

TABLE OF CONTENTS

2.18 CONCRETE AND/OR CORRUGATED STEEL STORM SEWER 1

2.18.1 GENERAL 1

2.18.2 MATERIALS 1

 2.18.2.1 **Storm Sewer Pipe** 1

 2.18.2.2 **Cement Mortar** 1

 2.18.2.3 **Granular Materials** 1

2.18.3 CONSTRUCTION 2

 2.18.3.1 **Excavation and Preparation of Base** 2

 2.18.3.2 **Assembly** 3

 2.18.3.2.1 General 3

 2.18.3.2.2 Concrete Storm Sewer 3

 2.18.3.3 **Backfill** 4

 2.18.3.3.1 General 4

 2.18.3.3.2 Sand Backfill 4

 2.18.3.3.3 Earth Backfill 5

 2.18.3.3.4 Extra Sand Backfill 5

 2.18.3.3.5 Pit-Run Gravel Bedding 5

 2.18.3.4 **Workmanship and Final Acceptance** 5

2.18.4 MEASUREMENT AND PAYMENT 6

 2.18.4.1 **Excavation for Sewer Installation** 6

 2.18.4.2 **Supply and Install Storm Sewer** 6

 2.18.4.3 **Bedding and Backfill** 7

 2.18.4.3.1 Placing 7

 2.18.4.3.2 Supply of Sand Material 7

 2.18.4.3.3 Extra Sand Backfill 7

 2.18.4.3.4 Pit-Run Gravel Bedding 7

 2.18.4.3.5 Supply of Aggregate 7

2.18 CONCRETE AND/OR CORRUGATED STEEL STORM SEWER**2.18.1 GENERAL**

The Work shall consist of trenching, preparation of base, laying of sewer pipe, backfilling, and constructing related items such as manholes, storm drain inlets, catch basins, special fittings, and special inlet and outlet structures.

2.18.2 MATERIALS**2.18.2.1 Storm Sewer Pipe**

The Contractor shall supply pipe material in accordance with Specification 5.23, Supply of Corrugated Metal Pipe and Pipe Arches or Specification 5.16, Supply of Concrete Pipe and Related Junctions, Fittings and Materials, as applicable.

Storm sewer material supplied shall include couplings, bands, bolts, hoops, gaskets, tie bars, and any other applicable hardware.

Corrugated steel pipe material may, where specified, be of the asbestos bonded and/or bituminous coated type.

2.18.2.2 Cement Mortar

If concrete pipe is specified, the supply of cement mortar shall be the responsibility of the Contractor. This cement mortar mixture shall be composed of one part Portland Cement and two parts sand by volume. The quantity of water in the mixture shall be sufficient to produce a stiff, workable mortar. The sand shall conform to the requirements of A.A.S.H.T.O. Specification M45-42 and latest revisions thereof, or shall be an equivalent subject to approval by the Consultant. The cement shall conform to the requirements of A.A.S.H.T.O. Specification M85-63, or latest revisions thereof.

2.18.2.3 Granular Materials

The Contractor shall produce aggregate in accordance with Specification 3.2, Aggregate Production and Stockpiling for the designation and class of materials specified or as shown below. The Contractor shall supply aggregate in accordance with Specification 5.2, Supply of Aggregate and haul of aggregate shall be in accordance with Specification 4.5, Hauling.

The Contractor shall produce uniformly graded material, containing sufficient fines to act as a binder, which shall be composed of sound, hard, durable particles free from injurious quantities of flaky particles, soft shale, organic matter, frozen lumps and other foreign material. If, due to foundation conditions, pit-run gravel is required for the bedding material, the Contractor shall supply gravel capable of passing a 50 mm screen, and shall be so graded as to provide a stable foundation.

2.18.3 CONSTRUCTION2.18.3.1 **Excavation and Preparation of Base**

In general, the storm sewer shall be placed in a trench, the dimensions of which shall be in accordance with the drawings contained in this contract. The trench shall be excavated to a depth of not less than 100 mm below the base of the storm sewer.

All soft, yielding, or otherwise unsuitable material encountered at the bottom of the trench shall be removed to a depth as indicated by the Consultant, and replaced with gravel or other acceptable material to afford a firm foundation of uniform density throughout the entire length of the storm sewer. The exposed surface of the excavation shall then be thoroughly compacted, and the excavation backfilled with pit-run gravel material to within the 100 mm grade elevation established for the storm sewer installation.

Where ledge rock, boulders, rocky or gravelly soil, hardpan, or other unyielding material is encountered, the material shall be removed to provide for a minimum bedding thickness of 100 mm. The excavation shall then be backfilled with sand to the elevation established for the storm sewer installation.

