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DIVISION 2

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EXCAVATION AND BACKFILLING FOR STRUCTURES

1. GENERAL

1.1 Description

.1 Work includes, but is not necessarily limited to the following items:

- .1 Excavation to construct the Work
- .2 Disposal of surplus excavated material
- .3 Drain tile, drain pipe, and appurtenances
- .4 Dewatering, shoring, and bracing of excavations

1.2 Job Conditions

.1 Examination

- .1 Visit the Site and note all characteristics and irregularities affecting the Work of this Section.
- .2 To proceed with the Work will mean acceptance of the conditions, and failure to comply with the above will in no way form the basis for any claim.
- .3 Review the Geotechnical Report prior to submitting Bid for the Work.

.2 Protection

- .1 Use all means necessary to protect all materials of this Section before, during, and after installation, and to protect all objects designated to remain.
- .2 In the event of damage, immediately make all repairs and replacements necessary at no additional cost.
- .3 Protect benchmarks and structures against damage from equipment and vehicular traffic.

1.3 Reference Standards

- .1 Conform to requirements of the National Building Code and the Canadian Construction Safety Code.
- .2 Comply with excavation and trenching regulations of Provincial authorities.

1.4 Submittals

- .1 Submit an excavation plan sealed and signed by a qualified Professional Engineer registered in the Province of Manitoba in accordance with Section 01300. The qualified Professional Engineer will have a minimum of ten years experience in geotechnical analysis including but not limited to slope stability. Submit proof of qualifications, as requested by Contract Administrator. Indicate limits of cement-stabilized fill on the excavation plan.

EXCAVATION AND BACKFILLING FOR STRUCTURES

- .2 Submit plans for shoring, bracing, sheet piling, and related structural work, sealed and signed by a qualified Professional Engineer registered in the Province of Manitoba in accordance with Section 01300. The Professional Engineer retained by the Contractor for sealing of the plans shall review the shoring at critical stages and certify in writing to the Contract Administrator that the related construction meets the requirements of his or her design.
- .3 Submit 75 kg sample of Type 1, 2, and 3 materials for analysis by testing laboratory.
- .4 Submit 30 kg sample of Type 4 materials for analysis by testing laboratory.
- .5 Ship samples prepaid or deliver in tightly closed containers to testing laboratory designated by Contract Administrator.
- .6 Costs for analysis will be paid by the City.

1.5 Compaction Testing

- .1 Testing of compacted fill materials will be performed by an independent inspection and testing firm appointed and paid by the City.
- .2 The City will pay for the first series of tests only, on the area being evaluated. Contractor to pay for costs for additional testing, if required, if Work is not in accordance with the Contract Documents.
- .3 Tests are to be performed in accordance with ASTM D698 for Standard Proctor Density.
- .4 Notify the Contract Administrator when Work of this Section or portions of Work are completed to own satisfaction. Do not proceed with additional portions of Work until test results have been verified and reviewed.
- .5 If tests indicate that compacted materials do not meet specified required materials, remove defective Work, replace, and re-test at own expense as directed by the Contract Administrator.
- .6 Ensure compacted fills are tested and reviewed before proceeding with placement of surface materials.

2. PRODUCTS

2.1 General

- .1 All materials are subject to Contract Administrator's review and acceptance.
- .2 Granular materials to be composed of sound, hard, uncoated particles, free from injurious quantities of clay, flaky particles, soft shale, friable materials, roots, vegetable matter, and frozen lumps.

EXCAVATION AND BACKFILLING FOR STRUCTURES

- .3 Grading of granular materials to show no marked fluctuations between opposite ends of extreme limits.
 - .1 Type 1: well graded pit run gravel graded in accordance with Type 1 in Table CW2030.1 – Grading Requirements for Imported Backfill.
 - .2 Type 2: granular drain material shall consist of clean, crushed white crystalline limestone aggregate or a processed granular material (pea-gravel), ranging in size from 5 mm to 19 mm. Softer buff or yellow dolomite and dolostone will not be accepted. The material shall be free from sod, roots, organics, snow, and any other deleterious material.
 - .3 Type 3: base course shall consist of well graded granular or crushed limestone material in accordance with Table CW3110.2 - Base Course Material Grading Requirements.
 - .4 Type 4: sand shall consist of granular material free from silt, clay, loam, friable, or soluble material and vegetable matter, graded in accordance with Sand in Table CW2030.1 – Grading Requirements for Imported Backfill.
- .4 Suitable excavated material from the Site shall be free from organic material and rocks larger than 150 mm in size and building debris and is not to be frozen. Fill under landscaped areas to be free from alkali, salt, petroleum products, and other materials detrimental to plant growth and is not to be frozen.
- .5 Suitable excavated clay material from the Site shall be free from organic material and rocks larger than 150 mm in size and building debris and is not to be frozen. Provide at areas where clay cap is indicated in the Drawings.
- .6 Drain Tile to perforated Goldline pipe complete with knitted polyester continuous seamless sleeve as manufactured by Prinsco. Drain pipe from drain tile to sump pit is to be non-perforated Goldline pipe as manufactured by Prinsco. Appurtenances by same drain tile manufacture.
- .7 Cement-stabilized fill shall be in accordance with Table CW2160.1-Design Requirements for Concrete Used for Underground Structures.

3. EXECUTION

3.1 General

- .1 Familiarization
 - .1 Prior to all Work of this Section, become thoroughly familiar with the Site, the Site conditions, and all portions of the Work falling within this Section.
 - .2 Review and understand the Geotechnical Report – refer to Section 01055.

EXCAVATION AND BACKFILLING FOR STRUCTURES

.2 Protection

- .1 Before starting Work, locate all utilities crossing the Site. Notify all agencies or companies having jurisdiction over the specific utilities and protect, relocate, remove, or discontinue service according to their requirements. Any damages shall be repaired at the Contractor's expense.
- .2 Protect and restore pavements, boulevards, grassed areas, etc., that may be opened or damaged in the performance of the Work.
- .3 During construction, maintain roadways in a clean and safe condition and, at the completion of the Contract, clean and restore all roads used to perform the Contract.
- .4 To reduce surface runoff from exposed work areas wet weather restriction will apply to construction.
- .5 Implement and maintain erosion and sediment control measures.
- .6 Avoid excavation and construction activities with the potential to release airborne particulates during dry and windy periods.

3.2 Finish Elevations and Lines

- .1 For setting and establishing finish elevations and lines, secure the services of a registered surveyor or experienced instrumentman acceptable to the Contract Administrator.
- .2 Carefully preserve all data and all monuments. If data or monuments are displaced or lost, immediately replace at no additional cost to the City.
- .3 Place drain tile and drain pipe to indicate elevations.

3.3 Excavation

- .1 Three weeks prior to commencement of the Work, submit an excavation plan. No excavation Work shall proceed and no claim for delay will be allowed, until the excavation plan has been reviewed and accepted by the Contract Administrator.
- .2 Perform excavation in strict compliance to Workplace Safety and Health and authorities have jurisdiction.
- .3 Reduce excavation depths and cuts near wells and sensitive areas, where safe and feasible.
- .4 Excavate to noted limits and as required for the Work. Stockpile material to be used for backfilling on-site as directed by the Contract Administrator. Excess material is to be disposed of immediately.
- .5 Cover and stabilize stockpiles of soil with erosion control material.
- .6 Contaminated soil must be disposed of in accordance with provincial requirements.

EXCAVATION AND BACKFILLING FOR STRUCTURES

- .7 When complete, request Contract Administrator to review excavations.
- .8 Local pockets of material which, in the opinion of the Contract Administrator are unsuitable, shall be removed to such depths as required by the Contract Administrator.
- .9 The completed excavation shall provide clean, level, solid, and water-free surfaces at the required elevations, ready to receive construction.
- .10 Excavations shall not encroach on normal 45° bearing support under any foundation or structure.
- .11 Excavation slopes shall be designed in reference to the Geotechnical Report and shall be indicated on the excavation plan. Do not undermine the existing backfill below any structure.
- .12 Prepare areas around piles for adequate support of piling equipment.
- .13 Make good all damage occurring as a result of inadequate, unauthorized, or defective methods of protection.
- .14 Areas used for temporary stockpiling shall be restored to existing condition or better.

