

PART E
SPECIFICATIONS

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS, STANDARD DETAILS AND DRAWINGS

E1.1 *The City of Winnipeg Standard Construction Specifications* in its entirety, whether or not specifically listed on Form B: Prices, shall apply to the Work.

E1.1.1 *The City of Winnipeg Standard Construction Specifications* is available in Adobe Acrobat (.pdf) format on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division internet site at <http://www.winnipeg.ca/matmgt>.

E1.1.2 Further to GC:2.4(d), Specifications included in the Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.

E1.2 The following Drawings are applicable to the Work:

<u>Drawing No.</u>	<u>Drawing</u>
	Cover Sheet – General Locations Plan
D-8553	Site Plans and Profiles
D-8554	Structural Plans and Sections
D-8555	Structural Sections, Details and Temporary Shoring

E1.3 The Following Historical Drawings are provided for informational purposes only:

<u>Drawing No.</u>	<u>Drawing</u>
D-817	Second Branch Aqueduct – Plan and Profile 330+00 to 390+00
D-1010	54" Dia Aqueduct Interconnection Plan & Profile Sta 155+31 to Sta 157-28.44
D-1011	54" Dia Aqueduct Interconnection Main Line Valve Chamber and Misc. Details
D-1013	54" Dia Aqueduct Interconnection Detail of Thrust Blocks & 108" Storm Sewer Crossing
F-874	42" Drilled Flanged Outlet in 66" in Prestressed Concrete Embedded Cylinder Pipe (Branch II)
F-876	Typical Manhole Assembly in Prestressed Concrete Embedded Cylinder Pipe (Branch II)
F-989	42" Dia Short Pipe S & Vict – 44 Ends With Sub-Lugs
F-991	42" Dia Short Pipe B & Flange Ends With Sub-Lugs
F-992	54" Dia 22°-30' Elbow B&S Ends
F-1009	54" Dia. Std. Pipe with 24" Dia. Fl. Branch & Blind Flange
F-1017	Layout of 54" Dia Aqueduct Interconnection
F-1013	54" to 42" Dia. Reducer Bell & Vict-44 Ends

E2. SOILS INVESTIGATION REPORT

E2.1 Further to GC:3.1, the test holes in Appendix A, and as shown on the drawings, are provided to supplement the Bidder's evaluation of the Site conditions within the repair work areas. The information is considered accurate at the locations indicated and at the time of the investigation. However, variations in soil conditions may exist between test holes and fluctuations in groundwater levels can be expected seasonally and may occur as a result of construction activities or variations in flow level inside the Aqueduct.

- E2.2 Any test holes or test pits made by the bidder shall be done in accordance with the requirements of the Water and Waste Department. Bidders shall notify the Contract Administrator prior to proceeding with any subsurface investigations.

GENERAL REQUIREMENTS

E3. OFFICE FACILITIES

- E3.1 The Contractor shall supply office facilities meeting the following requirements:
- (a) The field office shall be conveniently located near the Site of the Work.
 - (b) The building shall have a minimum floor area of 20 square metres, with window area of 3 square metres and a door entrance with suitable lock satisfactory to the Contract Administrator.
 - (c) The building shall be suitable for all-weather use. It shall be capable of maintaining a temperature range between 16°C and 25°C.
 - (d) The building shall be supplied with adequate lighting and 120 Volt power supply.
 - (e) The building shall be furnished with one desk, one meeting table, one drafting table, one filing cabinet and six chairs, all satisfactory to the Contract Administrator.
 - (f) A separate toilet with door lock shall be supplied for the Contract Administrator.
 - (g) The field office shall be cleaned weekly immediately prior to the Job Site Meetings to the satisfaction of the Contract Administrator.
 - (h) The provision of the field office with the aforementioned furnishings and equipment shall also include maintenance and removal of the field office, operating costs and any service installation costs.

E4. SITE SECURITY AND SAFETY

E4.1 Security

- E4.1.1 The Contractor shall be responsible for site security and safety, as stated below:
- (a) Provide 24 hour site security personnel during all periods when the Aqueduct is exposed and contractor staff are not present on site.
 - (b) Report all site trespassing or suspicious activity immediately to McPhillips Control Centre at 986-4781.
 - (c) Refrain from providing statements with respect to water supply, site security or emergency situations to the media. All media inquiries in this regard shall be directed to the City of Winnipeg Customer Services.
 - (d) Provide secure temporary site storage compound for all specialized components such as valves, PCCP pipe and supplies, from the time they are delivered to the Site until they are incorporated into the Works. Compound shall consist of a minimum 1.8 metre chain link fence with lockable access gate. Permitted locations for on-site storage compounds shall be as generally located on the drawings.

E4.2 Safety

- E4.2.1 Be fully responsible for all aspects of site and public safety, in compliance to D19.
- E4.2.2 Arrange for all required safety watches in the vicinity of buried and overhead hydro utilities, and pay all required safety watch fees.
- E4.2.3 Install Contractor's locks on City installed lock-out devices, on Aqueduct valves at the following locations.

- (a) Deacon Reservoir
- (b) MacLean Reservoir
- (c) Wilkes Reservoir

E4.2.4 The City of Winnipeg will provide access to valve locations. The Contractor shall name a primary contact and backup personnel, available on a 24 hour per day basis, with access to lockout keys, in the event on an emergency.

E5. CONDITION, PROTECTION OF AND ACCESS TO THE AQUEDUCT

E5.1 Condition of the Aqueduct

E5.1.1 The Branch II Aqueduct and interconnector Aqueduct are constructed of pre-stressed concrete cylinder pipe circa 1958-1964. All Work procedures conducted by the Contractor on and/or near the Aqueduct shall be well planned and executed to ensure that the Aqueduct is not subjected to construction related loads, including excessive vibrations and concentrated or asymmetrical lateral loads during backfill placement.

E5.2 Protection of the Aqueduct

E5.2.1 Contractors carrying out repair work on the Aqueduct or working in the vicinity of it shall ensure that:

- (a) Equipment shall only be permitted to cross the Aqueducts at designated locations.
- (b) Granular material, construction material, soil or other material shall not be stockpiled on the Aqueduct or within 5 metres of the Aqueduct centerline.
- (c) Construction practices shall not subject the Aqueduct to asymmetrical loading at any time.
- (d) Construction practices or procedures at or near the Aqueduct shall not impart excessive vibration loads on the Aqueduct and/or cause settlement of the subgrade below the Aqueduct.
- (e) Asymmetrical water pressures shall not be permitted to build up on one side of the Aqueduct arch.
- (f) Further to CW 2030-R6, only smooth edged excavation buckets, soft excavation or hand excavation shall be used for excavation adjacent to and over the Aqueduct.
- (g) Install watertight bulkheads at all locations where the Aqueducts are exposed, or pipe is removed.

E5.2.2 It is the Contractors' responsibility to ensure that all work crew members understand and observe the requirements of E5.1 and E5.2. Prior to commencement of on-site work, the Contractor's superintendent, foreman and heavy equipment operators shall attend an orientation meeting that will outline restrictions for working on and around the Aqueduct. Failure to comply with these restrictions will be grounds for removing the offending personnel from the Site.

E6. ENVIRONMENTAL PROTECTION

E6.1 The Contractor shall be aware that the Shoal Lake Aqueduct is for potable water supply and no contamination by fuel, chemicals, etc. shall be permitted at any time. Fuels or chemicals shall not be stored within 30 metres of the Aqueduct.

E6.2 The Contractor shall plan and implement the Work of this Contract strictly in accordance with the requirements of the environmental protection measures as herein specified.