The bedding shall be carefully and accurately shaped by means of a template to fit the lower 15 percent of the overall storm sewer height, so as to provide a uniform and firm contact for the bottom of the storm sewer. If concrete pipe is specified, particular care must be taken during shaping of the bedding to ensure that it is shaped to conform to the bell joint for uniform support. There shall be no rocks or other protuberances projecting into the template-formed bed section.

Unless otherwise directed by the Consultant, excavated trench material may be stockpiled alongside the trench, provided the working space is adequate for this purpose, and provided the material does not spill onto private property. All excavated material, other than that required and suitable for backfill, shall be removed to a suitable disposal area as shown on the plans, or as directed by the Consultant.

Excavated material piled along the trench shall not be allowed to unduly restrict cross traffic at road intersections. Material shall be cleared from road intersections and provisions made for use of the cross road by traffic, as soon as possible after excavation has taken place. Pedestrian traffic to individual properties shall be maintained at all times, and where required, temporary timber bridges shall be provided where it is necessary to cross open trenches.

Roadways, driveways, and drainage facilities shall not be blocked unnecessarily. Hindrance to local traffic must be kept to a minimum. In order that excavated material may be piled along the trench, roads may be temporarily closed to traffic if so approved by the Consultant, provided adequate detours are available.

Where excavated material cannot be piled along the trench in compliance with the above provisions, it shall be trucked to locations where backfilling is taking place, or to a temporary stockpile for return to the trench at the time of backfilling, as directed by the Consultant. Temporary stockpile sites or disposal areas will be located as shown on the plans, or as directed by the Consultant.

During construction operations, all necessary precautions are to be taken to protect the workers, the public, and both public and private installations and property. All Workers' Compensation Board regulations regarding trench shoring and safety are to be adhered to. The amount of open trench at any one time is to be limited to 100 m, or as otherwise directed by the Consultant.

2.18.3.2 **Assembly**2.18.3.2.1 General

Placing and assembling the pipe may proceed only after the excavation, foundation and bedding for the pipe have been approved by the Consultant. Where ground or surface water is encountered, the trench is to be de-watered before pipe laying commences.

A system of batter boards, or other such method, shall be used to control the grade of the installation to the elevations as staked by the Consultant.

When the work is left for any time, the open end of the sewer must be securely closed. When the sewer is completed, it shall be thoroughly cleaned of all earth, stones and any other debris.

2.18.3.2.2 Concrete Storm Sewer

Storm sewer pipe materials shall be handled and lifted by means of the lifting holes or slings. Assembly of the pipe shall start with the placing of the downstream end section, laid with its bell or grooved end facing upstream. Each successive section shall be placed to the true alignment, and shall bear firmly on the shaped bedding throughout its full length. After preparation of each joint, as described following, successive sections shall be drawn tightly together using a cable and winch method, or such other method as may be approved by the Consultant, to provide a positive, uniform and tight fitting joint. The mechanical tightening device shall be anchored a sufficient distance beyond the joint being tightened to avoid disturbance of previously tightened joints. Assembly tightening and joint construction shall be completed to the satisfaction of the Consultant before backfilling may commence.

Field cast wye connections shall be free of any cracks, and shall be fabricated to provide a field strength equivalent to the adjoining pipes.

Unless otherwise specified on the plans, a minimum of three end sections shall be anchored to adjacent sections by means of approved anchoring devices. All lift holes shall be filled with an approved mortar, finished off flush with the surface of the pipe.

2.18.3.2.2.1 **Mortar Joints**

Unless otherwise specified, all joints shall be filled with mortar. The mortar used shall conform to the mixture as outlined in Section 2.18.2.2 of these specifications.

The pipe ends shall be thoroughly cleaned and wetted with water immediately before the joint is made. Stiff mortar shall then be applied to the lower half of the groove section of the pipe already laid and, simultaneously, to the upper half of the tongue of the sections being placed, and the joint shall then be drawn up tightly. Sufficient mortar shall be used to fill the joint completely and form a bead on the outside of the pipe. The inside of the pipe shall have the joint pointed all the way around. The outside of the pipe shall have the joint mudded all the way around.

The mortar shall be protected from the elements with a proper covering until satisfactorily cured. No water shall be allowed to drain through the newly laid pipe until the joints have satisfactorily cured. No backfilling around the joint shall be undertaken until the joints have been approved by the Consultant.

2.18.3.2.2.2 Rubber Gasket Joints

Where specified, rubber gaskets shall be fitted between the bevelled surfaces of the tongue and groove ends of the connecting concrete pipe sections, to form a flexible, watertight seal.

