry out the design of the asphalt mix. The Contractor shall provide mix designs for each mix using the Marshall Method and procedures in the Asphalt Institute Manual Series No. 2 MS2 sixth edition. The design shall be carried out at 0.5% increments of asphalt content with a minimum of two points above and two points below the final design value. Superpave mix designs may be considered at the discretion of the Engineer. A mix design developed by NBDOT may be considered provided it has been designed in the same calendar year of paving activities.
- .2 At least two weeks prior to the date paving operations are to commence, the Contractor shall present information in writing outlining the proposed mix and job mix formula based on the use of aggregate stockpiles which are representative of those to be used for the work. This information shall include evidence that the proposed mix meets the requirements specified herein.
- .3 The laboratory tests shall be done using aggregate and asphalt cement representative of those proposed for use in the project. At the same time as the mix design information is provided, stockpiles of aggregates proposed for use in asphalt concrete for the project shall be available for sampling to permit checking of the mix design. Checking of the mix design shall be at no expense to the Contractor except that sample of materials shall be provided free of charge.
- .4 The Engineer or his authorized representative shall have access at any time to all parts of the paving plant for the verification of weights or proportions and character of materials and the determination of temperature used in the preparation of the mixture.
- .5 The design shall be verified in the field prior to paving.

## 2.3 PHYSICAL REQUIREMENTS FOR ASPHALT CONCRETE MIX DESIGN

- .1 75 blow Marshall Method. For calculations use aggregate bulk specific gravity and allow for asphalt cement absorbed by aggregate.

### Type I Mixes

Property	Mix Designation		
	B	C	D
Marshall Stability, N @ 60°C	8000	8000	8000
Flow, mm	2-4	2-4	2-4
Air Voids Design, %	4	4	4
Air Voids %, Range	3-5	3-5	3-5
VMA, %, Minimum	13.5	14	15
Voids Filled with Asphalt, %	68-78	68-78	70-80
TSR/TRS (Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures), minimum	75	75	75
Minimum Film Thickness, microns	9	9	9

**Type II Mixes**

Property	Mix Designation		
	B	C	D
Marshall Stability, N @ 60°C	6000	6000	6000
Flow, mm	2-4	2-4	2-4
Air Voids Design, %	3	3	3
Air Voids %, Range	2-4	2-4	2-4
VMA, %, Minimum	13.5	14	15
Voids Filled with Asphalt, %	75-85	75-85	75-85
TSR/TRS (Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures), minimum	75	75	75
Minimum Film Thickness, microns	9	9	9

**2.4 TACK COAT**

- .1 Tack coating shall meet the requirements of NBDOT Standard Specification Item 259, RS-1 Grade asphalt emulsion to ASTM D 977-05 and D2397-05 respectively.
- .2 Application shall be as per NBDOT standard specification 259.

**PART III - EXECUTION**

**3.1 GENERAL**

- .1 All equipment and construction methods shall conform with the requirements of the latest revision of the New Brunswick Department of Transportation (NBDOT), Standard Specification Item 259 (Bituminous Tack Coat) and Item 260 (Asphalt Concrete), except as otherwise specified herein.
- .2 The contractor must have adequate asphalt plant production and trucking capacity in place to ensure that the asphalt placement proceeds continuously without work stoppages.
- .3 An asphalt spreader shall be used for the placement of asphalt sidewalk.

**3.2 BASE COURSE**

- .1 Where the designated compacted thickness is greater than 50 mm, base course asphalt concrete is to be laid in two (2) lifts. The granular base course shall be prepared in accordance with Section 320.

**3.3 COMPACTING / FINISH ROLLING**

- .1 Roll asphalt continuously to a density not less than 92.5% of the theoretical maximum relative density.
- .2 Provide at least two rollers and as many additional rollers as necessary to achieve specified pavement density. one roller shall be of pneumatic tired type.

- .3 Start rolling operations as soon as placed mix can bear weight of roller without undue displacement of material or cracking of surface.
- .4 Operate roller slowly initially to avoid displacement of material. For subsequent rolling do not exceed 5 km/h for static steel-wheeled rollers and 8 km/h for pneumatic-tired rollers.
- .5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 20 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing should not exceed compacted lift thickness.
- .6 Overlap successive passes of roller by at least one half width of roller and vary pass lengths.
- .7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
- .8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.
- .9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
- .10 After transverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.
- .11 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.
- .12 Accomplish finish rolling with two-axle or three-axle tandem steel wheel rollers while material is still warm enough for removal of roller marks. If necessary to obtain desired surface finish, Engineer may specify use of pneumatic-tired rollers.
- .13 Conduct rolling operations in close sequence.