3.4 Shoring, Bracing, and Sheet Piling

- .1 Provide shoring, bracing, sheet piling, and related structural Work as required to prevent damage or undermining of the existing and new structures, excavations, and injury to personnel, specifically **the existing roadways, railway embankments, fencing, and cabling on the Site**. Submit Drawings and calculations sealed and signed by a qualified Professional Engineer registered in the Province of Manitoba for all shoring, bracing, sheet piling, and related structural Work used for the construction of this project.
- .2 Comply with all applicable rules and regulations of governmental authorities.
- .3 Erect shoring, bracing, and sheet piling as required, independent of utilities and structures.
- .4 Prefabricated cages or shields may be used to supplement or replace conventional shoring, provided they comply with all applicable safety regulations and permit placing and tamping of bedding material under and around new construction.
- .5 Maintain shoring, bracing, and sheet piling if used during backfilling and remove in stages as backfilling progresses.
- .6 Remove shoring, bracing, and sheet piling if used unless otherwise permitted by Contract Administrator.
- .7 If shoring, bracing, and sheet piling are allowed to remain, cut off to an elevation at least 1000 mm below finish grade and structures.
- .8 Assume full responsibility for any slope or structure failure, collapse, or movement of existing structures, shoring, bracing, sheet piling, earth banks, trenches, and other excavations.

EXCAVATION AND BACKFILLING FOR STRUCTURES

3.5 Dewatering

- .1 Surface water shall be handled in accordance with Section 01055 – Site Conditions. Excavation, pits, and the entire sub-grade in the vicinity of the Work shall be kept free of water. Positive surface drainage shall be maintained away from the excavation at all times. Provide and operate pumps or other suitable equipment, and provide and maintain a temporary drainage system within the excavation. Discharge from pumps or other dewatering equipment shall be located and controlled such that loss, damage, nuisance, or injury to the Work does not result. Additional excavation made necessary by water in the excavation shall be at no additional cost to the City.
- .2 Avoid dewatering in sensitive areas or near wells.
- .3 Avoid discharging into areas prone to flooding and erosion when trench dewatering.

3.6 Backfilling, Fill, and Compaction

- .1 Preparation
 - .1 Ensure areas to be backfilled are free from debris, snow, ice, and water and that ground surfaces are not in a frozen condition.
 - .2 Perform all necessary compaction of existing sub-grade surfaces under structures and slabs on grade if densities are not equal to that required for fill materials.
 - .3 Cut out soft areas of existing sub-grade, backfill with Type 1 fill, and compact to density specified for fill.
- .2 Backfilling and Filling
 - .1 Backfill and fill to grades, contours, levels, and elevations indicated on Drawings.
 - .2 Backfill and compact excavations as soon as possible and optimize the degree of compaction to minimize erosion.
 - .3 Place Type 2 material to avoid damage to drain tile. Hand level the material to ensure uniform placement.
 - .4 Where temporary unbalanced pressures are liable to develop on walls, erect necessary shoring to counteract imbalance.
 - .5 Backfill simultaneously on both sides of walls or structures to equalize soil pressures and to prevent unbalanced loading conditions.
 - .6 Do not backfill water-containing structures until after the watertightness tests have been completed and the structures have been accepted by the Contract Administrator.

EXCAVATION AND BACKFILLING FOR STRUCTURES

- .7 Do not backfill against foundation walls until the floor slabs, where applicable, have been completed and without the prior permission of the Contract Administrator. The wall and floor concrete must have attained the 28-day minimum compressive strength before backfilling.
 - .8 After sub-grade has been reviewed by the Contract Administrator, spread accepted fill material in layers, not exceeding specified uncompacted thickness, and then compact to required density prior to the addition of the next layer.
 - .9 Maintain optimum moisture content of materials to permit compaction to specified densities.
- .3 Compaction and Fill Types
- .1 Compact each soil layer to at least the specified minimum degree; repeat compaction process until plan grade is attained. Compaction densities indicated are based on ASTM D698 for Standard Proctor Density.
 - .2 Where excavation for structures will be below the bedding elevation of the proposed pipes, backfill the excavation for a distance 1.0 m each side of the centreline of the pipe to 100 mm below the pipe invert with cement-stabilized fill. Clearly indicated on the excavation plan the limits of cement-stabilized fill backfill.
 - .3 Type 1 Fill to be placed in lifts not greater than 200 mm in thickness around the structures and compacted to a density of at least 95 percent Standard Proctor. Do not compact backfill within 300 mm of building or tank wall. From 300 to 1500 mm away from wall, compact backfill with a walk-behind vibratory roller with maximum weight of a Bomag BW 75S or equivalent.
 - .4 Type 2 granular drain material, first lift to be placed to a depth of 300 mm above the crown of the drain tile, subsequent lifts to be placed in lifts not greater than 150 mm in thickness and compacted to a density of at least 95 percent Standard Proctor Density to ASTM D698. Surround the perforated pipes as shown on the Drawings.
 - .5 Type 3 Fill under concrete slabs on grade shall be placed in uniform lifts not greater than 150 mm in thickness and shall be compacted to a density of at least 100 percent Standard Proctor.
 - .6 Type 4 Fill to be placed in areas as required to bring grade to required levels under structural slabs.
 - .7 Suitable Excavated Material to be placed in lifts not greater than 200 mm in thickness around the structures and shall be compacted to a density of at least 95 percent Standard Proctor.
 - .8 Suitable Excavated Clay Material for the clay cap to be placed in lifts not greater than 300 mm in thickness around the structures and shall be compacted to a density of at least 95 percent Standard Proctor.

EXCAVATION AND BACKFILLING FOR STRUCTURES

3.7 Disposal

- .1 Surplus material not required for backfill and fill purposes shall be disposed of offsite at no extra cost to the City. The City's Sludge Drying Beds are available for disposal of surplus material, if required.

3.8 Clean-Up

- .1 As excavation proceeds, keep roads, streets, and sidewalks clean of dirt and excavated material.
- .2 Remove and dispose of all snow within the Work area as required to complete the Work.
- .3 Clean-up and wash down to remove all dirt and excavated materials caused by Work of this Section.
- .4 Clean at the end of each working day.

END OF SECTION

PLANING OF PAVEMENTS & BITUMINOUS PAVING

1. GENERAL

1.1 Work Included

- .1 This Specification covers the planing of asphalt pavements, the removal of lip curbs and the paving of bituminous pavements.

1.2 References

- .1 The following specifications of the City Standard Construction Specifications are applicable to the Work:
 - .1 CW 3410-R7 Asphaltic Concrete Pavement Works
 - .2 CW 3450-R4 Planing of Pavement
- .2 Measurement and payment clauses in the above specifications do not apply.
- .3 Division 2 General Requirements of the City Standard Construction Specification are not applicable.

2. PRODUCTS

2.1 Materials

- .1 Asphaltic concrete constituent materials and gradations shall conform to CW 3410-R7.

3. EXECUTION

3.1 General

- .1 Familiarization
 - .1 Prior to all Work of this Section, become thoroughly familiar with the Site, the Site conditions, and all portions of the Work falling within this Section.
 - .2 Review and understand the Geotechnical Report.
- .2 Protection
 - .1 Before starting Work, locate all utilities serving the Site. Notify all agencies or companies having jurisdiction over the specific utilities and protect, relocate, remove, or discontinue service according to their requirements. Any damages shall be repaired at the Contractor's expense.
 - .2 Protect and restore pavements, boulevards, grassed areas, etc., that may be opened or damaged in the performance of the Work.

PLANING OF PAVEMENTS & BITUMINOUS PAVING

- .3 During construction, and at the completion of the Contract, all roads used to haul materials shall be cleaned of materials dropped on them.

3.2 Asphaltic Concrete Pavements

- .1 Production, supply, compaction and placement of bituminous pavements for main line paving, tie-ins and approaches shall conform to CW 3410-R7.

3.3 Planing of Asphalt Pavement

- .1 Remove the existing asphalt overlay where shown on the Drawings and in accordance with CW 3450-R4.

3.4 Lip Curb Removal

- .1 Remove the existing lip curb by planing where shown on the Drawings and in accordance with CW 3450-R4.

END OF SECTION

EARTHWORK

1. GENERAL

1.1 Work Included

- .1 This Section outlines the requirements for: clearing and grubbing, excavation, supply and installation of base and sub-base materials, placement of suitable site fill material, removal of existing pavement, preparation of existing ground surface, embankment, compaction, ditch grading, boulevard grading, culvert installation and removal, sub drain installation, geotextile fabric and grouted stone riprap.

1.2 References

- .1 The following City Standard Construction Specifications are applicable:
 - .1 CW 3010-R4 Clearing and Grubbing
 - .2 CW 3110-R9 Sub-Grade, Sub-Base and Base Course Construction
 - .3 CW 3120-R1 Installation of Sub Drains
 - .4 CW 3130-R1 Supply and Installation of Geotextile Fabrics
 - .5 CW 3170-R3 Earthwork and Grading
 - .6 CW 3610-R3 Installation of Culverts
 - .7 CW 3615-R2 Riprap
- .2 Measurement and payment clauses in the above specifications are not applicable.
- .3 Division 2 General Requirements of the City Standard Construction Specification are not applicable.