- E6.3 The Contractor is advised that at least the following Acts, Regulations, and By-laws apply to the Work:
- E6.3.1 Federal
- (a) Canadian Environmental Protection Act (CEPA) c.16
 - (b) Transportation of Dangerous Goods Act and Regulations c.34
- E6.3.2 Provincial
- (a) The Dangerous Goods Handling and Transportation Act D12
 - (b) The Endangered Species Act E111
 - (c) The Environment Act c.E125
 - (d) The Fire Prevention Act F80
 - (e) The Manitoba Nuisance Act N120
 - (f) The Public Health Act c.P210
 - (g) The Workplace Safety and Health Act W120
 - (h) And current applicable associated regulations.
- E6.4 The Contractor is advised that the following environmental protection measures apply to the Work.
- E6.4.1 Materials Handling and Storage
- (a) Construction materials shall not be stored within five (5) metres of the Aqueduct centerline.
- E6.4.2 Fuel Handling and Storage
- (a) The Contractor shall abide by the requirements of Manitoba Environment for handling and storage of fuel products.
 - (b) All fuel handling and storage facilities shall comply with The Dangerous Goods and Transportation Act Storage and Handling of Petroleum Products Regulation and any local land use permits.
 - (c) Fuels, lubricants, and other potentially hazardous materials as defined in The Dangerous Goods and Transportation Act shall be stored and handled within the approved storage areas.
 - (d) The Contractor shall ensure that all fuel storage containers are inspected daily for leaks and spillage.
 - (e) Products transferred from the fuel storage area(s) to specific work sites shall not exceed the daily usage requirement.
 - (f) When servicing requires the drainage or pumping of fuels, lubricating oils or other fluids from equipment, a groundsheet of suitable material (such as HDPE) and size shall be spread on the ground to catch the fluid in the event of a leak or spill.
 - (g) Refueling of mobile equipment and vehicles shall take place at least 100 metres from a watercourse.
 - (h) The area around storage sites and fuel lines shall be distinctly marked and kept clear of snow and debris to allow for routine inspection and leak detection.
 - (i) A sufficient supply of materials, such as absorbent material and plastic oil booms, to clean up minor spills shall be stored nearby on-site. The Contractor shall ensure that additional material can be made available on short notice.

E6.4.3 Waste Handling and Disposal

- (a) The construction area shall be kept clean and orderly at all times during and at completion of construction.
- (b) At no time during construction shall personal or construction waste be permitted to accumulate for more than one day at any location on the construction site, other than at a dedicated storage area as may be approved by the Contract Administrator.
- (c) Indiscriminate dumping, littering, or abandonment shall not take place.
- (d) No on-site burning of waste is permitted.
- (e) Equipment shall not be cleaned near watercourses; contaminated water from onshore cleaning operations shall not be permitted to enter watercourses.

E6.4.4 Dangerous Goods/Hazardous Waste Handling and Disposal

- (a) Dangerous goods/hazardous waste are identified by, and shall be handled according to, The Dangerous Goods Handling and Transportation Act and Regulations.
- (b) The Contractor shall be familiar with The Dangerous Goods Handling and Transportation Act and Regulations.

E6.4.5 Emergency Spill Response

- (a) The Contractor shall ensure that due care and caution is taken to prevent spills.
- (b) The Contractor shall report all major spills of petroleum products or other hazardous substances with the potential for impacting the environment and threat to human health and safety to the Contract Administrator and Manitoba Environment, immediately after occurrence of the environmental accident, by calling the 24-hour emergency telephone phone number (204) 945-4888.
- (c) The Contractor shall designate a qualified supervisor as the on-site emergency response coordinator for the project. The emergency response coordinator shall have the authority to redirect manpower in order to respond in the event of a spill.
- (d) The following actions shall be taken by the person in charge of the spilled material or the first person(s) arriving at the scene of a hazardous material accident or the on-site emergency response coordinator:
 - (i) Notify emergency-response coordinator of the accident:
 - identify exact location and time of accident
 - indicate injuries, if any
 - request assistance as required by magnitude of accident (Manitoba Environment 24-hour Spill Response Line (204) 945-4888, Police, Fire Department, Ambulance, company backup)
 - (ii) Assess situation and gather information on the status of the situation, noting:
 - personnel on site
 - cause and effect of spill
 - estimated extent of damage
 - amount and type of material involved
 - proximity to waterways and the Aqueduct
 - (iii) If safe to do so, try to stop the dispersion or flow of spill material:
 - approach from upwind
 - stop or reduce leak if safe to do so
 - dyke spill material with dry, inert sorbent material or dry clay soil or sand
 - prevent spill material from entering waterways and utilities by dyking

- prevent spill material from entering Aqueduct manholes and other openings by covering with rubber spill mats or diking
- (iv) Resume any effective action to contain, clean up, or stop the flow of the spilled product.
- (e) The emergency response coordinator shall ensure that all environmental accidents involving contaminants shall be documented and reported to the Manitoba Environment according to The Dangerous Goods Handling and Transportation Act Environmental Accident Report Regulation 439/87.

E6.4.6 Controlled Products

- (a) Materials classified as “Controlled Products” under Regulation 52/88, “Workplace Hazardous Materials Information System”, including amendments, are prohibited inside the Aqueduct, unless the material will be directly employed in the Work.
- (b) Notwithstanding the aforementioned requirement, materials have been tested by an ANSI accredited laboratory and meet the requirements of ANSI/NSF 60, “Standard for Drinking Water Treatment and Chemicals – Health Effects”, and ANSI/NSF 61, “Standard for Drinking Water System Components – Health Effects”, as specified in the Specifications, shall be permitted inside the Aqueduct.

E7. CONSTRUCTION SEQUENCING AND AQUEDUCT OPERATION

E7.1 Description

E7.1.1 This specification shall generally outline construction sequencing, Aqueduct operation, Aqueduct shutdown and regional water supply criteria.

E7.2 Construction Sequencing for Valve Chamber Construction

E7.2.1 Stage 1 Excavation

- (a) Installation of shoring piles and /or sheet piling at perimeter of valve chamber excavation
- (b) Excavation and installation of shoring, walers and bracing to 300 mm above the bottom of the Branch II Aqueduct pipe (elevation 229.6, 90 degree bedding angle). Excavation within 0.3 metres of the Aqueduct in any direction shall be completed by hand and/or soft excavation methods. Localized excavation to the proposed bottom of the base slab for installation of temporary support footings and columns. Local excavations shall be tight shored and braced.
- (c) Hand tunnelling under the Branch II Aqueduct locally for the installation of temporary support beams, and connection to temporary support columns.
- (d) Installation of temporary pipe support cradles.
- (e) Excavation for purposes of installation of lower excavation shoring, restricted as follows:
 - (i) Maintaining elevation of 229.6 m to a point 1.0 metres beyond the outside of the Branch II pipe wall.
 - (ii) Sloped excavation at a maximum slope of 1H:1V to the invert of the proposed mud slab.

E7.2.2 Stage 2 Excavation

- (a) Excavation of remaining valve chamber, and installation of remaining shoring and bracing to the invert of the base slab (Elevation 227.76 m). Excavation within 0.6 metres horizontally of the Aqueduct shall be completed by hand or soft excavation methods.