### 3.4 COLD MILLING

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall take care in full depth removal not to contaminate the reclaimed asphalt concrete Pavement (RAP) with the underlying aggregate material.
- .3 The Contractor shall provide, in partial depth removal, equipment with automatic controls for the control of longitudinal grade and transverse slope.
  - .1 All loose material remaining after cold milling shall be swept to a granular shoulder or picked up from paved shoulders or gutters before reopening to traffic.
  - .2 When partial depth removal is performed on a roadbed with paved shoulders, and some or all of the paved shoulder area is to remain, the Contractor shall provide for drainage.
- .4 The Contractor shall remove all asphalt concrete from the faces of gutters, catch basins or manhole frames and other structures abutting the Work, in such a manner that the Structures are not damaged, and the area after removal matches the grade of the adjacent removal area.

- .5 The reclaimed asphalt concrete Pavement (RAP) shall remain the property of the Owner and shall be loaded and hauled to a stockpile site as indicated in the Contract Documents or as directed by the Engineer.
  - .1 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.
- .6 Proper stockpiling procedures shall be used and care taken not to contaminate or consolidate the reclaimed asphalt concrete stockpile.
  - .1 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.
- .7 The height of RAP stockpiles shall be a maximum of 3m to limit the consolidation of the stockpiled material and no loaders, crawler tractors, trucks or other Equipment shall be permitted to travel on the stockpile.
- .8 If the Contract Documents specify that the reclaimed asphalt concrete is to be used in a hot recycled asphalt mix, the RAP shall be weighed prior to placement in the stockpile.
- .9 The Contractor shall continuously maintain the Work Site, in a condition to provide for the safe and efficient flow of traffic, free of potholes, from the time of removal until such time as the new asphalt concrete is placed.

### **3.5 QUALITY CONTROL TESTING**

- .1 Sampling and testing program to be followed is illustrated in Section 110 General Requirements under Item 7 Quality Control.
- .2 NBDOT Standard Specification Item 260.4 .4 (Quality Control Testing) and Item 260.4 .5 (Quality Assurance Testing and Adjustments) shall not be included in these requirements. The Engineer reserves the right to carry out quality assurance testing on any or all aspects of the work.
- .3 The Contractor shall provide a copy of the asphalt cement delivery slip and refinery certification prior to commencing paving, and shall submit such certificates on an ongoing basis as asphalt cement is delivered. Under no such circumstances shall the contractor deviate from a supplier other than the one that has been included in the mix design without prior notification to and approval from the Engineer.
- .4 The number of testing days for asphalt that will be borne by the City of Miramichi shall be based on a average tonnage of 500 tonnes per day. Any tonnage for an item less than 500 tonnes shall be considered as 1 testing day. Should asphalt production not meet the minimum tonnages specified herein, the City shall deduct the cost of the additional testing required from the payment.

### **3.6 DEFECTIVE WORK**

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form a true and even surface and compact immediately to specified density.
- .2 Repair areas showing checking or rippling.

- .3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.
- .4 If, at any time before the work is finally accepted, any raveling, shoving or other fault develops in the pavement as laid, all materials in such place shall be removed, the edges of the joints cut square and painted with tack coat and fresh mixture placed and compacted. All such removal and replacement of unsatisfactory material shall be done at the expense of the Contractor.
- .5 Any obvious defects, as determined by the Engineer, will be cause for rejection of the pavement course. Correction of the defects shall not be measured and shall be considered incidental to the work. Upon request by the Engineer, a detailed repair procedure shall be submitted and approved prior to completing any repair.
- .6 Such defects shall include but not limited to the following;
  - .1 Segregated areas
  - .2 Areas of excess or insufficient asphalt binder
  - .3 Excessive roller marks
  - .4 Cracking or tearing
  - .5 Improper matching of longitudinal and transverse joints
  - .6 Improperly constructed patches
  - .7 Contaminant spills on the mat
  - .8 Flushed areas
  - .9 Improper grades causing rough transitions into existing asphalt surfaces
  - .10 Inadequate drainage into existing storm appurtenances
  - .11 Inadequate crown
  - .12 Improper adjustment of structures
- .7 The finished surface of any pavement course shall have a uniform texture and be free of visible signs of poor workmanship and excessive bumps and dips.

### **3.7 FINAL CLEAN UP**

- .1 Immediately after the completion of the work, or any consecutive portion of it, the Contractor shall remove from the street all unused material, refuse and dirt placed by him on or in the vicinity of the work and leave the street in a neat and clean condition.