2. PRODUCTS

2.1 Materials

- .1 Suitable site fill material shall be in accordance with Specification CW 3170-R3.
- .2 Use only those products listed in the Surface Works Approved Products in the City Standard Construction Specifications and in these Specifications.
- .3 Culvert properties to be in accordance with CW 3610-R3
- .4 Properties of subdrains to be in accordance with CW 3120-R1
- .5 Properties of geotextile fabrics to be in accordance with CW 3130-R1
- .6 Properties of grouted stone riprap shall conform to CW 3615-R2

EARTHWORK

3. EXECUTION

3.1 General

.1 Familiarization

- .1 Prior to all Work of this Section, become thoroughly familiar with the Site, the Site conditions, and all portions of the Work falling within this Section.
- .2 Review and understand the Geotechnical Report.

.2 Protection

- .1 Before starting Work, locate all utilities serving the Site. Notify all agencies or companies having jurisdiction over the specific utilities and protect, relocate, remove, or discontinue service according to their requirements. Any damages shall be repaired at the Contractor's expense.
- .2 Protect and restore pavements, boulevards, grassed areas, etc., that may be opened or damaged in the performance of the Work.
- .3 During construction, and at the completion of the Contract, all roads used to haul materials shall be cleaned of materials dropped on them.

3.2 Fill Placement

- .1 The Contractor shall place suitable site fill material stockpiled from excavation operations for the proposed structures to create embankments adjacent to the structures. Placements of suitable site fill material and embankment construction shall be completed in accordance with Specification CW 3170-R3.

3.3 Excavation

- .1 Strip topsoil in accordance with CW 3110-R9 in all areas where new roadways and ditches are to be constructed. Haul all stripped material off-site.
- .2 Remove trees, roots, rubbish and all other surface litter within the limits of the Work in accordance with CW 3010-R4. Dispose off-site.
- .3 Excavate to the lines and grades shown on the Drawings and Surface Works Standard Details in accordance with CW 3110-R9. Dispose of unsuitable fill materials off-site.
- .4 Excavate, load, haul and dispose of culverts to be removed off-site.

3.4 Subgrade Preparation

- .1 Prepare subgrade in accordance with CW 3110-R9. Upon approval of the excavation bottom by the Contract Administrator, compact subgrade to 95 percent Standard Proctor Density.
- .2 Place and compact additional suitable site material to bring subgrade up to bottom of sub-base elevation where required.

EARTHWORK

- .3 Proof roll subgrade prior to installation of geotextile fabric. Notify the Contract Administrator of deficiencies in the subgrade. Excavate defective subgrade areas as directed by the Contract Administrator. Backfill excavated areas with suitable site material.
- .4 Install subdrains as shown on the Drawings and in accordance with CW 3120-R1.
- .5 Install geotextile fabric in accordance with CW 3130-R1.

3.5 Installation of Culverts

- .1 Supply and install culverts to the line and grade as shown on the Drawings and in accordance with CW 3610-R3.

3.6 Sub-base and Base Course Construction

- .1 Construct sub-base and base course to the lines and grades shown on the Drawings in accordance with CW 3110-R9 for roadways and approaches.

3.7 Grouted Stone Riprap

- .1 Construct grouted stone riprap where shown on the Drawings and in accordance with CW 3615-R2.

3.8 Removal of Existing Pavement

- .1 Removal of existing pavement shall conform to CW 3110-R9.

END OF SECTION

EXCAVATION, TRENCHING, AND BACKFILLING

1. GENERAL

1.1 Description

- .1 This Section provides the requirements associated with the excavation, trenching and backfilling for utilities.

1.2 References

- .1 The following Specifications of the City of Winnipeg Standard Construction Specifications-latest edition are applicable to the Work:
 - .1 CW 2030-R7 Excavation, Bedding and Backfill
 - .2 Division 3 Standard Details – Underground Works
 - .1 SD-001 Standard Pipe Bedding
 - .2 SD-002 Standard Trench and Excavation Backfill
 - .3 SD-003 Jetting Nozzle Insertion Locations
 - .3 Division 3 Approved Products for Underground Works
- .2 Measurement and payment clauses in the above specifications are not applicable to the Contract.
- .3 Division 2 General Requirements of the City of Winnipeg Standard Construction Specification are not applicable to the Work.

1.3 Existing Conditions

- .1 Review the Geotechnical Report prior to submitting Bid for the Work.
- .2 Notify Contract Administrator in writing if subsurface conditions at Site differ materially from those indicated and await further instructions from the Contract Administrator.

2. PRODUCTS

2.1 Materials

- .1 Products shall be as specified in CW 2030-R7.

EXCAVATION, TRENCHING, AND BACKFILLING

3. EXECUTION

3.1 General

.1 Familiarization

- .1 Prior to all Work of this Section, become thoroughly familiar with the Site, the Site conditions, and all portions of the Work falling within this Section.
- .2 Review and understand the Geotechnical Report.

.2 Protection

- .1 Before starting Work, locate all utilities serving the Site. Notify all agencies or companies having jurisdiction over the specific utilities and protect, relocate, remove, or discontinue service according to their requirements. Any damages shall be repaired at the Contractor's expense.
- .2 Protect and restore pavements, boulevards, grassed areas, etc., that may be opened or damaged in the performance of the Work.
- .3 During construction, and at the completion of the Contract, all roads used to haul materials shall be cleaned of materials dropped on them.

.3 Do excavation, trenching and backfill to CW 2030.

.4 Except as specifically noted on the construction drawings, backfill requirements are as follows:

- .1 Beneath, or within 1 m of all existing and proposed pavements, structures or rail sub-grades: Class 2 Backfill.
- .2 Within boulevard areas, except as noted above: Class 4 Backfill.
- .3 Where trenchless installation is specified, backfill shafts with the class of backfill noted on the construction drawings.

.5 Stockpile material to be used for backfilling on-site as directed by the Contract Administrator. Excess material is to be disposed of immediately off-site.

.6 All excavated or disturbed areas are to be restored to a condition better than or equal to original. Restoration of boulevard areas will be with topsoil and sod; seeding will not be acceptable.

END OF SECTION

PILE FOUNDATIONS, GENERAL

1. GENERAL

1.1 Description

- .1 This Section provides the requirements associated with the installation of precast concrete piles as specified in Section 02468 – Precast Concrete Piles.

1.2 Delivery, Storage and Handling

- .1 Protect piles from damage due to excessive bending stresses, impact, abrasion, or other causes during delivery, storage, and handling.
- .2 Replace damaged piles to satisfaction of Contract Administrator. Causes for pile rejection are as follows:
 - .1 Out of fabrication tolerances at time of installation
 - .2 Cracked, spalled, or broken piles
 - .3 Out of driving tolerances

1.3 Existing Conditions

- .1 Review the Geotechnical Report prior to submitting Bid for the Work.
- .2 Notify Contract Administrator in writing if subsurface conditions at Site differ materially from those indicated and await further instructions from the Contract Administrator.

1.4 Scheduling

- .1 Submit schedule of planned sequence of driving to Contract Administrator for review, not less than two weeks prior to commencement of pile driving.

2. PRODUCTS

2.1 Materials

- .1 Material requirements for piles are specified in Section 02468 – Precast Concrete Piles.
- .2 Supply or fabricate full length piles as indicated and provide equipment to handle full length piles without cutting and splicing.
- .3 Do not splice piles without written permission of Contract Administrator. When permitted, provide details for Contract Administrator review. Design details of splice to bear dated seal and signature of Professional Engineer registered in the Province of Manitoba.

PILE FOUNDATIONS, GENERAL

3. EXECUTION

3.1 Equipment

- .1 Prior to commencement of pile installation, submit to Contract Administrator for review, details of equipment for installation of piles.
 - .1 Impact hammers: give manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer, mass of driving cap, and type and elastic properties of hammer and pile cushions.
- .2 Hammer
 - .1 Hammers with proven performance in local conditions for piles of the same size specified for this project will be accepted for use on this project. For other hammers the driveability analysis as outlined in the following paragraphs shall be submitted to the Contract Administrator for review prior to driving piles.
 - .2 Hammers to be selected on basis of driveability analysis using wave equation theory, performed to show that piles can be driven to levels indicated.
 - .3 The driveability analysis shall include, but not be limited to, the following: hammer, cushion, and capblock details; static soil parameters; quake and damping factors, total soil resistance, blow count, pile stresses, and energy throughput at representative penetrations.
 - .4 Driveability analysis shall be submitted to the Contract Administrator for review of the hammer or hammers.
 - .5 When required criteria cannot be achieved with the proposed hammer, use larger hammer and take other measures as required.
 - .6 Drop hammers are not permitted.
- .3 Leads
 - .1 Construct pile driver leads to provide free movement of hammer. Hold leads in position at top and bottom, with guys, stiff braces, or other means to ensure support to pile while being driven.
 - .2 Length: provide length of leads so that use of a follower is unnecessary.
 - .3 Swing leads: firmly guy top and bottom to hold pile in position during driving operation.
- .4 Followers: when permitted by the Contract Administrator, provide followers of such size, shape, length, and mass to permit driving pile in desired location to required depth and resistance. Provide followers with socket or hood carefully fitted to top of pile to minimize loss of energy and prevent damage to pile.

