CITY OF BATTLE CREEK

ADDENDUM 1

IFB#2017-075B

TITLE: Site Improvements for SW Quad of Hill Brady/Skyline Drive

ADDENDUM ISSUED: April 12, 2017

The following changes, additions and deletions have been provided:

Please see attached Addendum 1, dated April 12, 2017.

DUE DATE AND TIME REMAIN THE SAME

THIS ADDENDUM MUST BE ACKNOWLEDGED ON THE OFFER TO CONTRACT FORM IN THE SOLICITATION OR YOUR BID MAY BE DEEMED NON-RESPONSIVE.

ADDENDUM No. 1
April 12, 2017

CITY OF BATTLE CREEK

SW Quad of Hill Brady/Skyline Development and W.K. Kellogg Airport
IFB #2017-075B

The following changes, additions, and/or clarifications to the Contract Documents shall be incorporated in said documents and shall be allowed for in the unit price bid by the Contractor such that the unit prices indicated in the Bid Form shall represent the conditions as set forth in the Contract Documents and this addendum. The bidder shall acknowledge the receipt of this addendum on the BID FORM.

This Addendum contains 144 pages.

The following Project Manual Sections are being reissued:

SECTION II – OFFER TO CONTRACT, BID FORM (formerly pages 6-8)

SECTION VI – SPECIAL PROVISIONS, SECTION 01 22 00 – UNIT PRICES (formerly pages 30-45)

ADDITIONS AND CHANGES TO THE BIDDING REQUIREMENTS

1. SECTION I – SPECIAL INFORMATION FOR BIDDERS. The following revision is being made to the last paragraph of item 10 (Contractor's Insurance).

   A. The City of Battle Creek, OHM Advisors, and Mead & Hunt shall be listed as an **additional insured** on general liability coverage, and shall be provided with a Certificate of Insurance that reflects this additional insured status. A 30-day notice of cancellation or material change shall be provided to the City and so noted on the Certificate of Insurance. All certificates and notices shall be sent to City of Battle Creek, 10 N. Division, Suite 214, Battle Creek, MI 49014.

2. Section II – OFFER TO CONTRACT, BID FORM. Remove and replace this section with BID FORM issued as part of this addenda. (3 pages)

ADDITIONS AND CHANGES TO THE TECHNICAL SPECIFICATIONS

3. SECTION VI – SPECIAL PROVISIONS, SECTION 01 22 00 – UNIT PRICES. Remove and replace this section with UNIT PRICES issued as part of this addenda. (17 pages)

4. SECTION VI – SPECIAL PROVISIONS, EXHIBIT A. Add the exhibit which includes available Geotechnical Information for the project. (45 pages)

5. SECTION VI – SPECIAL PROVISIONS, EXHIBIT B. Add the exhibit which includes City of Battle Creek Special Provisions for the Sanitary Sewer and Water Main Improvements. (28 pages)

6. SECTION VI – SPECIAL PROVISIONS, EXHIBIT C. Add the exhibit which includes the Technical Specifications applicable for W.K. Kellogg Airport. (50 pages)

Addendum #1 - Bid Form For
SW Quad of Hill Brady/Skyline Development and W.K. Kellogg Airport
City of Battle Creek, Calhoun County, Michigan
OHM Project: 1053-17-0010 / Contract No. 2017-075B

Item	Description	Estimated Quantity		Unit Price	Amount
	SKYLINE AND HILL BRADY SITE				
1	Mobilization (5% Max)	1	LSUM	$	$
2	Remove Concrete Curb & Gutter	92	Ft	$	$
3	Remove Storm Sewer	32	Ft	$	
4	Abandon Drainage Structure	1	Ea	$	
5	Embankment, CIP	444,828	Cyd	$	$
6	Excavation	846,785	Cyd	$	$
7	Stripping & Stockpiling Topsoil	73	Acre	$	$
8	Surplus Material Hauling	407,062	Cyd	$	$
9	Site Restoration	71	Acre	$	$
10	Erosion Control, Inlet Protection, Fabric Drop	26	Ea	$	$
11	Erosion Control, Silt Fence	7,650	Ft	$	$
12	Erosion Control, Check Dam	14	Ea	$	$
13	Erosion Control, Gravel Access Approach	1	Ea		
14	Culv End Sect, Conc, 12 inch	2	Ea	$	$
15	Culv End Sect, Conc, 18 inch	2	Ea	$	$
16	Culv End Sect, Conc, 24 inch	1	Ea	$	$
17	Culv End Sect, Conc, 36 inch	1	Ea	$	$
18	Sewer, Cl IV, 12 inch	222	Ft	$	$
19	Sewer, Cl IV, 18 inch	134	Ft	$	$
20	Sewer, Cl IV, 24 inch	321	Ft	$	$
21	Sewer, Cl IV, 30 inch	574	Ft	$	$
22	Sewer, Cl IV, 36 inch	77	Ft	$	$
23	Dr Structure, 24 inch dia	2	Ea	$	$
24	Dr Structure, 48 inch dia	11	Ea	$	$
25	Dr Structure, 60 inch dia	4	Ea	$	$