- E7.2.3 Base Slab Construction
- (a) Installation of working slab, reinforcing and construction of base slab.
 - (b) Installation of temporary bracing in preparation for installation of precast pipe components.
- E7.2.4 Removal and Installation of 1650 mm pre-stressed concrete pipe components and appurtenances.
- (a) Removal of the existing Branch II Aqueduct shall not commence until:
 - (i) all pipe, valves, components, compression seals, pipe couplers, fasteners, gaskets and other materials required to assemble the Branch II piping components are on site, inspected, tested and prefitted for reassembly.
 - (ii) Contractor has received written authorization from the Contract Administrator to proceed.
- E7.2.5 Installation of Butterfly valves and accessories.
- E7.2.6 Testing, inspection, disinfection and commissioning of the Branch II Aqueduct 1650 mm piping.
- E7.2.7 Construction and commissioning of remainder of valve chamber and 1350 mm interconnector piping.
- E7.3 Regional Water Supply Demand Usage
- E7.3.1 The Branch II Aqueduct is a key component of the City of Winnipeg Regional water supply infrastructure. Dependant on prevailing demand, the Branch II Aqueduct can only be taken out of service for limited periods of time. Allowable time in which to take the Branch II Aqueduct out of service is based on the following data, obtained from a review of the past 8 years of water supply record:
- Average overall October demand 225 Megalitres per day (MLd)
 - Peak overall October demand 245 MLd
 - Probability of exceedance of peak 2.5%
- Based on the assumption of a peak demand on 245 MLd, the maximum permissible window in which the Branch II Aqueduct may be severed and taken out of service is set at 13 calendar days, including drain time. Drain time is estimated to be 24 hours.
- E7.3.2 Branch II Aqueduct
- (a) At lower demand, the Branch II Aqueduct may be taken out of service for a longer period. However, due to the criticality of the City water supply, this longer window cannot be relied on. It is intended, however, to minimize construction site risk by maximizing the period of time that the Branch II Aqueduct can be removed from service. The following criteria shall apply:
 - (i) Stage 1 Excavation – The Branch II Aqueduct will remain in full service, as required to adequately supply water to the City Distribution Reservoirs. The Contractors operations shall preclude any damage to the Aqueduct during this period. Stage I excavation cannot commence prior to the date set out in D11.3(e) and must be completed by the date set out in D14.1(a).
 - (ii) Stage 2 Excavation and Base Slab Construction– It is intended to depressurize and drain the Branch II Aqueduct during this period. However, the Aqueduct must remain in a fully serviceable condition during this stage. All temporary bracing and shoring of the Branch II pipe shall be installed in such a manner to be fully capable of supporting full aqueduct flow at any time. Stage 2

Excavation must be complete by the date set out in D14.1(a). At any time during this period, the City of Winnipeg, reserves the sole right to order the Branch II Aqueduct to be returned to service. The Contractor will be given 24 hours notice of returning the pipe to service. The Contractor may continue construction operations that do not jeopardize the operation of the Branch II Aqueduct. If deemed necessary by the Contract Administrator, the excavation to the invert of the pipe, shall be backfilled with granular material in order to aide in support of the pipe.

- (iii) Removal and installation of 1650 pipe, valves and appurtenances - The Branch II Aqueduct will be removed from service and drained. At any time during this period, the City of Winnipeg, at its sole discretion, may order the Contractor to return the Aqueduct to service within receiving 48 hour written notice from the Contract Administrator. This will be achieved by installing pre-cast components, valves, spool or filler pieces, couplers and pipe seals or other methods required to return the Aqueduct to a serviceable, watertight state. This stage, including testing, inspection and commissioning must be completed by the date set out in D14.1(c).

E7.3.3 1350 Interconnector Pipe

- (a) The 1350 mm interconnector pipe will be removed from service from the commencement of Stage 2 excavation, until successful installation, testing and inspection of the relocated 1350 pipe. During all phases of construction, the contractor is to ensure components of this section removed, demolished or altered are kept in a secure, sanitary, watertight manner.
- (b) The 1350 mm Interconnector Aqueduct cannot be drained completely by gravity flow. Remaining volume of water in the interconnector line will require removal by pumping. Estimated remaining volume of water is 2,900 cubic metres.

E8. EROSION PROTECTION AND SEDIMENT CONTROL

E8.1 Description

- E8.1.1 The Contractor shall conduct his operations to comply with federal and provincial fisheries and environmental protection legislation, including preventing the loss or destruction of fish habitat, and minimizing the impact of sedimentation, silting or otherwise causing a degradation in water quality.

E8.2 Construction Methods

E8.2.1 Stream Crossings

- (a) Temporary stream crossings, where required, shall be constructed in accordance to "Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat" (1996).

E8.2.2 Dewatering

- (a) Discharge from dewatering operations will not be permitted directly into a watercourse. Dewatering discharge shall be directed to a constructed or natural settlement basin to allow for settlement of silts and debris
- (b) Discharge points of dewatering pumps and hoses shall be constructed to properly dissipate flow to prevent erosion, by means of discharging onto riprap, a properly anchored geotextile fabric or other means in order to reduce velocity of discharge to less than 0.3 metres per second.
- (c) Diversion ditches shall be constructed to minimize flow velocities and erosion by minimizing ditch slopes, and /or use of ditch berming devices or riprap. Outlets to

water courses shall be constructed to minimize discharge of silts and sediments by use of silt fencing, brush barriers, riprap and / or sediment basins

E8.2.3 Cofferd Dams

- (a) Cofferd dams across Navin Drain, to permit construction of the interconnector lines, shall be constructed, to provide a water-free excavation. Cofferd dams shall only be permitted to be constructed after October 15, and must be completely removed and the channel restored prior to the date of Substantial Performance.

E8.2.4 Limits of Work Area

- (a) The Contractor shall keep his work area to an absolute minimum area, to avoid disturbance of ground and vegetation that would increase the risk or severity of erosion.
- (b) Areas disturbed by the Contractors operations, including temporary access roads, shall be restored and re-vegetated to a condition equal to those existing prior to construction.
- (c) Areas immediately adjacent to water courses, and sloped areas susceptible to erosion shall be protected from erosion upon the completion of construction until the Site is adequately re-vegetated, by applying a temporary ground cover, such as: straw mulch; slash from clearing and grubbing; or erosion control blankets.

E8.2.5 Site Cleanup

- (a) Upon completion of site restoration and re-establishment of vegetation, remove all temporary devices including synthetic silt fences, geotextile fabrics, ditch berms and temporary riprap. Biodegradable products such as straw bales may be broken up and left on site. Synthetic materials shall be removed from site and properly disposed of.

E8.3 Method of Measurement and Basis of Payment

- E8.3.1 No measurement or payment will be made for Erosion Protection and Sediment Control. It will be considered incidental to construction works.

E9. CONSTRUCTION OF VALVE CHAMBER

E9.1 Materials

E9.1.1 Sub Drain Pipe

- (a) As per City of Winnipeg, Division 4 Approved Products, complete with geotextile filter sock.

E9.1.2 Formwork, Reinforcing Steel and Concrete

- (a) As per City of Winnipeg CW 2160-R6.

E9.1.3 Concrete Mix Design

- (a) Concrete Mix Design as per Table CW 2160.1, Type A mix.

E9.1.4 Water Stops

- (a) As indicated on the Drawings.

E9.1.5 Fibre Reinforced Plastic Grating

- (a) Fibre reinforced plastic grating shall be Fibregrate, as manufactured by Fibergrate Composite Systems, or approved equal.
- (b) Grating pattern shall be 50 mm square, colour yellow.

E9.2 Submittals

- E9.2.1 Submit reinforcing steel shop drawings and concrete mix design in accordance to CW 2160.
- E9.2.2 Submit fibre reinforced plastic grating design and erection details in accordance to CW 2160.

E9.3 Construction Methods

- E9.3.1 Cast-in-place concrete as per CW 2160.
- E9.3.2 Floor Drains
 - (a) Construct Floor drain as detailed on the drawings.
- E9.3.3 Pipe, Valves Fittings and Appurtenances
 - (a) As per E10 , E11 and E12.
- E9.3.4 Fibre Reinforced Gratings
 - (a) Prepare and install the fibre reinforced plastic grating in accordance with the manufacturer's instructions.

E9.4 Method of Measurement and Basis of Payment

- E9.4.1 Construction of Valve Chamber shall be measured on a lump sum basis. The lump sum price shall include excavation, backfill, cast-in-place concrete works, FRP grating, installation of butterfly valves, installation of prestressed concrete chamber piping, supply and installation of miscellaneous valves, appurtenances, miscellaneous metals, couplings, sub drains, interior plumbing, miscellaneous materials and bollards. Chamber piping shall be considered all piping within the chamber, to the first pipe joint beyond the chamber wall.

