

DIVISION 13

EXCAVATION AND BACKFILL FOR UNDERGROUND UTILITIES

13.01 Description:

The work shall consist of excavating and backfilling for storm sewers, sanitary sewers, watermains, conduits, and all other related underground utilities.

13.02 Materials:

13.02.01 Backfill and Bedding:

- (a) Sand and backfilling shall meet the requirements of Class II Granular Material as specified in MDOT Specifications, except that only natural aggregate shall be allowed.
- (b) Sand for Class B Bedding around the utility shall be either bank-run or screened material passing a one-half (1/2") inch square mesh screen.
- (c) Gravel for Class B-1 Bedding around the utility shall be either pea gravel or crushed stone, as directed, and shall conform to the following grading requirements:

Pea Gravel	-	Passing 1/2" sieve, 95%
		Retained on #4 sieve, 95%
1-inch Gravel	-	Passing 1/2" sieve, 95%
Crushed Stone	-	Retained on #4 sieve, 95%

13.03 Construction Methods:

13.03.01 Excavation:

- (a) Excavation of the trench shall begin at the outlet end for sewers. The excavation shall be true to line and grade and shall be of sufficient width to provide ample working space and to permit compaction of backfill around the utility, including sufficient space for bracing and supporting sides of trenches and for pumping and drainage of ground water and/or sewage. The minimum permissible trench widths and clearances between the installed pipe and either trench wall shall be as follows:

<u>Pipe Size</u>	<u>Minimum Trench Width</u>	<u>Minimum Clearance</u>
6"	18"	5"
10"	23"	5"
12"	26"	5"
15"	30"	5"
18"	35"	6"
24"	43"	7"
30"	54"	8.5"
36"	64"	10"
42"	73"	11"
48"	83"	12.5"
54"	92"	13.5"
60"	102"	15"
66"	109"	15"

The minimum clearances are not minimum average clearances, but are minimum clear distances which will be permitted between any part of the pipe as laid and any part, projection, or point of rock, shale, stone, or boulder.

Any over excavation of the trench bottom shall be backfilled and compacted to a minimum density of ninety five (95%) percent maximum unit weight.

- (b) Maximum Trench Width – Trench widths at a point at the top of the pipe shall be limited to the maximum values indicated in the following table:

MAXIMUM TRENCH WIDTHS (INCHES)

Where U is Unlimited Trench Width up to and including depth indicated

<u>Pipe Size</u>	<u>Class</u>	<u>Clay Pipe</u>						
		<u>0-8</u>	<u>8-10</u>	<u>10-12</u>	<u>12-14</u>	<u>14-16</u>	<u>16-18</u>	<u>18-20</u>
8"	C-700 Std Str C-700 Ext Str			U	29	28	27 U	35
10"	C-700 Std Str C-700 Ext Str		U	33	31	30 U	38	36
12"	C-700 Std Str C-700 Ext Str		U	35	34 U	33 40	39	38
15"	C-700 Std Str C-700 Ext Str	U	40	38 U	36 45	42	41	40
18"	C-700 Std Str C-700 Ext Str	U	43	40 U	38 49	46	45	44
21"	C-700 Std Str C-700 Ext Str	U	46	43 U	40 55	51	49	47