PILE FOUNDATIONS, GENERAL

3.2 Preparation

- .1 Ensure that ground conditions at pile locations are adequate to support pile driving operation. Make provision for access and support of piling equipment during performance of Work.
- .2 Pre-boring of holes may be acceptable to facilitate pile alignment control. Submit plan and procedures prior to commencing pile driving operations to the Contract Administrator for review.

3.3 Field Measurement

- .1 Contractor shall cooperate with the Contract Administrator and shall allow access by inspection and testing firm engaged by the City during pile installation operations to facilitate all the field measurements to be performed expeditiously.
- .2 Records of driving for each pile will include:
 - .1 Type and make of hammer, stroke, or related energy
 - .2 Other driving equipment including water jet, driving cap, cushion
 - .3 Pile size, cast date, batch number or designation, and supply length, location of pile in pile group, location or designation of pile group, and date driven
 - .4 Sequence of driving piles in group
 - .5 Number of blows per metre for entire length of pile and number of blows per 25 mm for last 150 mm
 - .6 Final tip, cutoff, and grade elevations
 - .7 Re-driving records
 - .8 Pile plumbness upon completion of driving
 - .9 Other pertinent information such as interruption of continuous driving and pile damage
 - .10 Record elevation taken on adjacent piles during, before, and after driving of each pile
 - .11 If requested by the Contract Administrator, all measurements, observation, and calculations associated with pile driving analyzer and wave equation analysis

3.4 Driving

- .1 Drive precast piles only when concrete has attained strength of 35 MPa as determined by related concrete compression testing in accordance with CSA A23.2-00.

PILE FOUNDATIONS, GENERAL

- .2 Use driving caps and cushions to protect piles. Reinforce pile heads as required by Contract Administrator. Piles with damaged heads as determined by Contract Administrator will be rejected.
- .3 Hold piles securely and accurately in position while driving.
- .4 Deliver hammer blows along the axis of the pile.
- .5 Drive piles to practical refusal, as outlined in the Geotechnical Report. Blow count requirements shall be determined by the Contract Administrator. If followers are used, established criteria for refusal will be increased as determined by the Contract Administrator.
- .6 When driving precast concrete piles, adjust hammer, as required, to deliver reduced impact so that reflected tensile stress in pile does not exceed allowable.
- .7 Do not drive piles within 10 m of masonry or concrete that has been in place less than seven days. Do not drive piles within 30 m of masonry or concrete which has been in place less than one day.
- .8 Re-strike already driven piles lifted during driving of adjacent piles to confirm and assure set.
- .9 Remove loose and displaced material from around piles after completion of driving, and leave clean, solid surfaces to receive foundation concrete.
- .10 Cut off piles neatly and squarely at elevations as indicated. Provide sufficient length above cut-off elevation so that part damaged during driving is cut off. Do not cut tendons or other reinforcement which will be used to tie supported structure above to pile. A minimum of 450 mm of strands shall remain for this purpose. The cut off surface of the piles shall be mechanically chipped to expose sound concrete.
- .11 Remove cut-off lengths from Site on completion of Work.

3.5 Design Load Capacity

- .1 Support for structures has been designed with allowable design load capacity of piles as follows:
 - .1 300 mm diameter hex - 445 kN
 - .2 350 mm diameter hex - 625 kN
 - .3 400 mm diameter hex - 800 kN
- .2 Installation of each pile will be subject to review of Contract Administrator. Contract Administrator will be sole judge of acceptability of each pile with respect to final driving resistance, depth of penetration, or other criteria used to determine load capacity. Contract Administrator to review final driving of all piles prior to removal of pile driving rig from Site.

PILE FOUNDATIONS, GENERAL

3.6 Driving Tolerances

- .1 Pile heads shall be within ± 50 mm of plan locations as indicated.
- .2 Piles shall not to be more than 2 percent of length out of vertical alignment.

3.7 Obstructions

- .1 Where obstruction is encountered that causes sudden unexpected change in penetration resistance or deviation from specified tolerances, proceed as directed by Contract Administrator.

3.8 Repair and Restoration of Rejected Piles

- .1 The Contract Administrator may require one or more of the following remedial measures in case of rejected piles:
 - .1 Pull out rejected pile and replace with new pile
 - .2 Remove rejected pile and replace with a new, and if necessary, a longer pile
 - .3 Remove rejected pile and fill hole as directed by Contract Administrator
 - .4 Leave rejected pile in place and cut off as directed by Contract Administrator
 - .5 Leave rejected pile in place, place adjacent pile(s), and modify pile cap as directed by Contract Administrator
- .2 No extra compensation will be made for removing and replacing or other Work made necessary through rejection of defective piles.

3.9 Protection

- .1 Protect adjacent structures, services, and Work of other Sections from hazards due to pile driving operations.
- .2 Arrange sequencing of pile driving operations and methods such that no damage occurs to adjacent existing structures. If damaged, remedy damaged items to restore to original or better condition at own expense.
- .3 After the pile driving is complete, undertake a review of the existing adjacent infrastructures with the Contract Administrator to identify any damage to the infrastructures resulting from the pile driving operations.
- .4 Protection for pile strand ends:
 - .1 Highly visible protection safety caps shall be installed for all pile reinforcing strand ends immediately following strand exposure operations. One protection cap may be used for each pile by grouping and securely tying the strands.

PILE FOUNDATIONS, GENERAL

- .2 The protection caps shall be highly visible and shall be made secure so that accidental contact will not easily dislodge the caps. Dislodged caps shall be re-installed immediately.
- .3 Pile reinforcing strands shall be protected from severe bending. Kinked or broken strands shall be repaired to the satisfaction of the Contract Administrator.

END OF SECTION

PRECAST CONCRETE PILES

1. GENERAL

1.1 Work Included

- .1 Fabrication, delivery, and installation of precast concrete piles.

1.2 References

- .1 CSA-A23.1-00/A23.2-00, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete
- .2 CSA A23.4/A251, Precast Concrete – Materials and Construction/Qualification Code for Architectural and Structural Precast Concrete Products
- .3 CAN/CSA-A3000, Cementitious Materials Compendium (consists of A5, A8, A23.5, A362, A363, A456.1, A456.2, and A456.3)

1.3 Shop Drawings

- .1 Submit Shop Drawings in accordance with Section 01300 - Submittals.
- .2 Each Drawing submitted shall bear the dated signature and stamp of qualified Professional Engineer registered in the Province of Manitoba.
- .3 Indicate the following items:
 - .1 Lifting point details and locations
 - .2 Storage support point locations
 - .3 Connector details complete with calculations
 - .4 Concrete strength
 - .5 Steel grades
 - .6 Reinforcing details
 - .7 Type and grade of steel

1.4 Certificates

- .1 Piles delivered to Site to be certified by manufacturer that each batch of piles to have strength of 35 MPa at 28 days.

1.5 Review and Monitoring

- .1 Notify Contract Administrator at least four days prior to pile driving operations.

PRECAST CONCRETE PILES

- .2 Pile driving review and monitoring is to be performed by a geotechnical inspection and testing firm appointed and paid by the City.
- .3 Provide free access to all portions of Work and cooperate with appointed firm.

2. PRODUCTS

2.1 Materials

- .1 Concrete mixes and materials: to CSA-A23.1-00 and CSA-A23.4
- .2 Reinforcing steel: to CAN/CSA-G30.18
- .3 Cold-drawn steel wire for concrete reinforcement: to ASTM A82
- .4 Fabricate and supply full length piles as indicated and provide equipment to handle full length piles without cutting and splicing.

2.2 Qualifications

- .1 Pile type shall have a proven record of successful service in the Province of Manitoba of at least 20 years.