E10. BUTTERFLY VALVES, MANUAL ACTUATORS, MISCELLANEOUS VALVES AND FITTINGS

E10.1 Supply and Field Testing of 1350 and 1650 Butterfly Valves

- E10.1.1 1350 and 1650 Butterfly valves are being supplied under a separate tender, City of Winnipeg Tender 493-2003. Valves supplied under Tender 493-2003 are to be supplied and delivered to the City of Winnipeg, 1500 Plessis Road on or before July 30, 2004. Contact for the Valve Supply Contract is:
 - Mr. Rick Pochenco
 - Mueller Flow Control
 - (204) 774-3461
- E10.1.2 The Contractor shall attend a delivery inspection, with the Valve Supply Contractor, and Contract Administrator. The Supply Contractor, prior to turning valves over to the Installation Contractor, shall rectify any damage noted during the delivery inspection. Written acceptance of the valves and actuators by a duly completed "Certificate of Equipment Delivery (Form 200)" (Appendix B) shall constitute acceptance for installation from the Installation Contractor.
- E10.1.3 The City shall perform hydrostatic leakage testing of the valves, after delivery. Any leakage or defects noted during field testing shall be repaired by the Supply Contractor, prior to the Installation Contractor taking possession.
- E10.1.4 The Installation Contractor may leave the valves in storage at the City facility at 1500 Plessis Road, until required on-site for preassembly and installation.

E10.1.5 Once removed from storage at the City facility, the Contractor shall provide 24 hour secure storage for the valves. Once delivered to the Site for preassembly and installation, the valves shall remain stored in a secure, on-site storage compound.

E10.1.6 For the purposes of transportation of the valves from the storage facility to the job site, the Contractor shall ensure the following:

- (a) Valve flange faces are protected from damage by installation of a minimum of 20 mm plywood cover on both faces of each valve.
- (b) Valves be handled only by methods approved by the manufacturer, and properly secured to preclude any damage during transport.

E10.2 Materials

E10.2.1 Bolts

- (a) Bolts for installation of butterfly valves shall be Type 316 stainless steel. Bolt size, type and diameter shall be in accordance to AWWA C207-01, and as indicated on Supplier Shop Drawings (Appendix C).
- (b) Flange insulator kits shall be Advance Products and Systems or approved equal, including full faced gasket, hole sleeves and washers.

E10.2.2 Flange Gaskets

- (a) 3mm, full faced, cloth inserted rubber gaskets and shall be in accordance to AWWA C207-01. Gaskets shall be one piece construction.

E10.2.3 Blind Flanges

- (a) Steel Blind Flanges shall be AWWA C207-01 Class B.

E10.2.4 Valve Stem Extensions

- (a) Schedule 40 Stainless Steel ASTM A-276 Type 304. Size and length as shown on the drawings.

E10.2.5 Threaded Valves

- (a) Small diameter threaded gate valves (75mm diameter and less) shall be all cast bronze, solid wedge disk, rising stem c/w hand wheel rated for minimum 1.0 MPa non-shock cold water service. Direction of opening shall be counter clockwise and shall be indicated on the hand wheel. Bronze material shall conform to ASTM B62. Acceptable product; Crane, Jenkins, Kennedy, Mueller, or approved equal.

E10.2.6 Threaded Piping, Fittings and Flanges

- (a) Small diameter brass threaded piping, fittings and flanges (75mm diameter and less) shall be cast red brass conforming to ASTM B43 or cast bronze conforming to ASTM B62. Flange dimension and drilling shall be in accordance with ANSI B16.24 - 150#.
- (b) Small Diameter steel threaded fittings and flanges (75mm diameter and less) shall accordance with ANSI B16.5 - Class 150.
- (c) Small diameter steel pipe nipples shall be Schedule 80 steel.

E10.3 Construction Methods

E10.3.1 Installation of Butterfly Valves

- (a) Provide bolts and 1350 blind flange in advance, to the City of Winnipeg for purposes of valve testing. Sufficient bolts shall be delivered to the City of Winnipeg storage facility at 1500 Plessis Road, no later that July 31, 2004. Any bolts damaged by the City during testing operations will be replaced at the City's expense.

- (b) Install butterfly valve as shown on the drawings. Valves shall be installed with the valve shaft in the horizontal position. The Supply Contractor is obligated to provide installation supervision, and will completed Form 202 (Appendix B) upon successful installation.
- (c) Core 125 mm opening in roof slabs directly above actuator operation nut. Valve box and valve stem extensions shall be installed plumb and aligned directly above the valve actuator operation nut.
- (d) Temporarily install blind flange and gasket on the 1350 mm butterfly valve outlet. Flange to be in place, prior to returning the Branch II Aqueduct to service. Blind flange to remain in place until connection to the 1350 mm Interconnector pipe is made.

E10.3.2 Commissioning of Butterfly Valves

- (a) The Contractor shall assist in operation of the butterfly valves for the purpose of commissioning. The Supply Contractor is required to complete Form 203 (Appendix B), indicating a qualified representative has checked the installed equipment, and has found the equipment to be installed and operating in accordance to the specifications.

E10.3.3 Threaded Valves and Fittings

- (a) Install threaded nipples and flanges where indicated. Wrap all threads with a minimum of two wraps of Teflon tape or "pipe dope" containing Teflon. Isolate dissimilar metal flanges with gaskets, insulating bolt sleeves and non metallic washers.

E10.4 Method of Measurement and Basis of Payment

E10.4.1 Installation of Large Diameter Valves

- (a) Large diameter butterfly valve installation will not be measured for payment. They are to be included in the price bid for "Valve Chamber Construction".

E10.4.2 Supply and Installation of Small Diameter Valves, Fittings, Nipples and Flanges

- (a) Supply and Installation of small diameter valves, fittings, nipples and flanges will not be measured for payment. They are to be included in the price for "Valve Chamber Construction".

E11. SUPPLY AND DELIVERY OF PRESTRESSED CONCRETE PIPE AND APPERTANENCES

E11.1 Description

- E11.1.1 This Specification supplements and amends AWWA Specification C301-99, AWWA Manual M9 Concrete Pressure Pipe, and AWWA C304-99 Design of Prestressed Concrete Cylinder Pipe.

E11.2 Materials

E11.2.1 Prestressed Concrete Pressure Pipe

- (a) Prestressed concrete pressure pipe for the 1650mm Branch II and 1350mm interconnector Aqueduct piping shall be embedded-cylinder pipe (ECP).

E11.2.2 Cement

- (a) Approval in writing is required if the Contractor proposed to use fly ash or pozzolan as a supplementary cementing material in conformance with AWWA Standard C301, Section 4.4.1.
- (b) Approval requests should be accompanied by a submission from an independent testing laboratory complete with sampling and testing results of the material conforming to ASTM Standard C311.

E11.2.3 Fittings

- (a) Fittings shall be manufactured using minimum steel thicknesses specified in Table 1, Section 4.7 of AWWA C301-99.
- (b) Flanges for fittings shall be AWWA C207-01 minimum Class D Flanges.
- (c) Pipe sections passing through valve chamber walls shall be manufactured with a 12 mm thick by 150 mm wide steel waterstop ring, located at the midpoint of the chamber wall.
- (d) The 1650 x 1650 x 1350 tee shall be manufactured with a steel thrust flange for embedment in the chamber thrust block.

E11.2.4 Pipe Marking

- (a) Each section of pipe and each fitting shall be plainly marked with a waterproof marking material both inside, on the bell or spigot end, and outside, at the pipe's midspan, the classification, the date of manufacture and marks of identification sufficient to show its proper location in the line by the reference to the laying schedule specified. The point of maximum bevel shall be marked on the end of the spigot on each piece of bevelled pipe. All bends shall be marked on the ends with the angle of deflection. The manufacturer's proposed marking system shall be included with the "Data to be Supplied by Contractor" in Clause E11.3.4. Colour coded markings shall be required when there is more than one pipe classification.

E11.2.5 Closures

- (a) Closures shall be steel sleeve coupling closures.
- (b) Nuts and bolts used on couplings for closures shall be Type 316 stainless steel. Nuts and bolts used shall be identified with raised or indented 316 numerals.
- (c) The plain steel end of each closure piece shall extend 150mm longer than the required length of the piece to provide an overlap in order to compensate for any correction required when installed.
- (d) The Contractor shall be responsible for any interior or exterior mortar coating damage.