<u>Pipe Size</u>	<u>Class</u>	<u>Concrete Pipe</u>							
		<u>0-8</u>	<u>8-10</u>	<u>10-12</u>	<u>12-14</u>	<u>14-16</u>	<u>16-18</u>	<u>18-20</u>	
8"	C-14 C-14X		U	28	27		U	33	32
10"	C-14 C-14X		U	29	27		U	34	32
12"	C-14 C-14X	U	32	31 U	38	36			
15"	C-14 C-14X	U	36	34	U	44	42		
18"	C-76, II C-76, III C-76, IV	U	43 U	40 47	44		U	55	52
21"	C-76, II C-76, III C-76, IV	U	49	45 U	52	49 U	60	58	
24"	C-76, II C-76, III C-76, IV	U	54	50 U	57	53 U	69	67	
27"	C-76, II C-76, III C-76, IV		U	55 U	51 64	59 U	72	70	
30"	C-76, II C-76, III C-76, IV		U	58 U	54 68	62 U	80	76	
33"	C-76, II C-76, III C-76, IV		U	62	58 U	72 U	68 86	82	
36"	C-76, II C-76, III C-76, IV		U	72 U	66 78	74 U	94	90	
42"	C-76, II C-76, III C-76, IV		U	75 U	70 86	80 U	103	100	
48"	C-76, II C-76, III C-76, IV		U	82	78 U	100	96		U
54"	C-76, II C-76, III C-76, IV		U	92 U	84 105	96 U	125	120	
60"	C-76, II C-76, III C-76, IV		U	105 U	92 115	105 U	135	130	

For cast iron and ductile pipe, the maximum trench width shall not exceed the outside diameter of the pipe plus twenty four (24") inches.

Maximum trench width for pipe of materials other than those listed shall be established by the Engineer.

Pipe strength indicated on the Plans are minimum strengths which shall be provided regardless of trench width used. Refer to Wyoming Specification 13.03.01 (c) for unauthorized trench width.

- (c) Unauthorized Trench Widths – Where, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted on the plans, either pipe of adequate strength, special pipe embedment, or arch concrete encasement as required by loading conditions and as determined by the Engineer shall be furnished and installed by and at the expense of the Contractor.
- (d) Unstable Foundation – When the soil beneath the normal pipe embedment area is soft or unsuitable, does not meet backfill requirements, or in the opinion of the Engineer, cannot support the pipe or utility, further depth shall be excavated and refilled to the proposed grade with approved materials compacted in twelve (12”) inch layers as specified in 13.03.09 (b), or other approved means shall be employed to assure a firm foundation for the utility, with extra work being paid for as trench undercut in cubic yards. The volume of unstable foundation removed and replaced with approved materials for which payment will be allowed shall be determined in cubic yards unless otherwise specified on the plan or in the proposal. Said volume will be computed on the basis of field measurements. If the soil in the bottom of the trench meets the requirements of trench backfill material, but is not due to excessive amounts of ground water, stabilization of the trench bottom shall be at the Contractor’s expense.

13.03.02 Cutting Pavement – Cuts in pavement and base pavement shall be no larger than necessary to provide adequate working space for proper installation of pipe and pipeline appurtenances. Cutting shall be with a concrete saw and in a manner which will provide a clean full depth groove along each side of the trench and along the perimeter of cuts for structures.

Pavement and base pavement over trenches excavated for pipe lines shall be removed so that a shoulder not less than six (6”) inches in width at any point is left between the cut edge of the pavement and the top edge of the trench. The trench width at the bottom shall not be greater than at the top and no undercutting will be permitted. Pavement cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the centerline of the trench.

Pavement removed for connections to existing lines or structures shall not be of greater extent than necessary for the installation as determined by the Engineer.

Where the line of trench parallels the length of concrete walks and the trench location is all or partially under the walk, then the entire walk shall be removed and replaced. If necessary to remove concrete curbs, gutter, or walks, they shall be replaced to and between existing joints.

- 13.03.03 Tunneling – Tunneling shall be done only where shown in plans, or as directed by the Engineer.
- 13.03.04 Extent of Open Trench – The excavation shall at all times be finished to grade for a safe distance in advance of the completed structures, but unless otherwise specifically directed or permitted by the Engineer, not more than three hundred (300’) feet of trench shall be open at one time in advance of the built structure during the working day. No more than fifty (50’) feet shall be left open in non-working hours. The excavated earth along the line of the trench shall always be confined to approved limits. Excavation or use of land outside the street right-of-way or easement shown on the plan will not be permitted, unless approval is granted by the Owner, or, as specified on the plans or in the proposal, and unless specific approval is given by the Engineer.
- 13.03.05 Protection of Open Trench – All open trenches shall be protected during all non-working hours. The use of snow fence or other means to ensure trench protection is the daily responsibility of the Contractor. No additional compensation will be considered for this work.
- 13.03.06 Existing Underground Structures – The Contractor shall provide and install adequate supports and protection for all underground facilities extending into or crossing the trench. Where gas mains or electric cable or conduits extend into or across the trench, the Contractor shall notify the owner at once and provide such supports and protection as may be required by the owner.