**END OF SECTION**

## **PART I - GENERAL**

### **1.1 DESCRIPTION**

- .1 This section outlines requirements for construction and putting into operation wastewater lift stations and other related work as shown on drawings or as directed by Engineer. Lift stations comprising precast concrete wet-well, pumps, control system, SCADA interface requirements, overflow pipe supply and installation, etc. to be constructed in locations shown to convey wastewater flows via proposed in ground forcemains to discharge into sanitary sewer.
- .2 Lift station to include duplicate submersible solids handling non clog pumps, motors, liquid level regulators, optional servicing and ancillary pumping station equipment, precast concrete wet well, valves and pipework to connect to existing pipes outside well, control cabinet with all conduit, wiring and connections to pumps and all mechanical, SCADA interface equipment electrical and site work to attain a fully functional pumping installations to meet the specified operating conditions.
- .3 Work to be carried out in accordance with reviewed shop drawings and specifications for all site, mechanical and electrical work and to meet requirements of all regulatory and control agencies having jurisdiction over work associated with project.
- .4 The control systems shall be enclosed in a pre-fabricated shelter, as per standard drawing 41B

### **1.2 RELATED WORK**

Section 100: GENERAL  
130 Concrete

Section 200: UNDERGROUND INFRASTRUCTURE  
210 Excavation, Trenching, Bedding & Backfilling of Pipelines

Section 400: WASTE WATER PUMPING STATIONS  
410 Mechanical and Electrical General Provisions for Wastewater Pumping Station

### **1.3 SHOP DRAWINGS**

- .1 Submit six (6) original shop drawings, specifications and installation instructions in accordance with Section 110 including pump performance curves, horsepower requirements, operating conditions, etc. for pumping wastewater flows; precast concrete wet-well; miscellaneous metal; electrical equipment and other details specified.

### **1.4 MAINTENANCE DATA**

- .1 Provide three copies of operating and maintenance data for pumping, control and all ancillary equipment included for each pumping station.

### **1.5 MEASUREMENT FOR PAYMENT**

- .1 Lump sum basis for each station for all materials, labour, equipment, power supply, (from N.B. Power's termination) telephone overflow piping, connection to existing gravity and forcemain systems, provision of piping and services complete to construct and to put lift station into operation, commissioning and co-ordinating with the Owner's representative and all site works, restoration, etc. as specified.

## PART II - PRODUCTS

### 2.1 GENERAL

- .1 All equipment to be designed, constructed, installed and tested for very highest class of service and shall include every part or adjunct customary or necessary for highest degree of strength, durability, and reliability for continuous effective operation and for most convenient maintenance.
- .2 Components and assembly of lift station to conform with typical performance specifications incorporated herein and those published by suppliers of equipment.
- .3 Standard of Acceptance: Hydromatic Pumps Inc., ITT Flygt Corporation, F.E. Meyers or ABS.
- .4 Major components include for each station:
  - .1 Two (2) non clog pumps and motors.
  - .2 Two (2) plug valves.
  - .3 Two (2) check valves.
  - .4 Four (4) level regulators and hanger.
  - .5 Sufficient guide bars for the removal of each pump.
  - .6 Two (2) lifting chains and hooks.
  - .7 One (1) aluminum access cover complete with two (2) lockable access hatches, as manufactured by MSU Mississauga Ltd. ITT Flygt or approved equal. The access cover must have the provision for the installation of a lifting davit.
  - .8 One (1) removable lifting davit capable of hoisting each pump.
  - .9 Electrical and level regulator cable in sufficient length to allow for the mounting of the control panel directly above from the wet well.
  - .10 One (1) control panel suitable for alternating pump operation complete with main disconnect switch, manual/automatic switch for both pumps.
- .5 For each station other equipment to include:
  - .1 High water alarm circuit and flashing light (must be blue when lift station located on or near shoreline).
  - .2 Pump run lights.
  - .3 Elapsed time metres.
  - .4 Ampmeter.
  - .5 Thermistors in pump motors.
  - .6 Thermal overload.
  - .7 Overload reset buttons.
  - .8 Duplex outdoor receptacle with ground fault interrupter switch.
- .6 SCADA Ready Requirements Control
  - .1 Control at the Sewage Pumping Station shall be achieved through the use of PLC based pump controller capable of achieving the following real time tasks:
    - Control pump station operation.
    - Alarm detection and annunciation.
    - Pump alteration.
    - Change of state of alarming on all digital inputs.
    - Pump lockouts.
    - Safety interlocking.
    - Non concurrent starting of equipment.
    - Adjustable time delays for pump start, stop and fail.
    - Automatic transfer to standby (lag) in the event of lead pump failure.
    - Time delay to allow sequenced pump start.
    - Interfacing of pump monitoring sensor to the PLC.
    - Interfacing of Hand-Off-Auto selector switches and duty designation selector switches to the PLC.