E11.2.6 Pipe Couplers

- (a) Pipe couplers to be to the latest revision of AWWA C-219 for bolted, Sleeve Type Couplers for Plain End Pipe. Minimum requirements are:
 - (i) Minimum sleeve length 250 mm
 - (ii) Minimum centre sleeve thickness 12.7 mm
 - (iii) Couplings capable of accommodating up to 2 degrees deflection
 - (iv) Bolts and nuts to be 316 Stainless Steel.
 - (v) Couplings to be supplied with two di-electric insulating boots
- (b) Couplings to be fusion bonded epoxy coated to AWWA C213, and meeting the requirements of ANSI/NSF 61 "Standard for Drinking Water System Components – Health Effects"

E11.3 Design Requirements

E11.3.1 Pipe Design

- (a) The Contractor shall submit for approval of the Contract Administrator prior to manufacture, details of the pipe design. The Contractor may have more than one class of pipe to meet varying conditions along the route of the pipeline but the City will give preference to tenders based on a minimum number of pipe classifications. In the case of railway and road crossings, the effect of casing pipe in reducing pipe loading shall be neglected.

- (b) All pipe and fittings shall be design and constructed to withstand a 1.0 MPa test pressure and 0.5 MPa working pressure internally and all external pressures caused by overburden, traffic or other loads to which the pipe might be subjected, all in accordance with the applicable requirements of AWWA Standard C301.
- (c) Trench loadings shall be calculated and based on a trench width equal to transition width, a soil weight of 1925 kilograms per cubic metre, a trench bedding factor of 1.5 and a minimum earth cover of 2750 millimetres and a $KU = 0.110$ in Marston's formula. Live loading allowed for shall be HSS-25 highway loading.
- (d) The steel cylinder shall be a minimum of 1.6 millimetre thickness (No. 16 gauge) and the minimum thickness of the high tensile reinforcing wire shall be 4.2 millimetres thick (No. 8 gauge). Mortar coating shall be a minimum of 24 millimetres thick measured from the outside of the high tensile wire.

E11.3.2 Laying Schedule

- (a) 1650 and 1350 mm pipe laying schedule shall incorporate a short pipe length of approximately 1.5 times the diameter, immediately outside of the chamber piping.

E11.3.3 Fitting Design

- (a) The 1650 x 1650 x 1350 tee shall be designed with a steel thrust flange for embedment in the chamber thrust block. The thrust flange must be designed to resist the ultimate thrust forces indicated on the drawings.

E11.3.4 Data to be Supplied by Contractor

- (a) Sufficient numbers of copies of all drawings and laying schedules as specified in Specification CW1110, Clause 1.5, shall show full details of reinforcement, concrete and joint dimensions for the straight pipe, specials and connections and shall be furnished by the Contractor for the review by the Contract Administrator. No pipe shall be manufactured until the drawings have been entirely approved.
- (b) The data submitted by the Contractor shall include a tabulated laying schedule with reference to the stationing and grade lines shown on the Drawings. This schedule shall show the locations and length of each class of pipe which the Contractor proposes to furnish, and the point of change from one class to the next shall be clearly indicated by station number. The area of steel per linear metre and such other details as are required shall be listed for each of the pipe classes proposed by the Contractor.
- (c) The Contractor shall be responsible for the accurate details, fabrication and fit of the pipe and specials.
- (d) The Contractor shall submit to the Contract Administrator for review, design calculations for the determination of the details of the pipe reinforcement prior to the manufacture of any pipe. The manufacturer of the pipe shall have sufficient data to verify all design strengths.

E11.4 Delivery of Pipe

E11.4.1 Contractor is required to coordinate manufacture and delivery of the pipe with his sub-contractor (the manufacturer) and to meet project scheduling requirements.

E11.4.2 Delivery of the pipe shall be in accordance with AWWA M9 Manual – Concrete Pressure Pipe.

E11.5 Construction Methods

E11.5.1 Pipe Length

- (a) Standard pipe lengths shall be used, except where special lengths are required by an approved laying schedule.

- E11.5.2 1350 Adaptor Pipe
- (a) Connection to the existing 1350 mm Interconnector line may be made by means of a Bell/Bell adaptor pipe. Joint diameter of the existing 1350 mm line is 1467mm (57 $\frac{3}{4}$ inches).
- E11.5.3 Closures at Plain End by Spigot or Bell Wall Pipe
- (a) Plain end wall pipe for the 1350 mm and 1650 mm Aqueduct shall be manufactured with the plain end extending 150 mm beyond the required length to provide and overlap in order to compensate for any correction required when installed.
 - (b) Closure length for 1350 Interconnector line shall be field measured prior to final manufacture.
- E11.5.4 Tolerances
- (a) In addition to the requirements noted in Section 4.5 of AWWA C301-01, the overall length of pipe measured from the end of the spigot to the seat of the bell at any point around the circumference shall not vary more than 3 millimetres +/-.
- E11.6 Quality Control
- E11.6.1 Inspection
- (a) The Contractor shall afford the Contract Administrator every facility to access and inspect all plant to be provided, work to be performed, materials to be supplied and equipment or machinery to be installed in accordance with the provisions of GC 5.03.
- E11.6.2 Testing of Pipe and Materials
- (a) The Contractor shall provide access to the Contract Administrator or his appointed representative to conduct plant inspections, in accordance to Section 5.1 of AWWA C301-99. The Contractor shall provide a minimum of 7 calendar days notice of commencement of pipe manufacture, for the purposes of scheduling plant inspections.
 - (b) The Contractor shall make, conduct, arrange, make available, obtain and provide for all testing as described in Section 5.2 AWWA Standard C301-99. The following reports shall be made available to the Contract Administrator on request:
 - (i) Absorption tests shall be carried out by the Contractor on specimens of the exterior coating of the pipe. These tests shall be carried out in accordance with ASTM Standard C497 Method of Testing Concrete Pipe, Sections or Tile, method A.
 - (ii) Notwithstanding AWWA C301-99 4.6.8.3, no individual absorption test may exceed 10%.
 - (iii) Notwithstanding AWWA C301-99 4.6.8.3, mortar tests shall be conducted on a daily basis for the entire production run.
 - (iv) Every effort shall be taken to limit this absorption to 8% as measured in accordance with the ASTM Standard C497. The City will not accept pipe with an absorption rate in excess of 10. No pipe shall be shipped until the absorption results related to the particular shipment have been obtained and are satisfactory.
- E11.6.3 Testing of Fittings and Special Pipe
- (a) Fittings and special pipe shall be tested in the same manner as pipe except that fittings and special pipe shall be tested for tightness by the dye penetrant method as specified in Section 4.7.2.22 of AWWA Standard C301-99.

E11.6.4 Affidavit of Compliance

- (a) An affidavit of compliance signed by an officer of the pipe manufacturing company shall be provided stating that the pipe and fittings comply with this Specification, in accordance with Section 6.3 of AWWA C301-99.

E11.7 Method Measurement and Basis of Payment

E11.7.1 Prestressed Concrete Pressure Pipe

- (a) The supply and delivery of prestressed concrete pressure pipe shall be measured and paid on a length basis. The length to be paid for shall be the total number of linear metres of pipe delivered and accepted of each type, class and size of pipe supplied complete with all accessories and appurtenances. Measurement of prestressed concrete pressure pipe shall be made according to the laying length of each pipe. Measurement will be made from the proposed connection points of the existing piping, to the first pipe joint outside of the chamber walls.

E11.7.2 Fittings and Specials

- (a) The supply and delivery of fittings and specials shall be measured and paid on a unit basis. The price paid shall be the Contract Unit Price per unit for "Fittings" of each type, class and size, measured as specified herein, which price shall be payment in full for supplying and delivering all fittings, accessories and appurtenances and for performing all operations herein described and all other items incidental to the Work included in this Specification.

E12. INSTALLATION OF PRESTRESSED CONCRETE PIPE AND APPURTENANCES

E12.1 Description

- E12.1.1 This Specification shall cover the preparation of the pipe bed, including the supply of bedding materials and the placement of all pipe and accessories including fittings, as specified or shown on the Drawings.