Should any such gas main or electric cable or conduit require raising or lowering or moving to another location, such changes will be made by the owner without additional expense to the Contractor.

Where sewers, watermains, cables or conduits and all other underground facilities are parallel to the Contractor’s trench opening, the Contractor shall so carry on his work at all times as not to cause damage to the paralleling facilities.

Where gas, electrical, telephone, water or sewage service connections to occupied buildings must be temporarily disconnected, the Contractor shall give notice to the affected occupants of the time and duration of the anticipated cut-off.

When pipes, conduits or sewers are removed from the trench leaving “dead” ends in the ground, such ends shall be fully plugged or bulkheaded with brick and mortar by the Contractor without additional compensation, unless otherwise shown on the plans.

Where house connections, laterals or sub-main sewers require reconnection to the proposed sewer, same shall be made by the Contractor under the appropriate items of the contract. Where existing laterals or house connections are reconnected to the new facilities, the work shall be so arranged that sewage will not flow through newly built portions of the work until twenty-four (24) hours after mortar joints are made or after concrete masonry is placed.

Relocation of existing street lighting, storm, sanitary or watermain facilities, if required, shall be considered for extra compensation.

Certain utility lines and other existing underground installations and facilities in the vicinity of the proposed work hereunder are indicated on the plans according to the best information available to the City. The City does not guarantee the accuracy of such information. House sewer connections, water and gas services, and other utility lines may not be indicated on the plans. The Contractor shall make every effort to locate all underground utility lines and conduits by contacting owners of underground utilities, and by prospecting in advance of trench excavation.

Any delay or extra cost to the Contractor caused by pipe lines or other underground structures or obstructions not shown by the plans, or found in locations different than those indicated, shall not constitute a claim for extra work, additional payment, or damages.

- 13.03.07 Temporary Channels – The Contractor shall provide, without additional compensation, channels for water and sewage that may flow along or across the site of the work.

The Contractor shall receive written approval prior to discharging or redirecting any flow onto or across private property.

Trenches across roadways, driveways, walks, or other locations of pedestrian or vehicular traffic adjacent to drainage ditches or water courses shall not be backfilled prior to the completion of backfilling of the trench on the upstream side, to prevent the impounding of water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches.

All material deposited in roadway ditches or other water courses crossed by the line of trench shall be removed immediately after backfilling is completed and the section, grades, and contours of ditches or water courses shall be restored to their original condition. Surface drainage shall not be obstructed longer than necessary.

Where trenches are constructed in or across roadway ditches or other water courses, the backfill shall be protected from surface erosion by adequate means. Where the grade of the ditch exceeds one percent, suitable check dams as approved by the Engineer shall be installed as directed. Check dams may be of stone, or concrete as authorized. In any case, the check dams shall extend not less than two (2') feet below the original ditch or water course bottom for the full bottom width and not less than eighteen (18") inches into the side slopes thereof.

- 13.03.08 Disposal of Water and Sewage – The Contractor shall remove, by pumping, bailing or otherwise, any water which may accumulate or be intercepted or be found in the trenches

and in any other excavations made under this contract. He shall form all dams, flumes or other work necessary to keep the trenches entirely clear of water and sewage while the structures and their appurtenances are being constructed to the extent that no damage from hydrostatic pressures, flotation, or other causes will result. The Contractor shall at all times have sufficient pumping equipment on the job ready for immediate use.