- Interfacing of level controls to the PLC.
- Remote telemetry via leased line modem.
- .2 The PLC shall have the capability of interfacing with an ultrasonic level controller for full system operation.
- .3 System Operation and Control
  - .1 The sewage pumping station consists of two submersible constant speed pumps. The pumps are sized so that any one pump can facilitate peak flow.
  - .2 The two pumps shall be automatically alternated on a cycle by cycle basis so as to equalize pump usage. The controller shall assign lead and lag duty to each pump on an alternating basis.
  - .3 Duty assignment and alternation can be operator selectable via a door mounted selector switch.
  - .4 In the event of a failure of the lead pump or excessive inflows into the station, the system will be set-up such that the standby (lag) pump will be brought on line to assist in the operation.
  - .5 Under normal operation the lead and lag duty pumps shall stop and start in response to the output from the ultrasonic level controller.
  - .6 In the event of a failure of the PLC or ultrasonic level controller, automatic operation shall be initiated by float switches in the following manner.
    - LL - Stop all pumps and alarm.
    - LSL - Stop all pumps.
    - LSH - Start lead pump as selected by the alternator. The pump will remain in operation until the level reaches the stop float.
    - LSHH - Start lag pump and alarm. The pump will remain in operation until the level reaches the stop float.
    - Overflow alarm for overflow.
  - .7 Interlocks required for this station are as follows:
    - Low level float - Lockout pumps - Auto reset.
    - Heat sensor fault - Lockout pump - Manual reset.
    - Pump overload - Lockout pump - Manual reset.
  - .8 Guarantees
    - .1 Equipment, parts, and labour: minimum 2 years guarantee of lift station and all components replaced and repaired at no cost to the Owner.
    - .2 Guarantees effective upon date of acceptance by Engineer that completed unit is operating as required by project.
- .4 Duplex Pump Controller
  - .1 The duplex pump controller is to be housed in a prefabricated fibreglass enclosure as per standard drawing 41B. The inside panel is to include fully hinged aluminum inner door capable of opening ninety (90) degrees for full access to all backplate mounted devices. The panel is to come complete with a padlock hasp and quarter turn latches. The Engineer for the project reserves the right to change this requirement to either stainless steel or fibreglass depending on the local site conditions.
  - .2 The control panel is to house all necessary equipment to operate the pumps, including power supply level controls, and power and control feeds to and from each pump. The panel will be fed with a 120/240 power supply.
  - .3 The panel is to be supplied by the pump manufacturer, who shall be responsible for co-ordination of all devices and provide a single warranty ensuring the system is complete.

- .4 That all components are CSA approved and that the panel carries a CSA approval. All electrical equipment, wiring, grounding, and testing for this project must meet the Electrical Safety Code including all appendices and bulletins issued by the Inspectors Department applicable to this project.
- .5 The panel is assembled in Canada from components made or stocked in Canada.
- .6 The panel is manufactured to control the pumps.
- .7 Ensure the following:
  - .1 The panel is to come complete with a fully hinged aluminum inner door, padlock hasp and quarter turn latches.
  - .2 Provide a combination four jaw, 100 amp. meter socket with a 100A service entrance rated circuit breaker complete with solid neutral. Cutler-Hammer or Microelectric or approved equal.
  - .3 Provide an isolation barrier between the service entrance equipment and the control section.
  - .4 Provide a single phase lightning arrestor on the service entrance section of the panel. GE Tranquil or approved equal.
  - .5 Provide a 60 amp. inner door interlocked disconnect switch to act as an isolating switch for the panel. The disconnect switch must include provisions for padlocking in the OFF position. Allen Bradley 194 series or approved equal.
  - .6 Two motor circuit breakers, 240V, 2 pole, with a current interrupting rating, RMS symmetrical rating of 10,000 amps and sized for the full motor amps. Cutler-Hammer QC series or approved equal.
  - .7 Two control breakers, 120V, 1 pole, with a current interrupting rating, RMS symmetrical rating of 10,000 amps. Cutler-Hammer QC series or approved equal. Provide one for the control and one for the panel mount receptacle.
  - .8 Provide full voltage non reversing starters with 120V coils and overload protection in each phase. The starter is to come complete with 2 N.O and 2 N.X auxiliary contacts. The overloads are to come complete with 1 N.O and 1 N.C auxiliary contacts. Allen Bradley 100 series or approved equal.
  - .9 The control relays will be minimum of three-pole socket style with visual flag, test button, and 120V coil. Allen Bradley 700HA series complete with sockets.
  - .10 The panel will come complete with the necessary start and run capacitors and relays as recommended by the pump manufacturer.
  - .11 The PLC required for this project shall require the following components:
    - Processor with a maximum user memory of 8K words
    - A 1ms program scan time/Kword
    - Floating point math capabilities
    - Two communication ports
    - Modbus Plus protocol
    - 32 digital inputs
    - 16 relay outputs
    - Four analog inputs to handle 4-20mA signals
    - Optical isolation for telephone interfacing
    - 900 baud leased line telephone modem
    - Telephone line surge suppressionThe programming shall be compatible to RSLogix 500