Addendum #1 - Bid Form For
SW Quad of Hill Brady/Skyline Development and W.K. Kellogg Airport
City of Battle Creek, Calhoun County, Michigan
OHM Project: 1053-17-0010 / Contract No. 2017-075B

Item	Description	Estimated Quantity		Unit Price	Amount
26	Dr Structure, 72 inch dia	2	Ea	$	$
27	Detention Outlet Structure	4	Ea	$	$
28	Trench Undercut and Refill	100	Cyd	$	
29	Subgrade Underdrain, 6 inch	3,488	Ft	$	$
30	HMA, 2C	1,203	Ton	$	$
31	HMA, 3C	687	Ton	$	$
32	HMA, 4C	516	Ton	$	$
33	Base Aggregate, 21AA	3,034	Ton	$	$
34	Conc. Curb and Gutter, Det F4	3,495	Ft	$	$
35	Traffic Maintenace and Control	1	LSUM	$	$
36	Riprap, Heavy	420	Syd	$	$
37	Stabilization Blanket	60,924	Syd	$	$
38	8" Sanitary Sewer in 16" Casing Pipe, Bore & Jack	96	Ft	$	$
39	8" Sanitary Sewer	1,801	Ft	$	$
40	Sanitary Manhole	7	Ea	$	$
41	Sanitary Sewer Connection	1	Ea	$	$
42	8" Water Main in 16" casing Pipe, Bore & Jack	61	Ft	$	$
43	8" CL 52 Ductile Iron Water Main	2,380	Ft	$	$
44	Fire Hydrant, Valve and Lead	8	Ea	$	$
45	8" Tapping Sleeve, Valve, & Box	1	Ea	$	$
46	Connection to Existing Water Main	2	Ea	$	$
47	8" Gate Valve & Box	2	Ea	$	$
48	Construction Staking	1	LSUM	$	$
49	Exploratory Excavation	1	Ea	$	$

SUBTOTAL: SKYLINE AND HILL BRADY SITE (ITEM 1-49): $

Addendum #1 - Bid Form For
SW Quad of Hill Brady/Skyline Development and W.K. Kellogg Airport
City of Battle Creek, Calhoun County, Michigan
OHM Project: 1053-17-0010 / Contract No. 2017-075B

Item	Description	Estimated Quantity		Unit Price	Amount
	AIRPORT SITE				
50	Mobilization (5% Max, Airport Site)	1	LSUM	$_____	$_____
51	Borrow Placement	407,062	Cyd	$_____	$_____
52	Stripping and Stockpiling Topsoil	46	Acre	$_____	$_____
53	Site Restoration	46	Acre	$_____	$_____
54	Erosion Control, Silt Fence	8,850	Ft	$_____	$_____
55	Reconstruct Drainage/Utility Structure	1	Ea	$_____	$_____
56	Recycled Concrete Aggregate Base Course, 21AA, 8"	818	Cyd	$_____	$_____
57	Remove Pavement	640	Cyd	$_____	$_____
58	Subgrade Underdrain, 6 inch	1,140	Ft	$_____	$_____
59	Construction Staking	1	LSUM	$_____	$_____
60				$_____	$_____

SUBTOTAL: AIRPORT SITE (ITEM 50-60): $_____

GRAND TOTAL (Skyline/Hill Brady Site and Airport Site): $_____

SECTION 01 22 00 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:
   1. Section 01 26 00 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
   2. Section 01 40 00 "Quality Requirements" for field testing by an independent testing agency.

1.3 DEFINITIONS

A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

C. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

D. Payment for work under this contract will be based on a unit price or lump sum for work actually completed. Final measurements of the work will be taken by the Engineer to determine the amount of work done and thereby determine the total cost. The method of applying the unit prices to measured quantities will be as herein specified. Payment will include the cost of all labor, tools, materials, and equipment necessary to do the work.

