EXCAVATION AND BACKFILLING FOR STRUCTURES

1. GENERAL

1.1 Work Included

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

.1 Excavation to require elevations for the base slab, slab thickenings and pile caps, void form and granular levelling pad.

.2 Supply and placement of 100 mm thick granular levelling material below the void form.

.3 Supply, placement, and compaction of backfill and fill materials to attain indicated grades and profiles.

.4 Disposal of surplus excavated material.

.5 Dewatering of excavations.

1.2 Reference Standards

.1 Conform to requirements of the National Building Code (NBC) and the Canadian Construction Safety Code.

.2 Comply with excavation and trenching regulations of Provincial authorities.

1.3 Shop Drawings

.1 Submit Shop Drawings in accordance with Specification E11.

.2 Submit Shop Drawings for shoring, bracing, and sheet piling required in connection with excavation for the Raw Water Pump Station (RWPS), in accordance with Specification E10, for review two (2) weeks prior to commencement of the Work.

.3 Employ a qualified Professional Engineer registered in the Province of Manitoba for the shoring, bracing, and sheet piling design and to prepare and seal the Shop Drawings.

1.4 Samples

.1 There shall be no charge for any materials taken by the Contract Administrator for testing purposes.

.2 All materials shall be reviewed and accepted by the Contract Administrator at least ten (10) days before any construction is undertaken.

.3 For granular materials, submit a 25 kg sample for coarse, gravelly soil or 75 kg sample for coarse, crushed stone of each type, clearly labelled for type and source of the materials, for analysis by testing laboratory. Ship samples prepaid or deliver in tightly closed containers to testing laboratory designated by Contract Administrator.

.4 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. Testing will be performed so as to least encumber the performance of the Work.

.2 The City will pay for the first series of tests only, on the area being evaluated. Pay costs for additional testing, if required, due to improper performance of Work.

.3 Tests will be performed in accordance with American Society for Testing and Materials (ASTM) D698 for Standard Proctor Density on representative samples to control compaction requirements. The Contract Administrator will decide the frequency and number of tests required.

.4 The field density of the compacted layers shall be verified by field density tests in accordance with ASTM D2922, using nuclear methods performed by the inspection and testing firm. The frequency and number of tests required will be decided by the Contract Administrator.

.5 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 accepted.

.6 During Work tests, 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.

.7 Ensure compacted fills are tested and accepted before proceeding with placement of surface materials.

1.6 Geotechnical Information

.1 Refer to Specification E2 for a list of test hole logs and reports available associated with the Site.

.2 The Contractor should be aware that the surface soil condition in the excavations performed by the Bulk Excavation Contract, and subsequent contracts, may be soft.

2. PRODUCTS

2.1 General

.1 All materials to be subject to Contract Administrator's 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.

.3 Grading of granular materials to show no marked fluctuations between opposite ends of extreme limits.

.1 Type 1: pit run granular backfill shall consist of a clean, well-graded, and free-draining pit run material with a maximum size of 75 mm, and less than 5% by weight finer than 0.075 mm.

.2 Type 2: crushed gravel graded within following limits:

Canadian Metric Sieve Size	% Passing	
	Crushed Granular	Crushed Limestone
25,000	100	-
20,000	80 - 100	100
5,000	40 - 70	40 - 70
2,500	25 - 55	25 - 60
315	13 - 30	8 - 25
80	5 - 15	6 - 17

At least 60% of material retained on 5 mm sieve to have at least one (1) freshly fractured face.

.4 Type 3: pit run sand for levelling with maximum stone size 40 mm.

.5 Type 4: common backfill shall be free from organic material and rocks larger than 150 mm in size and building debris. Fill under landscaped areas to be free from alkali, salt, petroleum products, and other materials detrimental to plant growth. Common backfill shall be obtained from Disposal Sites 1 and 2 indicated on the Drawings subject to review by Contract Administrator.

.6 Type 5: impervious clay fill shall consist of high plasticity clay (CH) material as defined by the Unified Soil Classification System, with liquid limit (LL) greater than 50%, and permeability lower than 10 to 7 cm per second, and shall be free from stones, roots, or any other deleterious material as accepted by the Contract Administrator.

.7 Subdrain granular material is specified in **Section 02620 – Sub-Drainage.**

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 information.

.2 Protection

.1 Before starting Work, locate all utilities crossing the Work 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.

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 set by the registered surveyor. If displaced or lost, immediately replace to the acceptance of the Contract Administrator, at no additional cost to the City.

3.3 Excavation

.1 Submit excavation plan for the RWPS area sealed by qualified Professional Engineer registered in the Province of Manitoba to the Contract Administrator for review two (2) weeks prior to commencement of the Work.

.2 Perform excavation in strict compliance to Work Place Safety and Health and authorities have jurisdiction.

.3 Excavate to noted limits and as required for walls and foundations. Stockpile material to be used for backfilling on-site as directed by the Contract Administrator. Excess material is to be disposed of immediately as per Item 3.7 – Disposal.

.4 When complete, request Contract Administrator to review excavations.

.5 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.

.6 The completed excavation shall provide clean, level, solid, and water-free surfaces at the required elevations, ready to receive construction.

.7 Excavations are not to encroach on existing slopes and as indicated in the geotechnical information.

.8 Backfill and compact all over-excavated areas under structure surfaces with Type 1 fill and compact to 90% Standard Proctor Density and at no additional cost to the City.

.9 Make good all damage occurring as a result of inadequate, unauthorized, or defective methods of protection.