2.3 Concrete Mixes

- .1 Proportion normal density concrete in accordance with CSA-A23.1-00, Alternative 1, to give following properties:
 - .1 Use Type 50 cement
 - .2 Minimum compressive strength at 28 days: 35 MPa
 - .3 Minimum cement content: 365 kg/m³ of concrete
 - .4 Maximum water/cement ratio: 0.40
 - .5 Nominal size of coarse aggregate: 20 mm maximum
 - .6 Coarse and fine aggregates to be on the City accepted list
 - .7 Air content: 5 to 8 percent, to ASTM C260
 - .8 Chemical admixtures: in accordance with ASTM C494
 - .9 Pozzolanic mineral admixtures: in accordance with CSA 3000

PRECAST CONCRETE PILES

3. EXECUTION

3.1 Fabrication

- .1 Fabricate precast concrete piles to lengths determined with reference to the geotechnical information and required cut-off elevations.
- .2 Fabricate piles to following finish tolerances:
 - .1 Length: ± 3 mm/m of length.
 - .2 Cross section:
 - .1 Solid hexagon sections: -5 to +10 mm
 - .2 Deviation from straight line: not more than 3 mm/m of length; 10 mm in full length
 - .3 Deviation of internal core from true position: 10 mm
 - .4 Pile head: 10 mm/m from true right angle plane; surface irregularities 3 mm
 - .5 Strand projection: strands shall be cut off flush or be slightly below pile head surface
 - .6 Location of reinforcing steel main reinforcing cover: -3 to +5 mm; spiral: 10 mm
- .3 Pre-stress piles under the direction of an experienced and competent supervisor. All personnel operating the stressing equipment shall have been trained in its use.
- .4 De-tension in a manner to keep eccentricity to a minimum. Cut prestress strands in a manner to minimize the internal stress variation to the pile as much as possible.
- .5 Quality and dimensions of piles will be determined by Contract Administrator. Remove rejected piles from Site.
- .6 Submit to Contract Administrator concrete quality control records for all precast piles delivered to Site prior to installation.

3.2 Handling

- .1 Protect piles from damage due to excessive bending stresses, impact, abrasion, or other causes during handling, storage, and delivery both at the fabrication plant and on-site.
- .2 Replace damaged piles to satisfaction of Contract Administrator.

END OF SECTION

WATERMANS

1. GENERAL

1.1 Work Included

- .1 The Work included in this Section generally includes, but is not limited to the following items:
 - .1 Construction of new watermains and appurtenances by open trench and trenchless methods.
 - .2 Construction of new fire hydrants and valves.
 - .3 Connections to the existing site water distribution system.
 - .4 Construction of 25 mm water service connection to the Blower Building, 25 mm water service connection to the Fan Room, 100 mm water service to the Soda Ash Silo, and 38 mm water service connections to emergency showers/eyewashes.
 - .5 Pressure testing and disinfection of new water piping.

1.2 References

- .1 The following Specifications of the City of Winnipeg Standard Construction Specifications-latest edition are applicable to the Work:
 - .1 Section 02315 Excavation, Trenching and Backfilling
 - .2 CW 2110-R9 Watermains
 - .3 CW 2125-R3 Flushing, Hydrostatic Leakage Testing and Disinfection of Watermains and Water Services
 - .4 CW 2160-R7 Concrete Underground Structures and Works
 - .5 Division 3 Standard Details – Underground Works
 - .1 SD-001 Standard Pipe Bedding Classes
 - .2 SD-002 Standard Trench and Excavation Backfill Classes
 - .3 SD-003 Jetting Nozzle Insertion Locations
 - .4 SD-004 Concrete Thrust Blocks for Horizontal Watermain Fittings
 - .5 SD-005 Concrete Thrust Blocks for Vertical Watermain Fittings
 - .6 SD-006 Standard Fire Hydrant Assembly

WATERMAINS

- .7 SD-008 Location Map for Watermain Valve Closing Direction
- .8 SD-012 Water Service 20 mm to 50 mm
- .9 SD-016 Standard Watermain Valve Installation
- .10 SD-018 Watermain and Water Service Insulation
- .6 Division 3 Approved Products for Underground Works
- .2 Measurement and payment clauses in the above Specifications are not applicable to the Contract.
- .3 Division 2 General Requirements of the City of Winnipeg Standard Construction Specification are not applicable to the Work.

2. PRODUCTS

2.1 Materials

- .1 Use only those Products listed as Approved Products for Underground Use in the City of Winnipeg.

3. EXECUTION

3.1 General

- .1 Familiarization
 - .1 Prior to all Work of this Section, become thoroughly familiar with the Site, the Site conditions, and all portions of the Work falling within this Section.
 - .2 Review and understand the Geotechnical Report.

3.2 Excavation, Bedding and Backfill

- .1 Do excavation, bedding and backfill to Section 02315. Pipe bedding to be Class B Sand bedding.

3.3 Installation

- .1 Installation to CW 2110.
- .2 Install pipes to the lines and grades shown on the Drawings.
- .3 Insulate trenches to CW 2110, SD 018 where noted.

WATERMAINS

- .4 Coordinate all shut downs with Contract Administrator and submit schedule for shut downs 14 days prior to Work.

- .5 Operation of Valves
 - .1 Valves and hydrants on existing watermains and on new watermains connected to the existing system are only to be operated by personnel from the Water Services Division of the Water and Waste Department.
 - .2 Schedule valve operations with Water Service Division a minimum 24 hours prior to the required shut down or turn on.
 - .3 Submit schedule of all valve operations to the Contract Administrator and maintain a record of all valve operations performed by the Water Services Division.

- .6 Connection to the Existing System
 - .1 Locate and confirm size and material of the existing watermain prior to making connection.
 - .2 Submit schedule of connection to Contract Administrator 48 hours prior to Work.
 - .3 Limit interruption of service during connection to a maximum of six hours.

3.4 Testing

- .1 Perform hydrostatic leakage testing and disinfect pipe in accordance with CW 2125.

END OF SECTION

SANITARY SEWERS

1. GENERAL

1.1 Work Included

- .1 Construction of new sanitary sewer services from the emergency shower/eyewash stations and the soda ash silo to the equalization basin.

1.2 References

- .1 The following Specifications of the City of Winnipeg Standard Construction Specifications latest edition are applicable to the Work:
 - .1 Section 02315 Excavation, Trenching and Backfilling
 - .2 CW 2130-R10 Gravity Sewers
 - .3 CW 2160-R7 Concrete Underground Structures and Works
 - .4 Division 3 Standard Details – Underground Works
 - .1 SD-001 Standard Pipe Bedding Classes
 - .2 SD-002 Standard Trench and Excavation Backfill Classes
 - .3 SD-003 Jetting Nozzle Insertion Locations
 - .5 Division 3 Approved Products for Underground Works
- .2 Measurement and payment clauses in the above specifications are not applicable to the Contract.
- .3 Division 2 General Requirements of the City of Winnipeg Standard Construction Specification are not applicable to the Work.

2. PRODUCTS

2.1 Materials

- .1 Use only those products listed as Approved Products for Underground Use in the City of Winnipeg.
- .2 Flexible couplings at connections to structures shall conform to City of Winnipeg Standard AT-4.1.1.65.

SANITARY SEWERS

3. EXECUTION

3.1 General

.1 Familiarization

.1 Prior to all Work of this Section, become thoroughly familiar with the Site, the Site conditions, and all portions of the Work falling within this Section.

.2 Review and understand the Geotechnical Report.

3.2 Excavation, Bedding and Backfill

.1 Do excavation, bedding and backfill to CW 2030.

.2 Pipe bedding shall be minimum Class B compacted sand bedding.

3.3 Installation

.1 Installation to CW 2130.

.2 Insulate trenches to City of Winnipeg standard detail SD 018 where noted.

END OF SECTION

SEWAGE FORCEMAINS

1. GENERAL

1.1 Work Included

- .1 The Work included in this Section generally includes, but is not limited to the following items:
 - .1 Construction of centrate forcemain by open trench and trenchless methods, from the gallery adjacent to the sludge dewatering building to the new nitrate removal facility, including cleanout chambers.
 - .2 Construction of treated centrate forcemain by open trench and trenchless methods, from the new nitrate removal facility to existing manhole north of the sludge dewatering building. Construction of air release valve and meter chamber and associated piping.
 - .3 Construction of return activated sludge, waste activated sludge, and flushing water lines from the new nitrate removal facility to the high purity oxygen reactor.
 - .4 Hydro static leakage testing of new piping.

1.2 References

- .1 Section 02315 Excavation, Trenching and Backfilling
- .2 The following specifications of the City of Winnipeg Standard Construction Specifications latest edition are applicable to the Work:
 - .1 CW 2110-R9 Watermains
 - .2 CW 2125-R3 Flushing, Hydrostatic Leakage Testing and Disinfection of Watermains and Water Services
 - .3 CW 2160-R7 Concrete Underground Structures and Works
 - .4 CW 2130-R10 Gravity Sewers
 - .5 CW 2160-R7 Concrete Underground Structures and Works
 - .6 Division 3 Approved Products for Underground Works
 - .1 SD-001 Standard Pipe Bedding Classes
 - .2 SD-002 Standard Trench and Excavation Backfill Classes
 - .3 SD-003 Jetting Nozzle Insertion Locations
 - .4 SD-004 Concrete Thrust Blocks for Horizontal Watermain Fittings

SEWAGE FORCEMAINS

- .5 SD-005 Concrete Thrust Blocks for Vertical Watermain Fittings
- .6 SD-010 Standard Precast Concrete Manhole (for Up to 525 Diameter Pipe)
- .3 Measurement and payment clauses in the above specifications are not applicable to the Contract.
- .4 Division 2 General Requirements of the City of Winnipeg Standard Construction Specification are not applicable to the Work.