E12.2 Testing Apparatus

- E12.2.1 Testing apparatus for 1350 mm concrete pressure pipe shall be a sleeveless internal joint tester, Cherne Air-Loc or approved equal.
 - (a) Capable of test pressure of 140 KPa (20 psig) with air as a test medium, and 350 KPa (50 psig) with water as a test medium.
 - (b) Pressure gauge for test cavity shall be capable of reading pressures from 0 to 350 KPa (50 psi). Pressure gauge units shall be graduated in imperial units (psi) and Metric units (KPa).
 - (c) Provide two (2) spare end element seals, and three (3) spare frame sealing gaskets.

E12.3 Construction Methods

E12.3.1 Excavation

- (a) Excavation shall be in accordance with Specification CW2030, "Excavation, Bedding and Backfill". Over-excavated material shall be replaced with compacted, well-graded crushed limestone having a maximum aggregate size of 25mm.

E12.3.2 Installation of Pipe

- (a) All pipe shall be installed on a 150 millimetre thick bed of sand placed in the bottom of the trench prior to the installation of the pipe in accordance with AWWA M9 Manual, Type R5 Bedding. The sand bedding shall be levelled such that it forms a continuous solid bedding for the full length of the pipe except at the midpoint of each pipe and at

the joints. A small groove shall be left at the midpoint to facilitate the removal of the sling after the pipe has been laid. Another groove shall be provided at each joint to facilitate placing of a "diaper" band around the joint. Both grooves shall be filled with compacted sand after the removal of the sling and after placing of the diaper band. Compacted sand backfill shall be placed above the pipe to a depth of 200 millimetres above the top of the pipe, for the full trench width. The sand for bedding and backfill shall be supplied by the Contractor and shall conform to the requirements as specified in Specification CW2030, "Excavation, Bedding and Backfill". The Contractor shall ensure that disturbance of the pipe or damage to the pipe coating does not occur during sand bedding and backfilling operations.

- (b) The pipe shall be laid and fitted together so that when complete, the feedermain will have a smooth and uniform invert. The trench shall be free of water while the pipe is being installed. The excavation of the trench shall be fully completed a sufficient distance in advance so as not to interfere with the laying of the pipe.
- (c) Prestressed concrete pressure pipe shall be installed utilizing cut and fill methods. Coring, augering or jacking methods shall not be undertaken.
- (d) The exposed end of the pipe shall be fully protected with an approved stopper to prevent foreign matter from entering the pipe. The interior of the pipe shall be kept free of all dirt, concrete or superfluous material as the Work proceeds.

E12.3.3

Jointing

- (a) Immediately prior to connecting two lengths of concrete pressure pipe, the spigot end of the pipe shall be thoroughly cleaned. Prior to insertion of the rubber gasket in the spigot groove, the spigot groove shall be lubricated with vegetable soap. The gasket shall then be thoroughly cleaned and then lubricated with a vegetable soap approved by the pipe manufacturer, the consistency of which shall be approximately that of soft No. 2 cup grease. In stretching the gasket, care shall be exercised to maintain a uniform tension or volume of rubber around the whole circumference of the spigot. The bell of the pipe already in place shall be carefully cleaned and lubricated with vegetable soap. The spigot shall then be pushed into the bell and against steel inserts placed between the top of the spigot and the shoulder of the bell to provide a space for inserting the feeler gauge. The entire circumference of the joint shall be gauged to determine that the rubber gasket is in its proper position. If the gasket cannot be felt all around the pipe, the pipe shall be withdrawn and the gasket examined for cuts. If the gasket is undamaged it may be reused, but only after the bell ring and gasket have been lubricated with soap again, as previously specified, before the pipe is re-laid. When it has been determined that the gasket is in its proper position, the steel inserts shall be removed and the pipe pushed completely "home".
- (b) The outer joint of the concrete pipe shall be made using diaper bands approved by the pipe manufacturer and shall be made of burlap or other approved porous material. Diaper bands to hold grout in place shall be used according to the manufacturer's instructions. Immediately before pouring cement grout, the entire joint shall be thoroughly wetted. A cement grout of one part Sulphate-Resistant cement to two parts sand shall be poured between the burlap bag and the pipe, to ensure a thorough sealing of the joint around the portion of the pipe covered by the band. Silt, slush, water or polluted mortar grout shall be carefully forced out by the pouring and removed. The upper portion of the joint shall then be filled with mortar and a bead made around the outside of the top half of the pipe joint with a sufficient amount of additional mortar. The completed joints shall immediately be protected from the air, sun or cold with proper coverings and shall be kept protected for such a period as necessary to secure satisfactory curing of the mortar. No backfilling around joints shall be done until the joints have been fully inspected and approved.
- (c) The inside joint recess of the concrete pipe, sizes 600 millimetres and larger, shall be completely filled with mortar made from one part cement and one part sand so as to

provide a smooth continuous flush surface across the joint. The Contractor shall comply with all requirements and regulations of the Workplace, Safety and Health Division concerning air supply for workers performing operations inside the pipe and any associated costs shall be considered incidental to the installation.

- (d) Delay grouting and diapering of short pipe joints immediately outside of chamber, until completion of construction and partial backfill of chamber, to allow maximum differential deflection and settlement prior to final backfill.

E12.3.4 Closures

- (a) 1350mm and 1650mm Plain end wall pieces shall be accurately trimmed after installed, to accommodate plain end by flange valve adaptors. The pipe shall be accurately marked around the circumference, from the face of the butterfly valve flanges, to accommodate the flange x plain end adaptor, plus gap allowance shown on the drawings.
- (b) The 1350 mm closure shall be made as follows:
 - (i) Install 1350 pipe toward valve chamber, except short pipe immediately outside of chamber.
 - (ii) Place 1350 wall pipe inside valve chamber wall blackout, allowing enough room for insertion of last short pipe.
 - (iii) Lay short pipe immediately outside of chamber.
 - (iv) Butt wall pipe back out of wall blackout into short pipe outside of the chamber
 - (v) Complete closure as outlined in E11.2.4 a) above.

E12.3.5 Frost Conditions

- (a) No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when the Contract Administrator shall deem that there is danger of the formation of ice or the penetration of frost at the bottom of the excavation. Every precaution must be taken to prevent frost from penetrating the ground to depths below the foundations during construction. Any pipe which, in the opinion of the Contract Administrator, shall have been injured through neglect of this provision of the specifications, shall be removed and made good by the Contractor and at the Contractor's expense.
- (b) Heating of the pipe, sand, mortar and gaskets shall commence when the ambient temperature falls below -5 C. The pipe shall be heated throughout with a low heat immediately prior to installation (warm to the touch).
- (c) All mortar for joints shall be heated, and heated sand shall be placed around the pipe for the full height of the specified bedding and initial backfill and to at least 600 millimetres on either side of the joint, all to the satisfaction of the Contract Administrator.

E12.3.6 Thrust Blocks

- (a) Thrust blocks shall be installed at all tees, wyes, elbows, bends, plugs, reducers and crosses and at location shown on the Drawings. Thrust blocks shall consist of concrete as specified in Specification CW2160 and shall be installed as shown on the Drawings. The thrust block shall bear against undisturbed soil and the soil shall be cut smooth and at the proper angle to the pipe. No horizontal struts or braces required for trench bracing shall remain in the concrete thrust block. A bond breaker consisting of 0.20 millimetre (8 mil) polyethylene sheeting shall be installed between fittings, valves or plugs and the concrete of the thrust block to allow future removal of the thrust block without disturbing the fitting, valve or plug. Before any concrete is placed, all thrust block formwork shall be inspected and approved by the Contract Administrator.

E12.3.7 Clay Dikes

- (a) Clay dikes shall be constructed every 200 linear metres, 5 metres on each side of offtake/valve chamber walls, and as directed by the Contract Administrator. Clay dikes shall consist of compacted clay material extending the width of the trench and for a length of 600 millimetres and shall extend from the bottom of the sand bedding, i.e. from undisturbed earth to the top of the sand backfill.