E. Several items may have been included in the Bid Form but may not be called for on the plans. These items have been included in order to establish a unit price in the event that the item of work is necessary.

F. The Contractor acknowledged that the actual quantity of bid items may increase, decrease, or be zero based on field conditions or Owner direction.

1.5 INCIDENTAL ITEMS

A. Any items of work indicated as incidental or included shall be considered as part of the project work and shall be completed at no additional expense to the Owner. Incidental or included items shall include labor, materials, and equipment that may not be specifically listed in the Bid Form or in the drawings or specifications, but which are necessary to complete the work.

1.6 PERMITS

A. A number of permits have been applied for by the Owner of this project. The permits must be acquired from the appropriate agency by the Contractor when they are approved. Any permit fees, bonds, and/or permit agency inspection costs will be the responsibility of the Contractor and shall not result in additional cost to the Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

1. MOBILIZATION (BID ITEM)
The completed work as measured for MOBILIZATION will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Mobilization, 5% max. $_____	lump sum

The lump sum price shall be payment in full for all preparatory work and operations which may include, but is not limited to, the following items:

1. The movement of personnel, equipment, supplies, and incidentals to the project site.
2. The establishment of the Contractor's facilities to work on the project.
3. Other work and operations that must be performed.
4. Expenses incurred, prior to beginning work on the various contract items on the project site.
5. Pre-construction costs, exclusive of bidding costs, which are necessary direct costs to the project rather than directly attributable to other pay items under the contract.
6. Permits, bonds, etc.

The pay item will state the maximum amount that can be bid. When the percentage of the original contract amount earned is less than 5 percent, the costs of project specific bonding, insurances, and permits will be reimbursed when a paid invoice is received by the Engineer. The costs of these will then be made in accordance with the Partial Payment Schedule shown below. The original contract amount is the total value of all contract items including the mobilization item. The percentage earned is exclusive of the mobilization item. The total sum of all payments for this item shall not exceed the original contract amount bid for mobilization, regardless of the fact that the Contractor may have, for any reason, shut down his work on the project, moved equipment away from the project and then back again, or for additional quantities or items of work added to the contract.

Partial Payment Schedule

Percentage of Original Contract Amount Earned	Percentage of Bid Price for Mobilization Allowed
5	50
10	75
25	100

When a pay item for mobilization is not included in the proposal, payment for any such work is considered to have been included in payments made for other items of work.

2. CONSTRUCTION STAKING (BID ITEM)
The completed work as measured for CONSTRUCTION STAKING will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Construction Staking	lump sum at each site

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to complete all survey activities necessary to layout and install all site improvements, and re-establish any/all disturbed control points, property/section corners, monuments, or other points as further defined in the construction documents.

3. EXPLORATORY EXCAVATION (BID ITEM)
The completed work as measured for EXPLORATORY EXCAVATION will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Exploratory Excavation	each

Exploratory Excavation shall be paid for per test hole dug. The work consists of excavating test holes in order to evaluate potential on-site slurry pit materials, and determining if there will be special handling, placement, and/or disposal requirements associated with the materials.

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to dig test holes and shall include excavation, measurements as necessary, backfill, compaction, and restoration. The Contractor shall coordinate with the Engineer regarding test hole locations in advance of construction in order to allow for possible design changes due to conflicts.

Exploratory Excavation shall be paid only if authorized by the Engineer. Any test hole dug without consent of the Engineer will be done at the Contractor's expense.

Exploratory Excavation will not be paid for test holes dug to locate existing utilities for connections and/or in the path of directional drilling.

4. EROSION CONTROL, INLET PROTECTION, FABRIC DROP (BID ITEM)
The completed work as measured for INLET PROTECTION will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Erosion Control, Inlet Protection, Fabric Drop	each

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to furnish, install, and maintain catch basin or inlet filters in accordance with the plan notes and details. Maintenance work will include removal and replacement of filters as directed by the Engineer. Removal and disposal of the filters and accumulated sediment upon final completion of the project shall be considered as included in the work. The work shall also include removal of accumulated sediment from the ground surface and from the drainage structure sumps.

5. EROSION CONTROL, CHECK DAM (BID ITEM)
The completed work as measured for CHECK DAM will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Erosion Control, Check Dam	each

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to furnish, install, and maintain the gravel filter berms in accordance with the plan notes and details. Maintenance work will include removal and replacement of gravel filter berms as directed by the Engineer. Removal and disposal of the gravel filter berm upon final completion of the project shall be considered as included in the work.