All excavations for concrete structures or trenches which extend down to or below the static ground water elevations shall be de-watered by lowering and maintaining the ground water surface beneath such excavations a distance of not less than twelve (12") inches below the bottom of the excavation.

Water from the trenches and excavation shall be disposed of in such a manner as will not cause injury to the public health, nor to public or private property, nor to the surface of the streets, nor cause any interference with the use of the streets by the public. No additional payment will be made to the Contractor for this work.

The Contractor will be held responsible for the condition of any pipe line or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free from sediment. No water shall be pumped into any existing sanitary sewer.

13.03.09

Bracing and Sheeting – The Contractor shall provide sheathing or bracing for the full depth in all trenches in all clay or other heavy soils over five (5') feet deep unless the sides are cut to a one-on-one slope. Below fifteen (15') feet deep, the trench may be shelved in combination with sheathing and bracing. At no time shall any trench in any type of soil be wider than twenty (20') feet at the ground line or be outside the street right-of-way or outside the easement shown on the plans, unless specific approval is given by the Engineer. All sheathing is to conform to the "State of Michigan General Safety Rules and Regulations for the Construction Industry."

Use of a trench box shall be limited to eight (8') feet in width (or larger). Use of boxes less than eight (8') shall require prior approval of the Engineer.

Trench sheeting shall not be pulled unless the pipe strength is sufficient to carry trench loads based on the trench width to the back of the sheeting.

Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner, which will preclude the application of concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe for the purpose of supporting sheeting in the bottom of the trench may be removed after the pipe embedment has been completed.

Unless sheeting is to be left in place, all costs incurred in the installation of sheathing or bracing shall be incidental to the price bid for the furnishing and laying of the utility, and no extra compensation will be allowed.

13.03.10 Backfill:

- (a) **Pipe Embedment:** The material shall be as specified in Section 13.02.01 (b) and (c) and in accordance with Detail S-13.

The embedment material shall be hand placed in layers not exceeding six (6") inches in thickness below the springline of the pipe, and shall be hand tamped. Above the springline of the pipe, the material shall be compacted by means of a hand vibrator. The embedment material shall be compacted to a minimum density of ninety five (95%) percent of maximum unit weight as determined by MDOT Specifications.

- (b) **Trench Backfill:** The material shall be as specified in Section 13.02.01 (a).

The backfill material shall be placed in layers in one of the following approved methods to a minimum density of ninety five (95%) percent of maximum unit weight as determined by MDOT Specifications.

Vibratory Plate Compactor:

- 12" layers maximum
- Sufficient number of passes to achieve 95% compaction

Compaction by Dozer:

- 12" to 24" layers maximum
- Entire surface area must be compacted
- Gradual ramping of material for access to trench is required

Compaction by Loader:

- 12" to 24" layers maximum
- Allowable in very wide trenches or on surface only

Compaction by Hoe-pack:

- 12" to 24" layers maximum
- Use of Hoe-pack is required for compaction of backfill material within two feet (2') of all structures.

The use of a "Wheel-Roller" affixed to the boom of an Excavator shall not be permitted as an approved means of compaction without prior approval of the Engineer.

- 13.03.11 Disposal of Excess Excavation – All excavated material in excess of that needed for backfill shall be disposed of by the Contractor at the Contractor's cost. The Engineer reserves the right to direct the Contractor to haul any excess material and to pay the Contractor for such hauling.

Disposal of waste and excess excavated materials, including all hauling, handling, leveling and surfacing shall be a subsidiary obligation of the Contractor and no separate payment will be made therefor.