Gaskets and jointing materials shall be placed in accordance with the recommendation of the particular manufacturer in regard to the use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements and adhesives shall be dry and thoroughly cleaned of all foreign matter. The rubber gasket shall be placed on the tongue end of the pipe section being laid, and the gasket checked for proper positioning. Gaskets and jointing shall be inspected before installation of the pipe, and loose or improperly affixed gaskets and jointing materials shall be removed and replaced to the satisfaction of the Consultant. Both joint surfaces shall be thoroughly coated with the lubricant supplied, and the tongue of the pipe section being laid shall be lined up true with the groove of the preceding section, and the two sections united together to the tightest position by means of cable and winch, or other approved methods. If, while making the joint, the gasket becomes loose and can be seen through the exterior joint recess when the joint is pulled up to within 25 mm of closure, the pipe shall be removed and the joint remade to the satisfaction of the Consultant.

2.18.3.2.2.3 Corrugated Steel Storm Sewer

Corrugated steel pipe shall be laid on the prepared base, with the separate sections securely joined together by means of the coupling bands provided. Corrugated steel pipe of the round or elongated type, and pipe arch culvert constructed from individual steel plates, shall have the outside laps of circumferential joints in each pipe section on the upstream end, and the longitudinal lap seams at the sides of the pipe.

The pipe shall be laid true to the lines and grades as established by the Consultant. When designated, elbows shall be installed at locations as established by the sharp changes in gradient or direction of the pipe.

All pipe shall be carefully handled to prevent damage to the protective coating. Unavoidable damage to coatings shall be repaired by the Contractor by painting with two coats of zinc oxide or asphaltic type cement paint prior to backfilling.

2.18.3.3 **Backfill**2.18.3.3.1 General

After assembly of the pipe has been approved, the backfill shall commence, utilizing sand material to be compacted by means of pneumatic or other mechanical tamping equipment. As the backfill between the sides of the pipe and the sides of the trench must carry a part of the total vertical load on the horizontal plane at the top of the pipe, it is essential that it be good material, carefully placed and compacted.

2.18.3.3.2 Sand Backfill

Backfill under the haunches and up to the quarter points shall be carefully compacted and rammed into place in thin layers, to fill all voids and ensure firm contact with the entire bottom surface. Backfill alongside and above the pipe for a minimum of 0.30 m, unless otherwise shown on drawings contained in this contract, shall also be sand material. Backfilling shall be laid down and compacted in layers not exceeding 0.15 m, and shall proceed simultaneously to the same level on each side of the pipe. Sand backfill shall be

compacted to 100 percent of Standard Proctor density at the optimum moisture content. Puddling of the backfill will not be permitted.

In all backfilling operations, care shall be exercised, and it shall be the Contractor's responsibility to ensure that the pipe is not damaged by vertical or lateral forces imposed during installation and by compaction of the backfill. Circular pipe with elliptical reinforcement, and elliptical pipe with circular reinforcement, are particularly vulnerable to damage by careless compaction of backfill, and it may be necessary to install horizontal or vertical strutting until the fill over the pipe has been completed. Strutting, so required, shall be undertaken in an approved manner and at the Contractor's expense.

Sand backfill will be considered as Class B Bedding, as shown on the plans contained in this contract.

2.18.3.3.3 Earth Backfill

Unless otherwise directed by the Consultant, native earth backfill as excavated from the trench shall be used where shown on the plans, provided it is an approved, frost-free, fine grained soil. Such soil backfill shall be compacted to a density as specified in the plans.

2.18.3.3.4 Extra Sand Backfill

Where, in the opinion of the Consultant, the excavated trench material is unsuitable to be used as backfill, the area shown in the plans as earth backfill shall be constructed with sand. The extra sand backfill material shall be placed and compacted to the density specified in the plans.

2.18.3.3.5 Pit-Run Gravel Bedding

In areas where the Consultant directs excavation to be done below the normal 100 mm beneath the pipe grade as shown in the plans, pit-run gravel shall be used as bedding material for that portion of the pipe bed below the 100 mm grade line. The pit-run gravel shall be placed and compacted to 100 percent of Standard Proctor Density.

2.18.3.4 **Workmanship and Final Acceptance**

In addition to compliance with the details of construction, the completed structure shall show careful finished workmanship in all particulars.

If, in the opinion of the Consultant, any of the following defects are present in the structure, they shall be considered sufficient cause for rejection:

- (a) variation from the designed centerline or grade;
- (b) concrete pipe tongue or grooved edge which has been chipped such that 10 percent of the bevelled surface area is destroyed, or chipped at any point to such a degree that in the opinion of the Consultant a proper joint will not be achieved;
- (c) concrete pipe joined by the construction of improperly formed or cracked joints;

- (d) concrete pipe which shows as a result of negligent handling the exposure of reinforcing steel, or any permanent cracks in the concrete of 0.25 mm or greater width, or deformation induced through improper bedding, backfilling or construction procedures; or
- (e) steel pipe connected with improperly installed couplers and/or gaskets.