6. EROSION CONTROL, SILT FENCE (BID ITEM)
The completed work as measured for SILT FENCE will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Erosion Control, Silt Fence	feet

Silt fence shall be measured in place horizontally by linear feet. The length shall be measured along the top of fence from end of fence to end of fence.

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to furnish, install, and maintain the silt fence in accordance with the plan notes and details. Removal and disposal of the silt fence and accumulated sediment upon final completion of the project shall be considered as included in the work. Placement and maintenance of stone outlet filters at low points along the silt fence line shall also be considered as included in the silt fence work. Maintenance work will include removal and replacement of silt fence and outlet filters as directed by the Engineer. Restoration of disrupted areas shall be paid for separately under the appropriate surface restoration pay items.

7. EROSION CONTROL, GRAVEL ACCESS APPROACH (BID ITEM)
The completed work as measured for TEMPORARY CONSTRUCTION ENTRANCE will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Erosion Control, Gravel Access Approach	ea

Gravel access approach shall be paid as a unit price, inclusive item. The contract unit price shall be payment in full for all labor, materials, and equipment necessary to furnish, install, and maintain each gravel access approach or temporary construction entrance in accordance with the plan notes and details. Removal and disposal of gravel, geotextile, and accumulated sediment upon final completion of the project shall be considered as included in the work. Inclusion and proper placement of the geotextile liner shall be included. Maintenance work will include removal and/or adding of gravel and/or replacement of geotextile as directed by the Engineer. Restoration of disrupted areas shall be paid for separately under the appropriate surface restoration pay items.

8. REMOVE CONCRETE CURB AND GUTTER (BID ITEM)
The completed work as measured for REMOVE CONCRETE CURB AND GUTTER will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Remove Concrete Curb and Gutter	feet

Concrete curb and gutter removal shall be measured along the gutter line in linear feet.

The contract unit price shall be payment in full for all labor, materials and equipment required to sawcut, remove, and properly dispose of the concrete curb and gutter offsite.

9. REMOVE PAVEMENT (BID ITEM)
The completed work as measured for REMOVE PAVEMENT will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Remove Pavement	square yard

Pavement removal shall be measured in place by area in square yards. The removal area shall be based upon the average length and width measurements as determined in the field by the Engineer.

The contract unit price shall be payment in full for all labor, material and equipment required to sawcut, remove, and properly dispose of the pavement off site. The contract unit price shall apply to pavement of any thickness (both bituminous and concrete).

10. REMOVE STORM SEWER (BID ITEM)
The completed work as measured for REMOVE STORM SEWER will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Remove Storm Sewer	feet

Storm sewer removal shall be measured in place horizontally by linear feet. The length shall be measured along the sewer centerline from center of structure to center of structure or to end of end section. In the event that the storm sewer is not connected to a structure then the measurement for payment shall be made end-to-end of pipe removed.

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to remove and properly dispose of the existing sewer offsite as well as furnish, place, and compact suitable backfill material in the remaining trench. The contract price shall also include any temporary sheeting, shoring, and bracing that may be necessary for the removal work. Payment for removing storm sewer shall not apply when a new storm sewer is to be constructed in the same trench where the existing storm sewer is being removed. In this case, removal of the existing storm sewer shall be considered as incidental to the new storm sewer construction.

11. ABANDON DRAINAGE STRUCTURE (BID ITEM)
The completed work as measured for ABANDON DRAINAGE STRUCTURE will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Abandon Drainage Structure	each

The contract unit price for abandoning drainage structures shall include removing and salvaging the casting as well as removing the cone and riser sections down to an elevation at least three feet below the proposed ground elevation. Any necessary excavation as well as furnishing, placing, and compacting suitable backfill shall be considered as included in the drainage structure abandonment work. Drainage structures may include manholes, catch basins, or inlets. Disposal of the cone, riser sections, or other masonry shall also be considered as included as part of the work. If the Owner wishes to retain the salvaged casting, then the Contractor shall deliver it to the Owner's storage yard. Otherwise, the Contractor shall be responsible for disposal of the unwanted appurtenances.