- Professional  
Acceptable PLCs: Modicon 110 CPU or approved and compatible equal to existing City SCADA infrastructure.  
The panel is to ensure a minimum of ten percent spare I/O for future expansion.
- .12 Provide time delay relays with 120V coils for sequential starting on float control. Timers will be an on delay style with a time range of 0-60 seconds.
  - .13 Provide a panel heater/blower with a minimum of 200 watt heating element and an adjustable thermostat. Hoffman DAH series.
  - .14 Provide terminal blocks (tubular screw or screw type) for all field devices and pumps. Ensure a minimum of ten-percent spare terminals are provided in the panel.
- .8 Provide the following on the inner door. The operators are to be Allen Bradley 800E series.
- .1 Hand-Off-Automatic selector switch for each pump.
  - .2 Ultrasonic-Float selector switch.
  - .3 Pump 1 - Automatic Alternation - Pump 2 selector switch.
  - .4 Pump Run pilot light for each pump.
  - .5 Pump Heat Sensor Fault pilot light for each pump.
  - .6 Pump Seal Leak Fault pilot light for each pump.
  - .7 Pump Overload Tripped pilot light for each pump.
  - .8 High Level pilot light.
  - .9 Low Level pilot light.
  - .10 Alarm Acknowledge pushbutton.
  - .11 Alarm Reset pushbutton.
  - .12 Alarm/Lamp Test pushbutton.
  - .13 Seven digit non-resettable elapsed time meter for each pump.
  - .14 Seven-digit-non-resettable elapsed time meter for override conditions (two pumps running).
  - .15 Ultrasonic level controller.
  - .16 Lamicoid nameplate for all door mounted items.
  - .17 Duplex ground fault receptacle rated at not less than 10 amps at 120V.
  - .18 When standby power is required (i.e. an overflow for the wet well is not provided), a three position (Hydro-Off-Standby Power) manual transfer switch shall be installed. Confirm with the Engineer if an interlock contract is required to prevent the lag pump from operating.
- .9 Mount the following on the top of the enclosure.
- .1 One blue lexan globe complete with flasher. The bulb is to be a minimum of 40W at 120V. Ensure that the mounting is watertight so as to prevent any moisture from entering the enclosure.
- .10 When an overflow for the wet well is not provided the following shall be mounted on the side of the enclosure.
- .1 One standby power receptacle complete with lockable, spring style cap. Ensure that the unit is compatible with the existing generator plug.
- .11 The ultrasonic level controller for this project is to have a minimum of five programmable relay outputs and one analog output. The unit is to come complete with a detachable programmer and transducer with sufficient cord length to reach the panel with the need to splice. Miltronics Multi-Ranger Plus complete with programmer and ST25C transducer.

- .12 The following wiring practices are to be followed:
- .1 Control wire not less than 16 AWG stranded type TEW or equal.
  - .2 Power Wire not less than 10 AWG stranded type TEW or equal.
  - .3 Numbered at each end of the wire with slip on market to correspond to the schematic.
  - .4 Adequately supported and neatly run wiring bundles.
  - .5 Incorporate the use of wiring duct on the backboard to provide ease of maintenance in the field.
  - .6 "Hingecable" wiring between backplate and door mounted components to cause minimum flexible, properly laced and secured.
- .13 The PLC programming is the responsibility of the pump supplier. The supplier shall provide two days start-up at site and four (4) operations manuals for this system. The manuals are to contain the following, as a minimum:  
As built set of panel schematic including layouts and terminal block connections.
- Hard copy of the PLC program.
  - Disk containing the PLC program.
  - Bill of material.
  - Information sheets on all materials used in the panel.

### 2.3 WET WELL

- .1 Precast reinforced concrete to details shown on pumping station drawing substructure minimum 200mm thick minimum compacted 0-40 crushed stone sub-base and control support structure.
- .2 Joints of pre-cast units and pipe connections through walls and all pipe, fittings and joint connections must be watertight.
- .3 50m Styrofoam insulation around top 1.5m depth of wet well structure.
- .4 Standard of acceptance: L.E. Shaw Ltd. packaged pumping station or approved equal.

### 2.4 PUMP AND MOTOR

- .1 Designed for pumping raw, unscreened wastewater.
- .2 Characteristics of pump to perform efficiently under operating conditions specified.
- .3 Pump and motor designed to be totally submersible and to retain adequate liquid in pump casing to ensure unattended automatic operating at rated speed in open system.
- .4 Design loads or any head in operating range specified shall not cause overloading of motor.
- .5 Pump openings and passages large enough to pass 75mm dia. solids.

### 2.5 VALVES AND PIPING

- .1 Check Valves: non-clog ball-type valve designed for full flows; class 125 flanges.
- .2 Gate Valves: AWWA C-500, "inside screw" type, class 125 flanged, counter clockwise opening handwheel.

- .3 Piping: schedule 40 steel pipe class 125 flanged. Automatic cast iron pump discharge flanged connection bolted to bottom of sump.