E12.3.8 Offtakes

- (a) Offtakes shall be installed at the locations shows on the Drawings. The City reserves the right to change the locations of these offtakes at any time prior to the actual installation of the fittings.
- (b) The offtake pipe shall be installed through the wall of the chamber and plugs shall be installed as shown on the Drawings so that the offtake watermain may be readily extended in the future.
- (c) Offtake shall be bedded and backfilled in the same manner as the feedermain.

E12.3.9 Connections to Existing Aqueducts

- (a) Connections to existing Aqueducts shall be made at the locations shown on the Drawings.
- (b) Connections to the existing Aqueducts will be supplemented by the installation of an internal compression seal. Installation of this additional seal does not relieve the Contractor from constructing a water-tight joint.

E12.3.10 Flange and Closure Assembly Protection

- (a) All flange and closure assemblies not in valve, meter or offtake chambers shall receive a coat of asphalt on all exposed metal surfaces. The entire flange and closure assembly shall then be coated with a minimum 50 millimetre thickness of sulphate-resistant cement mortar, reinforced with a light wire mesh approved by the Contract Administrator.

E12.3.11 Painting

- (a) All exposed metal surfaces including valves, fittings, anchor bolts, etc. where not specified to be copper, brass or galvanized, and all galvanized surfaces exposed by welding connections shall be painted. Where interior pipes are furnished with a bituminous protective coating, two coats of specified paint shall be applied directly over the bituminous finish.
- (b) Metal surfaces shall be cleaned thoroughly by wire brushing and given one coat of an approved zinc chromate primer, smoothly and neatly brushed on. After this has thoroughly dried, two coats of Tremclad Aluminum paint or approved equal, shall be applied. Should thinning of any paint become necessary, only the thinners recommended by the manufacturer shall be used.

E12.3.12 Change in the Laying Schedule

- (a) If the Contractor requests changes in the laying schedule, that is relocation of items such as offtakes, closures, valve chambers or any other alteration of the laying schedule, all costs associated with these changes shall be paid for by the Contractor.

E12.3.13 Demolition, Removal and Abandonment of Existing Pipe and Fittings

- (a) Where indicated, remove designated portions of pipe. Removal methods shall be employed that preclude damage to adjacent pipes and joints that are to remain in place.
- (b) Piping required to be cut and/or demolished to facilitate removal of adjacent pipe shall be a minimum of one complete pipe length away from proposed tie-in points.

- (c) All gaskets from existing pipes shall be carefully salvaged, cleaned and inspected. Due to changes in gasket design, existing gaskets may require re-use when tying to existing pipe spigots.
- (d) Existing 1050 mm butterfly valve and couplings shall be carefully removed from the existing valve chamber, and returned to a designated City of Winnipeg facility.
- (e) All pipe and valves removed shall be salvaged, and returned to a designated City of Winnipeg facility.
- (f) All abandon pipe to remain in place shall be filled with flowable fill, in accordance to CW 2130.

E12.4 Quality Control

E12.4.1 Inspection

- (a) The Contractor shall afford the Contract Administrator every facility to access and inspect all plant to be provided, work to be performed, materials to be supplied and equipment or machinery to be installed.

E12.4.2 Line and Grade

- (a) The pipe shall be installed to the line and grade shown on the Drawings and as set in the field by the Contract Administrator. Vertical variance from grade shall not exceed 25 millimetres and horizontal variance from line shall not exceed 100 millimetres. Sharp bends will not be permitted even though the pipe remains within these tolerances. Alignment corrections allowed in main line piping but not at closures. Tees and bends shall be installed to the grades and at the locations shown on the Drawings or where required to connect to existing watermains.

E12.4.3 Testing

- (a) Further to CW 2125, hydrostatic leakage testing will not be required.
- (b) Watermain testing will be completed by means of joint testing of individual pipe joints. Joint testing will be completed utilizing the 1350 mm Cherne Joint Tester provided under this contract, and City of Winnipeg's 1650 mm Cherne Joint Tester. The Contractor shall provide compressed air supply and all labour required to assemble, move and conduct test procedure.
- (c) Initial Testing
 - (i) Initial joint testing shall be immediately after installation, and prior to backfilling or grouting the joints.
- (d) Final Testing
 - (i) Final joint testing shall be conducted after all pipe is installed, and backfilled.
- (e) Test Procedure
 - (i) Testing to be conducted as per manufacturers' procedures.
 - (ii) In addition to manufacturers recommendations, the Contractor shall provide 150 mm wide by 10 mm thick closed cell ethyl foam "Sill Plate " gasket to assist in seating the concrete surface.
 - (iii) Test medium shall be compressed air.
 - (iv) Test pressure to be 140 KPa (20 psi), held for 20 seconds. If pressure drops by more than 7 KPa (1psi), the joint shall be retested.
 - (v) If test pressures continue to be below the acceptance criteria, the Contractor shall check the joint to ensure the gasket is properly seated and if necessary, disassemble the joint and relay the pipe.

E12.4.4 Disinfection of Watermains

- (a) Further to CW 2125, disinfection of watermains shall be completed by swabbing as outlined in Section 3.3.16 of CW 2125.

E12.5 Method of Measurement

E12.5.1 Aqueduct Installation

- (a) Construction of Aqueducts shall be measured on a length basis. The length to be paid for shall be the total number of linear metres acceptably installed as to each size, class, type of backfill and method of installation of Aqueducts complete with fittings, accessories, appurtenances and all testing requirements, measured horizontally, at grade, above the centreline of the pipe, as computed by measurements made by the Contract Administrator. The length measured and paid will be from the first pipe joint outside of the valve chamber, to the connection points on the existing Aqueducts. Measurement will be from face of bell to face of bell.

E12.5.2 Supply of 1350 mm Sleeveless Joint Tester

- (a) The supply of 1350 Sleeveless Joint Tester shall be made on a lump sum basis. The lump sum amount shall include the tester, spare parts, all applicable taxes (excluding GST), duty and brokerage fees. The tester will become the property of the City of Winnipeg, on completion of testing.

E13. EXCAVATION, BEDDING AND BACKFILL

E13.1 Shoring

- E13.1.1** Excavation shoring shall be designed to accommodate staged excavation, as explained in E7.2. Shoring components, bracing and walers shall be designed to accommodate installation of all pipe and fittings and temporary pipe support structure.

E13.2 Temporary Pipe Support Structure

- E13.2.1** The temporary pipe support structure shall be designed by a Professional Engineer, registered in the Province of Manitoba. The support structure design shall be submitted in accordance to Clause 1.5 of CW 1110. The structure shall be designed to the general intent laid out on the drawings, and the minimum design criteria:

- (a) Supports shall be designed to support the weight of the existing pipe and water (service load of 254 KN)
- (b) Beams shall be designed to allow a maximum deflection of not more than 10 mm
- (c) Pipe cradle supports shall be a minimum of 300 mm in width, and uniformly support the pipe invert for an included angle of 90 degrees. The pipe shall be uniformly supported by use of a 20 mm thick neoprene rubber bearing pad, or by setting the pipe in a bed of grout.
- (d) Area of footing pads shall be a minimum of 1.44 m². Footing pads may be square or round.
- (e) Excavation below the invert of the existing pipe for installation of the footing pads shall proceed in a careful manner. The excavation shall be tight shored to prevent undermining of the Aqueduct, and be designed in accordance to the specification CW 2030.

- E13.2.2** Temporary pipe support structure shall be installed and inspected by the design engineer, prior to proceeding with Stage 2 excavation

E14. SUPPLY AND INSTALLATION OF INTERNAL COMPRESSION SEALS

E14.1 Materials

E14.1.1 Pipe Joint Seals

- (a) The internal compression seals supplied shall be the AMEX-10/WEKO SEAL as manufactured by Miller Pipeline Corp. of Indianapolis, Indiana.
- (b) The AMEX-10/WEKO SEAL and all components therein shall be certified ANSI/NSF Standard 61 "Drinking Water System Components - Health Effects".