12. RECONSTRUCT STRUCTURE (BID ITEM)
The completed work as measured for RECONSTRUCT STRUCTURE will be paid for at the contract unit price for the following contract items (pay items):

Pay Item	Pay Unit
Reconstruct Drainage/Utility Structure	each

The work of reconstructing structures shall be paid for on a per structure basis and shall apply when the total amount of vertical change of the casting is more than 6 inches. The pay item for reconstructing drainage/utility structures shall apply to existing storm manholes, catch basins, inlets, and gate wells. This pay item shall not apply to new structures since final adjustment in this case is included in the contract unit price of the new structure.

The contract unit price shall be payment in full for all labor, material, and equipment necessary to reconstruct structures in accordance with the plan details so that the castings will match the new finished pavement or landscape surface grades. Excavation, backfill, cleaning the existing casting and disposal of excess or unsuitable materials shall all be considered as included as part of the adjustment work.

13. EMBANKMENT, CIP (BID ITEM)
The completed work as measured for EMBANKMNET (or FILL at Hill Brady and Skyline Site) will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Embankment, CIP	cubic yard

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to perform all earthwork necessary for the construction of the project.

The contract lump sum price shall include items such as transporting, placing, grading, and compacting earth as well as stockpiling and finish grading. Furnishing, grading, and compacting suitable embankment material as well as removing excess or unsuitable material shall also be considered as part of project earthwork. In addition, removing topsoil and vegetation, root trimming, clearing, brushing, and removal of trees under 6 inches in diameter shall be considered as part of the work unless separate pay items have been included in the bid form.

Measurement of this bid item shall be in the form of a computer volumetric (cut-fill) analysis, performed by the Engineer, comparing existing grades with final grades as determined by Engineer-performed survey. The quantity shall be determined by the total fill as calculated by such analysis, less any topsoil, pavement, or other site improvement feature above subgrade. Payment shall be for each in-situ cubic yard filled.

14. EXCAVATION (BID ITEM)
The completed work as measured for EXCAVATION will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Excavation	cubic yard

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to perform all excavation necessary for the construction of the project.

The contract unit price shall include items such as excavating, grading, and compacting earth as well as stockpiling and finish grading. Removing excess or unsuitable material and well as grading the excavated surface shall also be considered as part of project earthwork. In addition, removing topsoil and vegetation, root trimming, clearing, brushing, and removal of trees under 6 inches in diameter shall be considered as part of the work unless separate pay items have been included in the bid form.

Measurement of this bid item shall be in the form of a computer volumetric (cut-fill) analysis, performed by the Engineer, comparing existing grades with final grades as determined by Engineer-performed survey. The quantity shall be determined by the total cut as calculated by such analysis, less any topsoil, pavement, or other site improvement feature above subgrade. Payment shall be for each in-situ cubic yard excavated.

15. STRIPPING AND STOCKPILING TOPSOIL (BID ITEM)
The completed work as measured for STRIPPING AND STOCKPILING TOPSOIL (or UNCLASSIFIED EXCAVATION on Airport Site) will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Stripping and Stockpiling Topsoil	acre

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to perform all stripping and stockpiling necessary for the construction of the project.

The contract unit price shall include items such as stripping, transporting, and stockpiling topsoil as well as protection from contamination. Furnishing, grading, and compacting suitable embankment material as well as removing excess or unsuitable material shall also be considered as part of project earthwork. In addition, removing topsoil and vegetation, root trimming, clearing, brushing, and removal of trees under 6 inches in diameter shall be considered as part of the work unless separate pay items have been included in the bid form.

16. SURPLUS MATERIAL HAULING (BID ITEM)
The completed work as measured for SURPLUS MATERIAL HAULING will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Surplus Material Hauling	cubic yard

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to perform all earthwork necessary for the construction of the project. The quantity paid for this bid item shall not exceed the calculated and paid quantity, in cubic yards, for BORROW PLACEMENT.

The contract lump sum price shall include items such as excavating, stock piling, loading, and hauling. In addition, removing topsoil and vegetation, root trimming, clearing, brushing, and removal of trees under 6 inches in diameter shall be considered as part of the work unless separate pay items have been included in the bid form.

Measurement of this bid item shall be in the form of in-place cubic yards calculated under BORROW PLACEMENT.

17. BORROW PLACEMENT (BID ITEM)
The completed work as measured for BORROW PLACEMENT will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Borrow Placement	cubic yard

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to perform all earthwork necessary for the construction of the project.

The contract lump sum price shall include items such as unloading, stockpiling, placement, grading and compaction of earth. Furnishing, grading, and compacting suitable embankment material as well as removing excess or unsuitable material shall also be considered as part of project earthwork. In addition, removing topsoil and vegetation, root trimming, clearing, brushing, and removal of trees under 6 inches in diameter shall be considered as part of the work unless separate pay items have been included in the bid form.