## **2.6 FINISH**

- .1 Pumps, piping and exposed steel framework to be cleaned with industrial grade cleaner.
- .2 Prime coat: zinc-based synthetic primer.
- .3 Finish coat: automotive grade acrylic enamel.
- .4 Colours: safety colour-coded as per regulations.

## **2.7 ELECTRICAL**

- .1 All equipment and procedures shall be CSA approved and meet with the requirements of the Canada Electrical Code.
- .2 Panels: fabricated heavy gauge steel panels, suitable for external mounting of hinged lockable doors complete with neoprene gaskets and captive closing hardware; primary disconnect switch handle to be in "OFF" position to open inner door; lock for outer door panel.
- .3 Securely mounted operating controls and instruments with function clearly labelled.
- .4 EEMAC 4X rated magnetic motor starter for pump motor; include under-voltage release and overload protection.
- .5 Manually reset overload relays ambient compensating bimetallic to be block-type, with visual trip indication.
- .6 Control circuit protected by thermal-magnetic circuit breaker connected to allow power to be disconnected from all control circuits.
- .7 Starter H-O-A selector switches for manual start and stop of pumps and to select automatic alternating operation of pumps when governed by level control system; low water shut-off heat sensors (pump casing) for pumps.
- .8 Complete control assembly mounted in EEMAC-4X electrical enclosure.
- .9 A true on-line uninterrupted power supply (UPS) shall be supplied in the control for the lift station. Also included is a receptacle in the panel for the UPS and Relay to PLC

## **2.8 LEVEL CONTROL SYSTEM**

- .1 Function: to start and stop pump motors in response to changes in level of wastewater in wet well as shown on drawings; continuously monitor level in wet well; stop pumps when temperature high enough to damage pumps; initiate alarm for high wet well level conditions fully automatic control in conjunction with level regulators.
- .2 System shall be controlled by an ultrasonic level controller. The float system for a backup shall be liquid level float regulators connected to motor controls; each regulator shall have shockproof mercury switch enclosed in watertight, PVC plastic-jacketed casing suspended from galvanized support bracket in wet well using three-conductor jacketed cable.
- .3 Supply each regulator with sufficient length of cable for level adjustment on site.

- .4 High level alarm floats to energize exterior mounted blue light and forward signal to central SCADA system.
- .5 Lift station floats shall be secured using sufficient hoops embedded to the wall so as to not to cause the floats or cables to become entangled.

## **2.9 SERVICING EQUIPMENT**

- .1 Galvanized lifting davit suitable for external mounting with spar rated for raising and lowering pump and motor. Deliver to Owner for storage in maintenance shed.
- .2 Manual chain hoist for lifting pumps and motors to be delivered to Owner for storage.

## **PART III - EXECUTION**

### **3.1 GENERAL**

- .1 The Contractor shall construct lift station and install all equipment and related appurtenances in accordance with manufacturer's instructions and to the satisfaction of Engineer.
- .2 Supply Engineer with manufacturer's test certificate stating results of operation tests on pumps, motors and controls to confirm equipment operation at design working conditions specified.

### **3.2 WET WELL**

- .1 Install precast concrete units with walls plumb and floor level on compacted granular base.
- .2 Ensure all joints between adjoining sections and pipe inserts are watertight.
- .3 Backfill carefully to avoid damaging Styrofoam insulation.