1.3 Standards

- .1 Work and materials to be in accordance with the following standards.
 - .1 AWWA C-906-99 Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 inch (100 mm) through 63 inch (1575 mm) for Water Distribution and Transmission
 - .2 NSF National Sanitation Foundation
 - .3 PPI Plastic Pipe Institute
 - .4 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C104/A21.4-95, Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
 - .2 ANSI/AWWA C104/A21.4-95, Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
 - .3 ANSI/AWWA C151/A21.51-02, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water
 - .4 ANSI/AWWA C600-99, Installation of Ductile-Iron Water Mains, and Their Appurtenances
 - .5 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM D 2241-00, Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
 - .2 ASTM F1055-98e1 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
 - .3 ASTM F1290-98a(2004) Standard Practice for Electrofusion Joining Polyolefin Pipe and Fitting
 - .4 ASTM D1603-06 Standard Test Method for Carbon Black Content in Olefin Plastics

SEWAGE FORCEMAINS

- .5 ASTM F714-05 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
- .6 ASTM D3035 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
- .7 ASTM D2837-04 Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
- .8 ASTM D1248-05 Standard Specification for Polyethylene Plastics Extrusion Material for Wire and Cable
- .9 ASTM D3350-05 Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
- .10 ASTM D2657-03 Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings
- .11 ASTM C1433M-02a Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
- .6 Canadian General Standards Board (CGSB): CGSB 41-GP-25M-77, Pipe, Polyethylene, for the Transport of Liquids.
- .7 Canadian Standards Association (CSA International)
 - .1 CSA B137.1-02, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services
 - .2 CSA B137.3-02, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications

1.4 Submittals

- .1 Submit manufacturer's test data and certification at least two weeks prior to beginning Work in accordance with Section 01300.

2. PRODUCTS

2.1 Materials

- .1 Use only those products listed as Approved Products for Underground Use in the City of Winnipeg except as noted herein.
- .2 Piping: pipe material, pressure class and coatings where applicable are indicated on the construction Drawings.

SEWAGE FORCEMAINS

- .3 Ductile Iron Pipe: to ANSI/AWWA C151/A21.51, Pressure Class 350 for 250 mm nominal diameter pipe and Pressure Class 250 for 350 mm nominal diameter pipe.
 - .1 Coating: fusion bonded epoxy coating to ANSI/AWWA C213-01
 - .2 Cement-mortar lining: where indicated on the construction Drawings, cement-mortar lined and seal coated to ANSI/AWWA C104/A21.4
 - .3 Glass Lining:
 - .1 Where specified indicated on the construction Drawings, apply glass lining to pipe interior in two (2) coats.
 - .2 Sandblast interior pipe surfaces prior to lining application to white metal finish in accordance with SSPC-10.
 - .3 After application of first and each subsequent coat, expose to naturation temperature above 750°C.
 - .4 Finished lining will be:
 - .1 250 to 300 microns thick
 - .2 Density of 2.5 g to 3.0 g per cubic centimetre
 - .3 Hardness in excess of 5.0 on the MOHS scale
 - .4 Capable of withstanding 175°C thermal shock without crazing, blistering, or spalling
 - .5 No visible loss of surface gloss after immersion in 8 percent sulphuric acid solution at 65°C for a period of ten minutes.
 - .6 No more than 0.01 percent exposure of the base metal due to defects in the glassed surface.
 - .5 Provide sample to Contract Administrator for use as a comparison guide.
 - .6 Perform the following testing procedures in factory and submit certification:
 - .1 The glass lining shall provide continuous coverage when tested by a low voltage wet sponge holiday detector, with no isolated voids permitted due to casting anomalies. Testing procedure and acceptance criteria shall be as per "MP-92, Porcelain Enamel Continuity Testing", as listed in Clauses 2.10.5.7.1 – .3.

SEWAGE FORCEMAINS

- .1 Purpose: proper application of the porcelain enamel coating provides beneficial long term characteristics of lubricity, adherence, and resistance to corrosion and high temperature. Currently, there is no test method, either destructive or non-destructive, which directly measures these characteristics. Rather, the industry has developed a testing method utilizing a holiday detector, which determines the continuity of the glass lining and indicates the relative quality of the process. This method is commonly referred to as "spark test".
- .2 Test Description
 - .1 Equipment: the equipment consists of a Tinker & Razor electronic device or equivalent designed to locate holidays (pinholes, voids, ridges, etc.) in the non-conducting porcelain enamel lining. It functions by applying a 67.5 V potential across the glass lining. Any pinholes or other holidays in the glass lining will close the circuit and produce an audible signal from the detector for any resistance less than 10,000 ohms. The current is applied through a circular sponge which has been wetted using water containing approximately 1 percent of a wetting agent such as Kodak "Photo Flo".
 - .2 Procedure: for testing long pipe sections, the diameter of the wetted sponge shall exceed the diameter of the pipe so that the sponge is in full circumferential contact with the porcelain enamel lining of the pipe. The sponge is attached to a rod which allows the sponge to be pushed through at least 50 percent of the pipe. Any discontinuities will result in an audible signal which will be recorded with regard to position along the pipe. Testing is performed from both ends of the pipe.
 - .3 Special techniques are required at the exposed pipe ends which are not enameled. If, due to excess water on the sponge, the electric current short circuits to the end of the pipe resulting in an audible signal (typically within 75 mm of the end), a visual inspection shall be made to determine if discontinuities exist.
- .3 Acceptance criteria: the pipe or fittings as tested by the procedure shall be rejected from shipment if testing reveals isolated voids and pinholes due to casting irregularities which represent more than 0.01 percent of the total glassed surface. Rejected pipe shall be evaluated for additional coating with porcelain enamel or for total reblasting, reprocessing, and retesting.
- .7 Acceptable products modified to meet this Specification are:
 - .1 Vitco
 - .2 Waterworks

SEWAGE FORCEMAINS

- .8 Field Procedure:
 - .1 All handling or lifting of glass lined pipe, valves and fittings shall be done on the exterior only.
 - .2 Avoid lifting internally with hooks, forks or chains at any time.
 - .3 Welding on glass lined pipe is not permitted. Wall collars, restrained joint weld ends, tapping connections, etc. to be fabricated by the manufacturer and then glass lining applied.
 - .4 Glass lined pipe shall not to be cut to length for field closure pieces. No site modification is permitted to the glass lined pipe without specific written instruction from the glass-lining manufacturer.
- .4 Pipe joints: to ANSI/AWWA C111/A21.11, push-on type
- .5 Rubber gaskets: to ANSI/AWWA C111/A21.11.
- .6 Flanged joints: provide flanged joints for connection to HDPE piping.
- .7 Provide mechanical couplings to City of Winnipeg Standard No. AT-4.1.1.65 for connection to PVC piping.
- .4 Polyvinyl chloride (PVC) pipe: PVC 1120 SDR 26 Series 160 to CSA-B137.3 ASTM D 2241 and NSF 61. All pipes shall be certified by CSA as being made in accordance to their specifications and stamped accordingly with the CSA logo.
 - .1 PVC fittings: in general conformance to AWWA C907-91 and of the same materials as the pipe.
 - .2 Pipe joints: bell and spigot with rubber gaskets to ANSI/AWWA C111/A21.11, Gasket to be permanently inserted and fastened at the factory.
- .5 Polyethylene pressure pipes:
 - .1 Use DR 11 for all piping unless otherwise stated.
 - .2 To be iron pipe sized, certified for potable water use, made in accordance with AWWA C901 or C906, CSA/Warnock Hersey/or NSF International certified.
 - .3 Resin to be Type III, Category 5, Class C, Grade P34 in ASTM D-1248 with a Long Term Hydrostatic Strength of 11 MPa when tested and analyzed by ASTM D2837. Resin to have a minimum hydrostatic design stress of 800 psi @140 F (i.e. 1600 psi @ 73 F).
 - .4 Minimum carbon black shall not be less than 2 percent when determined in accordance with ASTM D1603 as per CSA B137.1, 4.2 and 5.2.