.10 Areas used for temporary stockpiling shall be restored to existing condition or better.

3.4 Shoring, Bracing, and Sheet Piling

.1 Provide all shoring, bracing, and sheet piling required to prevent damage to existing structures, excavations, and injury to personnel where necessary for safe work within the excavated area. The shoring, bracing, and sheet piling shall account for the yard piping to be connected to the RWPS Substructure.

.2 Comply with all applicable rules and regulations of governmental authorities.

.3 Erect shoring, bracing, and sheet piling 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 compacting of backfilling material around new construction.

.5 Maintain shoring, bracing, and sheet piling during backfilling and remove in stages as backfilling progresses.

.6 Remove all shoring, bracing, and sheet piling unless otherwise permitted by Contract Administrator.

.7 If shoring, bracing, and sheet piling are allowed to remain, cutoff to an elevation at least 1000 mm below finish grade and structures.

.8 Assume full responsibility for any failure, collapse, or movement of existing structures, shoring, bracing, sheet piling, earth banks, trenches, and other excavations.

3.5 Dewatering

.1 The Contractor shall be responsible for the control of surface drainage on the excavations completed by the Bulk Excavation Contract and subsequent contracts.

.2 Dewatering systems shall be designed to expeditiously remove water from the excavation until wall backfilling is completed.

.3 The dewatering systems must protect the subgrade soils from excessive softening and saturation. Perimeter slope cutoff ditching shall not extend beyond a 2 m distance from the edge of wall footings.

.4 All access roadways shall employ culverts as required for the Contractor's proposed excavation dewatering plan.

.5 The Contractor shall submit the proposed dewatering plan two (2) weeks prior to commencement of construction to the Contract Administrator for review and acceptance.

.6 All temporary ditching and water retention areas shall be lined with an impervious membrane to the satisfaction of the Contract Administrator.

.7 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.

.8 Additional excavation made necessary by water in the excavation shall be at no additional cost to the City.

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 Backfilling and Filling

.1 Backfill and fill to grades, contours, levels, and elevations indicated on Drawings.

.2 Backfilling shall be performed only after the watertightness testing has been performed and the structure has been accepted by the Contract Administrator. If backfilling or partial backfilling is performed for construction reasons prior to watertightness testing, the fill shall be excavated for the watertightness testing to fully expose the structure walls.

.3 Do not backfill against foundation walls until the walls and the perimeter drainage system have been accepted by the Contract Administrator.

.4 Do not backfill against foundation walls until the floor slabs framing into the walls, where such slabs exist, have been completed. The wall concrete must have attained the twenty eight (28) day minimum compressive strength, and the slab concrete must have attained 80% of the twenty eight (28) day minimum compressive strength before backfilling. Do not backfill without the prior written permission of the Contract Administrator.

.5 Maintain optimum moisture content of materials to permit compaction to specified densities.

.6 Compact each soil layer to at least the specified minimum degree; repeat compaction process until plan grade is attained. Compaction densities indicated herein are based on ASTM D698 for Standard Proctor Density.

.3 Bedding over Sub-Grade

.1 Type 1 pit run gravel fill for over excavation shall be placed in uniform lifts not greater than 200 mm in thickness and shall be compacted to a density of at least 95% Standard Proctor Density.

.2 Type 3 pit run sand for the levelling layer shall be spread on the subgrade in the required minimum compacted thickness (100 mm) to attain smooth surfaces and required elevations indicated on the Drawings for the placement of the voidform under the footings and base slabs.

.4 Backfill around structure walls

.1 Type 1 pit run gravel fill shall be 1000 mm wide, placed immediately adjacent to the structure walls. Type 1 pit run gravel fill and Type 4 common backfill shall be placed in lifts not greater than 200 mm in thickness to the extents shown on the Drawings and shall be compacted to a density of at least 95% Standard Proctor Density to allow equipment tractability and limit settlement, but not result in a significant decrease in permeability of the Type 1 pit run gravel.

.2 Successive lift placement of Type 1 and Type 4 shall be coordinated so that the maximum difference in the elevations of the respective working surfaces shall not exceed 200 mm.

.3 Type 5 impervious clay fill shall be placed in lifts not great than 150 mm in thickness to the extents shown on the Drawings and shall be compacted to a density of at least 95% Standard Proctor Density. Each compacted lift shall be scarified a minimum of 50 mm prior to placement of successive lifts to ensure adequate bonding between each lift.

.4 A homogeneous, continuous, low permeability zone of impervious clay shall be achieved, free from any clay lumps, cracks, rutting, or deleterious material, to the satisfaction of the Contract Administrator.

.5 The geotextile material for use as a separator between the impervious clay and Type 1 pit run gravel shall conform to Geotextile A as specified in specification **Section 02620 – Sub-Drainage.**

.6 Care shall be taken when placing fill materials immediately adjacent to the structure walls to ensure no damage occurs to the walls and any covering materials. Any damage shall be repaired by the Contractor at his expense.

.5 Sub-drain

.1 Requirements for the perimeter sub-drain coarse granular drainage material are specified in **Section 02620 – Sub-Drainage.**

3.7 Disposal

.1 Surplus material not required for backfill and fill purposes shall be disposed of on-site to a location designated by the Contract Administrator at no extra cost to the City.

3.8 Clean-Up

.1 As excavation proceeds, keep roads clean of dirt and excavated material.

.2 Clean-up and wash down to remove all dirt and excavated materials caused by Work of this Section.

.3 Clean at the end of each working day as directed by the Contract Administrator.

END OF SECTION