### **3.3 WIRING**

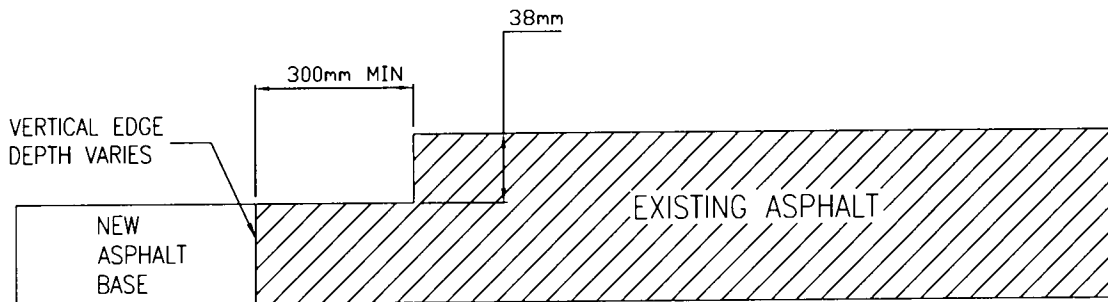
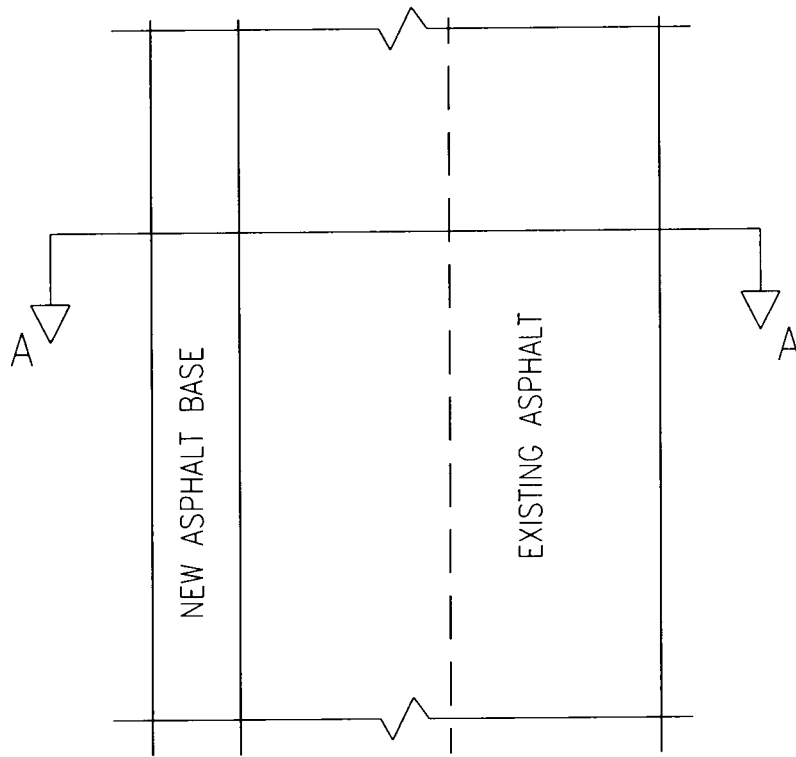
- .1 Pumping Station Components and assemblies shall be wired in accordance with N.E.C., N.E.M.A. J.I.C., and N.M.T.B.A.; colour coded and numbered. All wiring shall be in conduit; all components electrically grounded to common lug on control panel sub-plate; no splicing permitted.
- .2 Wiring at back of control panel shall be in wire troughs with removable covers.
- .3 The Contractor shall provide power supply and control wiring from N.B.E.P.C.'s current termination to bring power to equipment as intended by pump supplier and specifications.
- .4 Contractor to include costs of all material, equipment and labour for work not provided by N.B.E.P.C.
- .5 The Contractor shall be responsible for carrying out all underground and connecting work in accordance with N.B.E.P.C. requirements.
- .6 The Contractor shall be responsible for grounding wire to external ground in accordance with NBEPC codes before connecting power feeder line.
- .7 Notify NB Power and NB Tel at time of required connections.

### 3.4 OPERATION

- .1 Provide services of factory-trained representative for minimum period of one day to provide initial start-up of each lift station and to instruct Owner's representative how to operate and maintain equipment.
- .2 Ensure that all valves and equipment operate satisfactorily before and after installation; operational test in accordance with Hydraulic Institute Standards.
- .3 Ensure that all equipment operates properly to satisfaction of Engineer and is equipped with all necessary fittings and controls and is properly lubricated.
- .4 Supply all parts lists, as-built drawings and operating and maintenance manuals to Engineer.
- .5 Arrange with pump equipment supplier for execution of certificate stating that equipment has been inspected and tested to satisfaction of qualified personnel on behalf of supplier.

**END OF SECTION**

DRAFT



SECTION A: NTS



TITLE:

CONSTRUCTION DETAIL:  
LONGITUDINAL ASPHALT  
JOINT

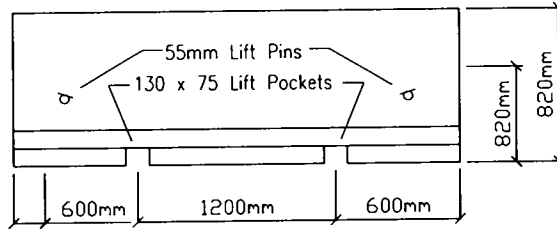
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REV.#

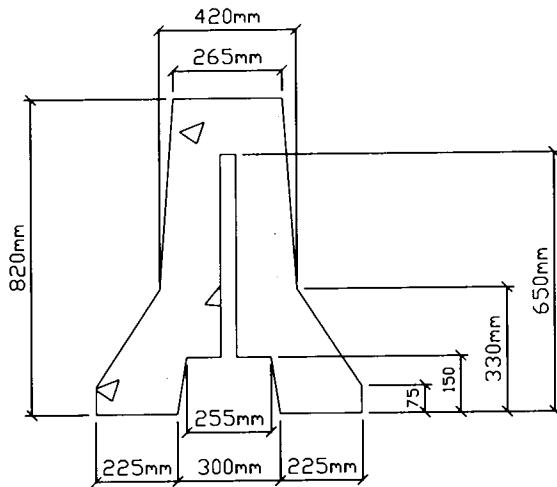
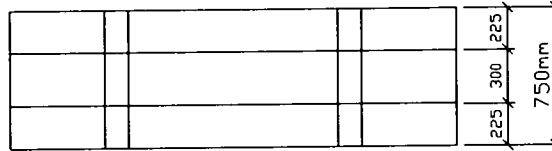
DETAIL  
NO.