SEWAGE FORCEMAINS

- .5 Shall contain no recycled material except that generated in the manufacturer's own plant from the resin of the same specification and same raw material supplier.
- .6 Compounds used shall meet the requirements of clause 7.2 of CSA B137.0 for toxicity for potable water service.
- .7 Minimum cell classification shall be PE 345434C for PE 3408 materials, per ASTM D 3350.
- .8 Design pressure rating in accordance with the relationships of the ISO-modified formula in accordance with ASTM F 714 and AWWA C906.
- .9 Dimensions to be in accordance with manufacturers' literature. Provide manufacturer's installation manual to the satisfaction of the Contract Administrator prior to ordering material.
- .10 Markings: continuously or at 1.5 m intervals indent print the following: pipe manufacturer, nominal pipe size, dimension ratio or series, PE grade, CSA/Warnock Hersey or NSF International certification complete with certification trademark logo, CSA/ASTM specification standard to which the pipe is certified, and date of manufacture.
- .11 Submittals:
 - .1 Submit manufacturer's recommended fusion parameters.
 - .2 Submit data on all fusion welds performed. Data shall include:
 - .1 Location of weld
 - .2 Ambient temperature
 - .3 Fusion temperature
 - .4 Interface pressure
 - .5 Heating time
 - .6 Cooling time
- .12 Maximum pipe ovality for polyethylene pipe prior to joining shall not exceed 4 percent.
- .13 Polyethylene Fittings: to be iron pipe sized, certified for potable water use, made in same manner and materials as pipe. Fittings to have same certification as piping. Polyethylene to polyethylene joints to be as per the following:
 - .1 Joints to be thermal butt fusion welded or electrofusion fittings to AWWA C207-78. Joints at ends may be flanged with backing flanges. Thermal socket fusion for sizes 75 mm and smaller.

SEWAGE FORCEMAINS

- .14 Back Up Rings: use epoxy coated ductile iron back up rings unless otherwise indicated on the Drawings or as directed by the Contract Administrator.
- .15 Bolts, Nuts: to be 304 or better stainless steel bolts, nuts and washers on all couplers or materials which are to be buried or submerged. Provide "certification" to Contract Administrator that materials used for bolts, nuts, and washers are stainless steel 304 or better.
- .16 Mechanical couplings:
 - .1 In cleanout chambers:
 - .1 HDPE piping to HDPE piping Victualic coupling Style 995 complete with stainless steel insert stiffeners. Couplings shall be zinc coated and be furnished with stainless steel trim as specified above.
 - .2 HDPE piping to DI piping Victualic coupling Style 997 complete with stainless steel insert stiffeners. Couplings shall be zinc coated and be furnished with stainless steel trim as specified above.
 - .17 All mechanical couplings shall be installed with stainless steel insert stiffeners.
- .6 Flexible couplings at connections to structures shall conform to City of Winnipeg Standard AT-4.1.1.65.
- .7 Chambers:
 - .1 Cleanout chambers: precast concrete manholes to CW 2130
 - .2 Valve/Meter Chambers: precast concrete box culvert sections to ASTM C1433 cover range as shown on the Drawings, HS20 live load. Submit Shop Drawings sealed and signed by a qualified Professional Engineering registered in the Province of Manitoba in accordance with Section 01300.
 - .3 Air/Vacuum Valve: 50 mm x 50 mm air vacuum valve, complete with inlet isolation valve, blow off valves and minimum 1.5 m flush hose with quick disconnect fittings. Acceptable Product: G.A. Industries Figure 935 or equal.

3. EXECUTION

3.1 General

- .1 Familiarization
 - .1 Prior to all Work of this Section, become thoroughly familiar with the Site, the Site conditions, and all portions of the Work falling within this Section.
 - .2 Review and understand the Geotechnical Report.

SEWAGE FORCEMAINS

3.2 Excavation, Bedding and Backfill

- .1 Do excavation, bedding and backfill to CW 2030.
- .2 Pipe bedding and initial backfill shall be Type 2 material as specified in Table CW 2030.1.

3.3 Installation

- .1 Installation to CW 2130
- .2 Insulate trenches to City of Winnipeg standard detail SD 018 where noted.
- .3 Thermal fusion of HDPE piping shall be performed only by personnel trained in the process of thermal butt fusion welding and in the use of the fusion equipment employed and shall be certified by the pipe manufacture as having received the required factory training within the last 12 months for the relevant pipe sizes. Submit evidence of training certification prior to commencement.
- .4 Thermoplastic pipes shall be installed with continuous #8 bare copper tracer wire buried 150 mm above the top of the pipe. At each end, and every 120 m tracer wires shall be brought to the surface in 100 mm PVC SDR35 casings topped with cast iron valve box tops to City of Winnipeg standards. Valve box top to be marked "S".

3.4 Testing

- .1 Perform hydrostatic leakage testing in accordance with CW 2125 and as indicated herein. Disinfection of the piping is not required.
- .2 For polyethylene piping - to accommodate the initial expansion of the pipe under test, sufficient make-up water shall be added to the system at hourly intervals for three hours to return to the test pressure. After completion of the initial expansion phase the pipe shall be tested for a period of two hours.
- .3 No leakage shall be permitted in polyethylene piping.

END OF SECTION

LAND DRAINAGE SEWER

1. GENERAL

1.1 Work Included

- .1 The Work included in this Section generally includes, but is not limited to the following items:
 - .1 Construction of new land drainage sewers, manholes and catchbasins by open trench and trenchless methods.
 - .2 Connections to the existing land drainage sewer system.
 - .3 Construction of by-pass drain from the methanol loading area to the SBR, including by-pass valve chamber.
 - .4 Video inspection of new land drainage sewers.

1.2 References

- .1 The following specifications of the City of Winnipeg Standard Construction Specifications latest edition are applicable to the Work:
 - .1 Section 02315 Excavation, Trenching and Backfilling
 - .2 CW 2130-R10 Gravity Sewers
 - .3 CW 2145-3 Sewer and Manhole Inspections
 - .4 CW 2160-R7 Concrete Underground Structures and Works
 - .5 Division 3 Standard Details – Underground Works
 - .1 SD-001 Standard Pipe Bedding Classes
 - .2 SD-002 Standard Trench and Excavation Backfill Classes
 - .3 SD-003 Jetting Nozzle Insertion Locations
 - .4 SD-010 Standard Precast Concrete Manhole (for Up to 525 Diameter Pipe)
 - .5 SD-020 Nine Arm Mandrel and Proving Ring for 5.25% Deflection Testing of SDR 35 PVC Pipe
 - .6 SD-023 Curb and Gutter Inlet with Catch Pit
 - .7 SD-024 Catchbasin with Curb and Gutter Inlet
 - .8 SD-025 Standard Catchbasin

LAND DRAINAGE SEWER

- .6 Division 3 Approved Products for Underground Works
- .2 Measurement and payment clauses in the above specifications are not applicable to the Contract.
- .3 Division 2 General Requirements of the City of Winnipeg Standard Construction Specification are not applicable to the Work.

2. PRODUCTS

2.1 Materials

- .1 Use only those products listed as Approved Products for Underground Use in the City of Winnipeg or as noted herein.
- .2 Where noted, 150 mm PVC piping shall conform to the following:
 - .1 Polyvinyl chloride (PVC) pipe: PVC 1120 SDR 26 Series 160 to CSA-B137.3 ASTM D 2241 and NSF 61. All pipes shall be certified by CSA as being made in accordance to their specifications and stamped accordingly with the CSA logo.
 - .2 Pipe joints: bell and spigot with rubber gaskets to ANSI/AWWA C111/A21.11, Gasket to be permanently inserted and fastened at the factory.
- .3 By-pass drain piping:
 - .1 Dual wall PVC piping system. Schedule 80 PVC (Primary)/Schedule 80 PVC (Secondary) double containment piping system suitable for the conveyance of storm water and/or methanol and or ethanol at atmospheric pressure.
 - .2 Submit Shop Drawings of the proposed piping system, including pipe support and spacing, terminations, wall penetrations, joint details, repair methods, valve connections, and all other pertinent technical data.
 - .3 Acceptable product: guardian prefabricated system as manufactured by IPEX or equal.
- .4 By-pass piping valves:
 - .1 Carbon Steel ball valves
 - .1 Body Carbon Steel
 - .2 Ball Stainless Steel
 - .3 Rating Class 150
 - .4 Seats PTFE

LAND DRAINAGE SEWER

- .5 Body/Valve Ends Split Body, Flanged
- .6 Shaft Stainless Steel, (304 or 316). Blow-out proof
- .7 Pattern Full Port
- .8 Trim 316 SS
- .2 Acceptable products:
 - .1 Kitz K150 SCTBZM, Watts CF-1500, Velan F-01402-SS, Crane KF943S, American Valve Model 4000D
- .3 Valve operator: lever style, with spindle extension and valve stand operator mounted on roof of valve chamber.
- .4 Quarter-turn lever operators to be perpendicular to the pipe run when the valve is closed.
- .5 Lever operators to be two position. The maximum pull at the end of the lever arm not to exceed 300 N when one side of the valve is at test pressure and one side is at atmospheric pressure. Minimum lever length to be 650 mm.
- .6 Provide Shop Drawings for valves and operators
- .5 Flexible couplings at connections to structures shall conform to City of Winnipeg Standard AT-4.1.1.65.

3. EXECUTION

3.1 General

- .1 Familiarization
 - .1 Prior to all Work of this Section, become thoroughly familiar with the Site, the Site conditions, and all portions of the Work falling within this Section.
 - .2 Review and understand the Geotechnical Report.