13.03.12 Rock Excavation:

- (a) Definition – Rock excavation shall include all ledge rock in place that cannot be excavated by hand except by blasting, or, in the opinion of the Engineer, by the continuous use of air tools, or by the exceptional use of excavating equipment, and all boulders whose individual volume is one-half (1/2) cubic yard or more. Rock shall be defined as that material which is harder than three on the Moore's Hardness Scale.
- (b) Pipe Clearance in Rock – When rock is encountered in the excavation, it shall be removed to the depth shown on the plans or six (6") inches below the bottom of pipe or conduit when no underdrain is required. If an underdrain is required, additional excavation shall be made to the depth and width required for the underdrain. The width of rock excavation shall be two (2') feet greater than the inside diameter of the pipe unless otherwise specified.
- (c) Blasting – Where blasting is necessary, the Contractor shall obtain the required permits and licenses at his own expense. This work shall be done with due regard to the safety of workmen, other people and public and private property. Suitable weighted plank coverings or mattresses shall be provided to confine all materials lifted by blasting within the limits of excavation or trench.

13.03.13 Protection of Lawns and Shrubs – Wherever excavation or trenching is performed in established lawns, the Contractor shall perform all such excavation and trenching work by hand methods to the satisfaction of the property owner and the Engineer. All shrubs on private property that are removed shall be replaced; all shrubs in street right-of-way shall be removed in a careful manner and placed on adjacent property for replanting by property owner.

All established lawn areas cut by the line of trench or damaged during the course of the work shall be restored per the requirements of Section 18.

13.03.14 Fences – All existing fences which interfere with the construction operations shall be maintained by the Contractor until the completion of the work affected thereby, unless written permission is obtained from the owner thereof to leave an interfering fence dismantled for an agreed period of time. Where fences must be maintained across the right-of-way, adequate gates shall be installed therein. Gates shall be kept closed and locked at all times when not in use.

Any fences, which are existing in the street right-of-way, shall be relocated to a point outside the right-of-way and adjacent to the right-of-way as directed by the Engineer in as good as original condition.

On completion of the work across any tract of land, the Contractor shall restore all fences to their original or to a better condition and quality, purchasing new material to replace all materials lost, damaged, or destroyed. Temporary gates installed by the Contractor in any fence line may be left in place with the permission of the owner and tenant of the property.

All materials used in fence repairs or replacements shall be approved by the Engineer.

- 13.03.15 Prolonged Trench Maintenance – When conditions are such that the final restoration has to be prolonged, the Contractor will be required to maintain all roadways, driveways, and sidewalks in condition suitable for their convenient and safe use until such time as they may be permanently restored in accordance with the completion date.

This will include the use of such bituminous material as may be necessary and directed by the Engineer as a temporary surface in areas which ultimately receive either a bituminous or concrete surface. The cost of furnishing such temporary bituminous material shall be incidental to the major items of work, unless otherwise specified on the plans.

- 13.03.16 Cleaning-up – The Contractor shall remove surplus excavated materials and materials for construction as the work progresses, and shall render the street suitable, safe, and convenient for traffic. Before final acceptance of the work, the Contractor shall clean the street surface, walks, gutters, fences, lawns, private property, right-of-way, and structures, leaving them in as good condition as originally found, and shall remove all machinery, tools, surplus materials, temporary buildings and other temporary structures from the site of the work. Furthermore, the sewers, manholes, inlets, etc. shall be cleared of all scaffolding, rubbish, dirt, dams or other obstructions.

All pavement surfacing, driveways, curb and gutter, sidewalks, buildings, utility poles, guy wires, and other surface structures affected by construction operations in connection with the performance of the contract, together with all sod and shrubbery removed or damaged, shall be restored to the original condition thereof as determined by the Engineer. All replacement of such underground and surface structures or parts thereof shall be made with new materials conforming to the requirements of these specifications or, if not specified, as approved by the Engineer.

In areas where no further improvements are proposed to be constructed over pipe installations, the Contractor shall replace and restore all surface improvements that existed prior to the pipe installation, and complete all cleanup work within 15 working days after the pipe installation is completed.

The Contractor shall be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property or facility, regardless of location or character, which may be caused by moving, hauling or otherwise

transporting equipment, materials, or men to or from the work, whether by him or his Subcontractors.