51

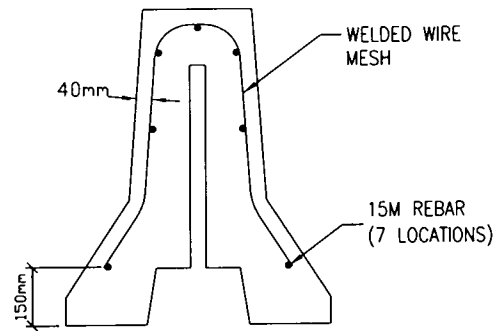
SIDE VIEW



BOTTOM VIEW



DIMENSIONS



40mm COVER ON WELDED WIRE MESH

REINFORCEMENT

END VIEW



TITLE:

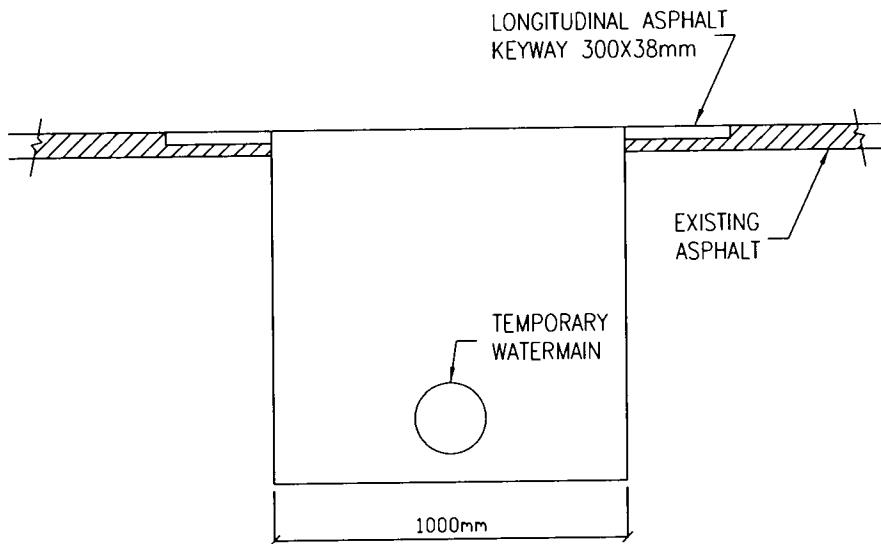
SAFETY BARRIER

DATE: FEB 16, 2011

REV.#

DETAIL  
NO.

52



NOTE:

1. TO BE BURIED A MINIMUM OF 600mm.
2. BACKFILL MATERIAL SHALL BE 0-31.5mm
3. ASPHALT THICKNESS FOR THE RESTORATION OF TRENCH SHALL BE MATCHED TO EXISTING ROADWAY OR AS SPECIFIED BY THE ENGINEER



TITLE:

TEMPORARY CROSSING FOR  
TEMPORARY WATER MAIN

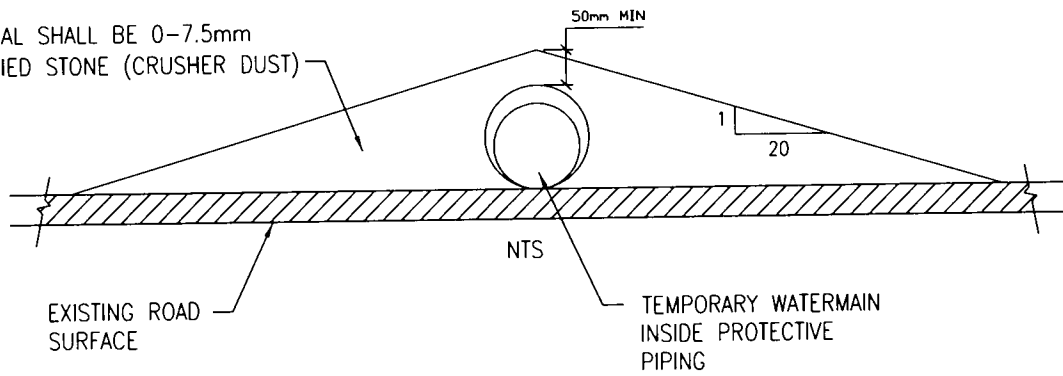
DATE: FEB 16, 2011

REV.#

DETAIL  
NO.

53

MATERIAL SHALL BE 0-7.5mm  
QUARRIED STONE (CRUSHER DUST)



TITLE:

TEMPORARY RAMP FOR  
TEMPORARY WATERMAIN  
CROSSING

DATE: FEB 16, 2011

REV.#

DETAIL  
NO.

54