3.2 Excavation, Bedding and Backfill

- .1 Do excavation, bedding and backfill to CW 2030.
- .2 Pipe bedding shall be Class B compacted sand bedding except as follows:
 - .1 Bedding and initial backfill for multiple pipes in common trench shall be Type 2 material as specified in Table CW 2030.1.

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3.3 Installation

- .1 Installation to CW 2130
- .2 Install dual-wall piping system in accordance with manufactures recommendations. The manufacturer shall furnish the services of a competent representative to supervise the Contractor's personnel during the start of the installation.
- .3 Maintain all sewer flows at all times during installation.
- .4 Abandon or remove elements of existing land drainage sewer system as indicated.
- .5 Insulate trenches as indicated on the construction Drawings in accordance with CW 2110.
- .6 Support valves in chambers with cast-in-place concrete supports to CW 2160.

3.4 Testing

- .1 Perform sewer and manhole inspections in accordance with CW 2145.
- .2 Testing procedure for dual wall piping as follows:
 - .1 The primary piping system shall be hydrostatically tested at 0.7 MPa in accordance with CW 2145. The secondary pipe shall be hydrostatically tested at 0.7 MPa in accordance with CW 2145, or as an alternative the use of air at a MAXIMUM 34.5 kPa (gauge) shall be allowed. The external joint should be soaped and visually inspected for leaks.
 - .2 Complete testing in strict accordance with the recommendations of the manufacturer including the sequence and duration of such tests.

END OF SECTION

PORTLAND CEMENT CONCRETE PAVING

1. GENERAL

1.1 Work Included

- .1 Construction of proposed building Portland Cement exterior concrete pavements, curbs and sidewalks.

1.2 References

- .1 The following specifications of the City Standard Construction Specifications are applicable to the Work:
 - .1 CW 3240-R6 Renewal of Existing Curbs
 - .2 CW 3310-R10 Portland Cement Concrete Pavement Works
 - .3 CW 3325-R2 Portland Cement Concrete Sidewalk
 - .4 CW 3230-R5 Full-Depth Patching of Existing Pavement Slabs and Joints
 - .5 CW 3235-R6 Renewal of Existing Miscellaneous Concrete Slabs
- .2 Measurement and payment clauses in the above specifications do not apply.
- .3 Division 2 General Requirements of the City Standard Construction Specification are not applicable.

2. PRODUCTS

2.1 Materials

- .1 Properties of Portland Cement Concrete to be in accordance with CW 3310-R10
- .2 Properties of Reinforcing Steel to be in accordance with CW 3310-R10

3. EXECUTION

3.1 General

- .1 Familiarization
 - .1 Prior to all Work of this Section, become thoroughly familiar with the Site, the Site conditions, and all portions of the Work falling within this Section.
 - .2 Review and understand the Geotechnical Report.

PORTLAND CEMENT CONCRETE PAVING

.2 Protection

- .1 Before starting Work, locate all utilities serving the Site. Notify all agencies or companies having jurisdiction over the specific utilities and protect, relocate, remove, or discontinue service according to their requirements. Any damages shall be repaired at the Contractor's expense.
- .2 Protect and restore pavements, boulevards, grassed areas, etc., that may be opened or damaged in the performance of the Work.
- .3 During construction, and at the completion of the Contract, all roads used to haul materials shall be cleaned of materials dropped on them.

3.2 Construction of Reinforced Concrete Pavements

- .1 Supply, place, and finish Portland Cement Concrete pavement to the line and grades shown on the Drawings and in accordance with CW 3310-R10.

3.3 Installation of Drilled Tie Bars in Concrete Pavements

- .1 Install 20 M epoxy coated drilled tie-bars along the longitudinal and transverse joints of the existing concrete pavement at mid-depth in accordance with CW 3230-R5.

3.4 Installation of Drilled Tie Bars in Dowelled Barrier Curb

- .1 Install 20 M epoxy coated drilled tie-bars at the edge of the existing concrete pavement, where the existing lip curb has been removed, in accordance with CW 3240-R6 and CW 3310-R10.

3.5 Installation of Concrete Sidewalks

- .1 Supply, place, and finish Portland Cement concrete sidewalk to the line and grades shown on the Drawings and in accordance with CW 3325-R5.

3.6 Installation of Curb and Gutter

- .1 Supply, place, and finish Portland Cement concrete curb and gutter to the line and grades shown on the Drawings and in accordance with CW 3310-R10. Slip form pave barrier curb and gutter.

3.7 Installation of Median Slab

- .1 Supply, place, and finish Portland Cement concrete median to the line and grades shown on the Drawings and in accordance with CW 3235-R6.

PORTLAND CEMENT CONCRETE PAVING

3.8 Installation of Dowelled and Separate Barrier Curb

- .1 Supply, place, and finish Portland Cement concrete barrier curb to the line and grades shown on the Drawings and in accordance with CW 3240-R6.

END OF SECTION

PAINTED TRAFFIC LINES AND MARKINGS

1. GENERAL

1.1 Work Included

- .1 This Section outlines the requirements for the painting of traffic lines and markings on roadways and in parking lots.

2. PRODUCTS

2.1 Paint

- .1 All materials supplied under this Specification shall be of a type approved by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.
- .2 The paint supplied for parking stall lines and markings shall be in accordance with CAN/CGSB-1.220-2001. The paint color shall be an approximate match to the following U.S. federal Standard 595B colors when tested in accordance with CGSB standard 1-GP-71:
 - .1 White – 37925
 - .2 Yellow – 33538
 - .3 Blue – 35250

2.2 Glass Beads

- .1 All materials supplied under this Specification shall be of a type approved by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.
- .2 Reflectorizing Glass Beads shall be supplied in accordance with OPSS 1750 Material Specification for Traffic Paint Reflectorizing Glass Beads.

3. EXECUTION

3.1 General

- .1 Do not perform Work during inclement weather conditions or under adverse field conditions such as frozen ground or ground covered with snow, ice, or standing water.

3.2 Application

- .1 Paint and glass beads shall be applied in accordance with CAN/CGSB-1.220-2001.
- .2 All paint markings shall be painted within ± 10 mm.
- .3 The color of the applicable paint markings shall be as indicated on the Drawings.

END OF SECTION

SUPPLY AND INSTALLATION OF STEEL BOLLARDS

1. GENERAL

1.1 Work Included

- .1 Supply and installation of steel bollards as shown on the Drawings at the proposed Nutrient Removal Facility.

2. PRODUCTS

2.1 Materials

- .1 The steel bollards shall be supplied in accordance with ASTM A53, DN 150, 168.3 mm O.D. (Weight Class XS, 10.97 mm wall thickness) galvanized pipe.
- .2 Concrete for filling the steel bollards shall be 30 MPa supplied in accordance with CW 3310-R10.

3. EXECUTION

3.1 General

- .1 Familiarization
 - .1 Prior to all Work of this Section, become thoroughly familiar with the Site, the Site conditions, and all portions of the Work falling within this Section.
 - .2 Protection
 - .1 Before starting Work, locate all utilities serving the Site. Notify all agencies or companies having jurisdiction over the specific utilities and protect, relocate, remove, or discontinue service according to their requirements. Any damages shall be repaired at the Contractor's expense.
 - .2 Protect and restore pavements, boulevards, grassed areas, etc., that may be opened or damaged in the performance of the Work.
 - .3 During construction, and at the completion of the Contract, all roads used to haul materials shall be cleaned of materials dropped on them.
- .3 Installation
 - .1 The steel bollards shall be installed as shown on the Drawings.

END OF SECTION

SEEDING

1. GENERAL

1.1 Work Included

- .1 Supply and placement of topsoil and seed on newly constructed boulevards and ditches.

2. PRODUCTS

2.1 Topsoil

- .1 All topsoil shall be supplied in accordance with the City Standard Specification CW 3540-R4.

2.2 Seed

- .1 All seed shall be supplied in accordance with the City Standard Specification CW 3520-R6, seed for athletic grounds, golf course fairways, general park areas, boulevards, medians and interchange areas.

3. EXECUTION

3.1 General

.1 Familiarization

- .1 Prior to all Work of this Section, become thoroughly familiar with the Site, the Site conditions, and all portions of the Work falling within this Section.

.2 Protection

- .1 Before starting Work, locate all utilities serving the Site. Notify all agencies or companies having jurisdiction over the specific utilities and protect, relocate, remove, or discontinue service according to their requirements. Any damages shall be repaired at the Contractor's expense.
- .2 Protect and restore pavements, boulevards, grassed areas, etc., that may be opened or damaged in the performance of the Work.
- .3 During construction, and at the completion of the Contract, all roads used to haul materials shall be cleaned of materials dropped on them.

3.2 Topsoil and Seed Installation

- .1 All topsoil and seed shall be installed in accordance with the City Standard Construction Specification CW 3520-R6 and as shown on the Drawings.

END OF SECTION