E14.1.2 EPDM Rubber Material

- (a) EPDM Rubber Derivative Membrane for use as joint liner material shall be manufactured in compliance with ASTM-D3900, D3568 and shall have designation M4AA710A13B13C12Z1Z2Z3 in accordance with ASTM-D2000.
- (b) The EPDM rubber material shall be 366mm in width for all seals.
- (c) The EPDM Rubber Membrane shall be individually sealed in plastic bags and packaged in a manner that will not damage or deform them in transit or storage.
- (d) Manufacturing Process:
 - Extrusion process for belt material.
 - All joints to be transfer moulded.
 - All material specifications must be certified.
 - Material Safety Data Sheet must be provided.

E14.1.3 Stainless Steel Bands, Shims, and Set Screws

- (a) Stainless steel bands, spacers, shims, and set screws for securing rubber membrane across piping joints shall be Type 303, 304, 316 or Maunell as manufactured in accordance with ASTM-A240-83.

E14.1.4 Liquid Joint Lubricant

- (a) Liquid joint lubricant to assist in installation of the AMEX-10/WEKO-SEAL and bands shall be a non-toxic vegetable based lubricating gel, Tyton Joint Lubricant or approved equal.

E14.1.5 Thread Sealing Compound

- (a) Thread Sealing Compound shall be Paste Type with "Teflon".

E14.2 Manufacturing

E14.2.1 Bands

- (a) Rolled to the radius of the pipe being renewed. Each band checked on fixed radius gauge.

E14.2.2 Cleated End

- (a) To be manufactured from the same manufacturer lot number as the band.

E14.2.3 Welding

- (a) All shop and field welds to be made by certified welders with a minimum of 2 years experience on this alloy (T-304). The welds are to be made with stick or wire of T-308 alloy. All shop welds to be accomplished in a A-1025-Helium/C02 gas atmosphere when using wire.

E14.2.4 Radius Shims

- (a) Material Specifications 0.48 x 2" x 6" T-304.

- (b) Manufactured by rolling to the radius of the pipe.
- (c) All edges to be deburred.

E14.3 Construction Methods

E14.3.1 Pipeline Preparation

- (a) Remove deleterious deposits from the pipe walls by hand brushing. Power tools may be required to remove deposits and stubborn or hard scale lamination in the joint area. Whatever method is adopted, the pipe must be as clean as reasonably possible to provide a reasonable working environment for the operators.

E14.3.2 Joint Filling

- (a) During pipe cleaning operations the gaps between the joints must be cleared of dust and debris leaving a clean area for "joint filling". The joints are filled to the full depth of the gap and rendered flush with the internal surface of the pipe. The filling material is a quick-setting cement mortar which is mixed as required in the pipe. All surplus material spillage should be removed from the joint area prior to the surface preparation of the seal area.

E14.3.3 Surface Preparation of Joint Area

- (a) The area of pipe either side of the joint where the actual "lip seals" make contact with the pipe must be prepared to a finish which will allow the "lip seals" to interface consistently, and to provide a permanent seal.
- (b) All high/low surface imperfections running axially through or part way through the sealing surface must be removed by scraping or grinding. Deep imperfections that grinding will not remove must be properly filled with approved quick setting cement mortar. This material must be rendered smooth and ground if necessary to suit the prepared surface of the joint area.
- (c) The pipe must be premarked with grease chalk to allow the preparation areas and seal position to be clearly defined.
- (d) If required, apply a coat of approved epoxy to the preparation area where the seal will be placed. This epoxy will control pipe porosity and irregularities and provide for an effective bubble test on the completed seal.
- (e) Immediately prior to fitting the seal, the area must be cleaned with a dry brush and coated with liquid joint lubricant, compatible with the composition of the AMEX-10/WEKO-SEAL. The lubricant is hand applied (using a brush) over the prepared area. Care must be taken not to pick up dust deposits from the unprepared surface. The lubricant is purely an aid to fitting the seal, and in no way contributes to its sealing capabilities.

E14.3.4 Positioning the Seal

- (a) The seal shall be checked that it is undamaged and that the test unit is tight before fitting the seal in place. The AMEX-10/WEKO-SEAL is placed in position bridging the joint gap, guided by the chalk marks previously referred to. The seal must be positioned accurately on the prepared areas. The test unit in the seal must be located at either 9 o'clock or 3 o'clock positions. The seal must be positioned parallel to the joint gap.

E14.3.5 Expanding the Seal into Position

- (a) When positioning the hydraulic expander in line with the retaining band, care must be taken to ensure that the band remains in the groove of the AMEX-10/WEKO-SEAL, and does not become moved or dislodged. Care should also be taken to ensure the expander is positioned correctly on the band.

- (b) A hydraulic expander is used to apply a set pressure to the retaining bands of the AMEX-10/WEKO-SEAL. A radiused locking piece called a "wedge" is fitted between the exposed gap of the expanded band ends. A size of wedge having a slight interference fit between the band ends is selected, the wedge (leading wedge first) is tapped into position, locking in the compression of the AMEX-10/WEKO-SEAL. The radius of the wedge is equal to the radius of the pipe.
- (c) The pressure is released from the expander and the procedure is repeated on the second retaining band of the seal.
- (d) It is essential to repeat this entire operation (i.e. re-expansion) not before 30 minutes have elapsed after the first expansion. This allows for any seal relaxation that may take place and usually a slightly larger wedge may be fitted. The load forces transmitted by the AMEX-10/WEKO-SEAL expander have been determined from the test data and should not be altered.
- (e) Once the expanding procedure is completed, the overlap locking device, if required, for the wedge shall be tightened down to a torque of 15 inch pounds.

E14.4 Testing

E14.4.1 Test 1

- (a) The test is applied after each section has been completed and not before 30 minutes have elapsed after final fitting of the seal. A restraining device called a "test band" is fitted over the seal. This is to prevent excessive ballooning that would otherwise occur during the test. The AMEX-10/WEKO-SEAL is pressured to 10 psig through the test valve and maintained with a regulated air supply, while a soap and water solution is applied to the outer edge of the seal to detect any leak.

E14.4.2 Testing the Seal - Test 2

- (a) In the second test, (5 psig) is introduced through the "valve" in the AMEX-10/WEKO-SEAL. This pressure is sustained while a soap and water test is applied to the outer edge and entire body of the seal.

E14.4.3 Test "Valve" Assembly

- (a) After the final test of 5 psig, the test "valve" of the AMEX-10/WEKO-SEAL is sealed with a counter sunk hex head completion plug using a non-toxic thread sealing compound on the threads.

E14.5 Personnel and Equipment

E14.5.1 Compression seals to be installed by personnel experienced in the installation and testing of internal compression seals.

E14.6 Method of Measurement and Basis of Payment

E14.6.1 Mobilization

- (a) Mobilization of Installation Technician shall be paid on a lump sum basis. The price paid shall include return travel, room and board of a factory technician. For the purpose of this contract, Room and Board shall be for one on site workday, unless time extension is required for repair of defective work, scheduling delays on the part of the Contractor, or other factors within the Contractors direct control, in which case, additional room and board costs shall be borne by the Contractor. The installation technician may be utilized by the City of Winnipeg at other locations to install further seals. Additional room and board required will be paid for outside of this contract.

E14.6.2 Supply of Internal Compression Seals

- (a) Supply of Internal Compression Seals will be measured on a unit basis. The units measured will be the total number of seals supplied, of each size, including seal, seating bands, an additional test band, wedges and lubricant. The price paid shall include all applicable taxes (excluding GST), freight, brokerage fees and duties. Seals not installed under this contract will become the possession of the City of Winnipeg.

E14.6.3 Installation of Internal Compression Seals

- (a) Installation of Internal Compression Seals will be measured on a unit basis. The units measured will be the total number of seals successfully installed and tested of each size. The price paid shall include all cost associated with the installation.