The Contractor shall make satisfactory and acceptable arrangements with the owner of, or the agency or authority having jurisdiction over, the damaged property or facility concerning its repair or replacement or payment of costs incurred in connection with said damage.

- 13.03.17 Responsibility for Backfill Settlement – The Contractor shall be responsible, financially and otherwise, for (a) all settlement of trench and other backfill which may occur from the time of original backfilling until the expiration of a period of one year after the date of final payment for the entire contract under which the backfilling work was performed, (b) the refilling and repair of all backfilling settlement and the repair or replacement to the original or a better condition of all pavement, top surfacings, driveways, areaways, curbs, gutters, walks, surface structures, utilities, drainage facilities, sod and shrubbery, which have been damaged as a result of said backfill settlement or which have been removed or destroyed in connection with backfill replacement operations, and (c) all damage claims or court actions against the City for any damage or damages directly or indirectly caused for backfill settlement.

The Contractor shall make, or cause to be made, all necessary backfill replacements, and repairs or replacement appurtenant thereto, within ten working days after due notification by the Engineer.

- 13.03.18 Responsibility for Lateral Locations – The Contractor shall be responsible for constructing laterals at the correct locations and elevations as specified. The Contractor shall be responsible for lowering laterals if found to be at the wrong elevation after the one-year guarantee period.

- 13.03.19 Soil Borings – Soil borings will normally be drilled along the routes of sewer and force mains to determine the character of the subsurface materials. This data will be available at the office of the City Engineer. While all soil borings are drilled with reasonable care and in accordance with good practices, there is no expressed or implied guarantee as to the accuracy of the data, nor of the interpretation thereof. Each bidder must form his own opinion of the character of the materials, which shall be encountered from an inspection of the ground, his own interpretation of the soil boring information and such other investigations as he may desire.

- 13.03.20 Water for Backfilling – Water in reasonable and adequate amounts for inundation or settling of backfill material or for any other use as may be required for proper completion of the work to be performed will be furnished at existing fire hydrants by the City without charge to the Contractor. Use of a backflow prevention device is required prior to connection. Backflow prevention unit shall be obtained via the project inspector.

The Contractor shall furnish all necessary pipe, hose, nozzles, and tools, except hydrant connections, and shall perform all necessary labor for and in connection with the

conveyance and application of water used. The City of Wyoming will furnish the backflow prevention device. The Contractor shall make arrangements with the Superintendent of the Water Department (who will fix the time, rate, and duration of each withdrawal from the water distribution system) as to the amount of water required and the time when such water will be needed. Unnecessary waste of water so furnished will not be tolerated. Special hydrant wrenches shall be used for opening and closing fire hydrants. In no case shall pipe wrenches be used for this purpose.

13.03.21 Measurement and Payment – All de-watering, excavation and trench backfill shall be considered part of the construction of underground utilities for which no compensation will be made, unless otherwise provided for in the proposal, or in these specifications.

Payment shall be made for unsuitable material encountered. The trench backfill above the embedment area shall be measured in linear feet of trench in unsuitable material areas. The contract unit price per linear foot shall be payment in full for removing and disposing of unsuitable material, and replacing with sand backfill regardless of depth of unsuitable material.

Stone or granular material which may be required for embedment as shown on Detail S-13 shall be considered incidental to laying the pipe, and no separate payment will be made therefor.

No payment for special backfill will be made unless specifically authorized by the Engineer before the material is placed.

Concrete curb and gutter or concrete sidewalk which is removed shall be measured and paid for in the same units as specified in the applicable specification for the items.

Sheeting which is left in place at the direction of the Engineer shall be measured and paid for.

Rock removed shall be measured at the top of the trench after removal. It shall be measured and paid for in cubic yards. Boulders shall be measured at the top of the trench individually in cubic yards.

Sod shall be measured and paid for in square yards placed. The contract price shall be payment in full for furnishing and placing sod as specified. Cutting existing sod shall be incidental.

Fence relocations shall be incidental to the major work items unless a specific item is given in the proposal.