Structures exhibiting defects will be rejected, and the Contractor shall be held responsible for replacing and reinstalling the unacceptable section(s). Any material damaged or destroyed by the Contractor shall be replaced at the Contractor's expense.

Conditions requisite to the final acceptance of the work shall include, in addition to the terms and conditions as set forth in this contract, a sewer thoroughly cleaned of any accumulations of silt, debris, or other foreign matter, any loose material or waste resulting from the operations disposed of, and the working areas restored to the satisfaction of the Consultant.

2.18.4 MEASUREMENT AND PAYMENT

2.18.4.1 **Excavation for Sewer Installation**

Excavation to the required depth and width as detailed in the plans will not be paid for directly, but shall be included in the applicable unit price bid for "Concrete Storm Sewer - Supply and Install", and/or "Corrugated Steel Storm Sewer - Supply and Install", and/or "Leads", which price shall include the necessary haul and disposition of the material.

There will be no separate payment for any shoring, dewatering, or any safety precautions necessary. Such payment will be considered to be included in the unit price bid for "Concrete Storm Sewer - Supply and Install", and/or "Corrugated Steel Storm Sewer - Supply and Install", and/or "Leads".

Payment for any necessary trucking to another area of the project, or to and from temporary stockpile or disposal areas, will not be made directly, but shall be included in the unit prices bid for "Concrete Storm Sewer - Supply and Install", and/or "Corrugated Steel Storm Sewer - Supply and Install", and/or "Leads".

2.18.4.2 **Supply and Install Storm Sewer**

Measurement for the supply and installation of storm sewers will be in metres along the invert centreline length of the sewer. The measurement will be continuous through manholes.

The measurement of laterals and leads shall be taken along the invert centreline of the branch line to the invert centreline of the main sewer. The measurement will be continuous through manholes or storm drains. In cases where the branch line originates at a manhole or storm drain, the measurement will be taken from the mid point of the facility.

Payment will be made at the applicable unit price bid per metre for the various sizes of "Concrete Storm Sewer - Supply and Install", and/or "Corrugated Steel Storm Sewer - Supply and Install", and/or "Leads". This payment will be full compensation for supplying and installing the sewer pipe, precast elbow connections, and all other precast appurtenances; excavation and preparation of the trench to the required depth; supplying and placing sand bedding; shoring; tunnelling under existing utilities; construction of concrete cradles; field casting of wye branches, supplying and backfilling with either native or imported

material; compacting where necessary; and the use of all equipment, tools, labour and incidentals necessary to complete the work.

2.18.4.3 **Bedding and Backfill**

2.18.4.3.1 Placing

Payment for supplying and placing of bedding and backfill for storm sewer trenches up to the original ground level will not be made directly, but shall be included in the unit price bid for "Concrete Storm Sewer - Supply and Install", and/or "Corrugated Steel Storm Sewer - Supply and Install", and/or "Leads".

For the purposes of this Specification, the original ground line shall be the surface elevation existing at the time of commencement of excavation of the storm sewer trench.

In order to provide reduced load on the storm sewer pipe, it may be specified in the plans that embankment shall be constructed over a storm sewer alignment prior to the excavation of the trench. In these cases, the original ground line will be the surface of the constructed embankment.

2.18.4.3.2 Supply of Sand Material

Payment for supplying and placing Class B Bedding Material as shown on the plans will not be made directly, but shall be included in the unit price bid for "Concrete Storm Sewer - Supply and Install", and/or "Corrugated Steel Storm Sewer - Supply and Install", and/or "Leads".

2.18.4.3.3 Extra Sand Backfill

Payment for "Extra Sand Backfill" will be made by the cubic metre in place. This payment will be full compensation for processing and hauling sand material to the point of the installation. Payment for placing this material shall be included in the applicable unit price for "Concrete Storm Sewer - Supply and Install", and/or "Corrugated Steel Storm Sewer - Supply and Install", and/or "Leads".

2.18.4.3.4 Pit-Run Gravel Bedding

Payment for "Pit-Run Gravel Bedding" will be made by the cubic metre in place. This payment will be full compensation for excavation in excess of the 100 mm below pipe grade shown in the plans, loading, hauling and disposing of unsuitable material, processing, hauling and placing the pit-run material.

2.18.4.3.5 Supply of Aggregate

Payment for the supply of aggregate for extra sand backfill and/or pit-run gravel bedding will be made in accordance with Specification 5.2, Supply of Aggregate.