Measurement of this bid item shall be in the form of a computer volumetric (cut-fill) analysis, performed by the Engineer, comparing existing grades with finished grades by Engineer-performed survey. The quantity shall be determined by the net fill as calculated by such analysis. Payment shall be for each in place cubic yard of material placed and compacted, less the replaced topsoil.

18. TRENCH UNDERCUT AND REFILL (BID ITEM)
The completed work as measured for TRENCH UNDERCUT AND REFILL will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Trench Undercut and Refill	cubic yard

Trench undercut and refill shall be measured in place and shall be based upon the average length, width, and depth measurements of the undercut areas as determined by the Engineer. Undercut areas that are not authorized or measured by the Construction Observer will not be considered for payment.

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to excavate the subgrade beyond 18 inches below the pipe invert and replace with compacted stone refill. Disposal of undercut materials shall be considered as incidental to the work.

19. STORM SEWER (BID ITEM)
The completed work as measured for STORM SEWER will be paid for at the contract unit price for the following contract items (pay items):

Pay Item	Pay Unit
Sewer, CI IV, _ inch	feet

Storm sewer shall be measured in place horizontally by linear feet. The length shall be measured along the centerline of the pipe from end of pipe to end of pipe or to center of structure. Radius pipe or bend sections will be measured and paid for as storm sewer. The measurement shall not include the length of end sections, which shall be paid for separately.

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to construct the storm sewer. The payment for storm sewer shall include the following (except such items for which separate prices are received on the Bid Form): clearing; excavating; trenching; disposal of items from clearing; disposal of unsuitable or excess excavated materials; temporary sheeting, bracing and shoring of excavations; support, relocation, replacement, connection or reconnection of existing pipe lines, building leads and utilities; furnishing and placing of pipe, jointing materials, fittings, bulkheads, plugs, adaptors; furnishing and placing of required bedding, backfill, and fill materials; complete cleanup and surface restoration. Removal of an existing storm sewer shall be considered as included in the price for the new storm sewer construction if the new storm sewer is being constructed in the same trench as the existing sewer.

Payment for storm sewer shall also include up to 18 inches of trench undercut with stone refill unless otherwise shown in the plan details. If additional undercut is required beyond 18 inches, then it shall be paid for separately as Trench Undercut and Refill.

The contract unit price shall also include payment in full for dewatering of the excavation as described in the technical sections. The contract unit price does not include dewatering by means of deep wells or well points. In the event that dewatering by means of deep wells or well points is required, as determined by the Engineer, then this work shall be paid for separately.

20. SUBGRADE UNDERDRAIN, 6" (BID ITEM)
The completed work as measured for SUBGRADE UNDERDRAIN, 6" will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Subgrade Underdrain, 6"	feet

Subgrade underdrain shall be measured in place horizontally by linear feet. The length shall be measured along with the centerline of the pipe from end of pipe to end of pipe or to center of structure.

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to construct the underdrain including all excavation, backfill and fill materials, disposal of excess materials, pipe, joint materials, complete cleanup, and all other work required for the proper placement of the underdrain in accordance with the plan details. The geotextile trench wrap and trench aggregate that are called for in the plan detail shall be considered as included in the placement of the underdrain.

21. DRAINAGE STRUCTURES (INLETS, CATCH BASINS, MANHOLES) (BID ITEM)
The completed work as measured for DRAINAGE STRUCTURES will be paid for at the contract unit price for the following contract items (pay items):

Pay Item	Pay Unit
Dr Structure, __inch dia.	each

The contract unit price shall be payment in full for all labor, materials and equipment necessary to construct the storm structure. Each storm structure shall be complete with base, steps, frames and covers, stubs, pipe opening, channels, and sumps (where appropriate) as called for in the plan details. Payment for storm structures shall include the following (except such items for which separate prices are received on the bid form): excavating; disposal of unsuitable or excess excavated materials; temporary sheeting, bracing and shoring of excavations; support, relocation, replacement, connection or reconnection of existing pipe lines, building leads and utilities; furnishing and placing of structure, jointing materials, fittings, bulkheads, and plugs; cleaning; furnishing and placing of required bedding, backfill and fill materials; final adjustment or reconstruction of casting to finished grade; complete cleanup and surface restoration. Payment will be the same for standard and low head structures of the same diameter. Payment will also be the same for storm manholes of the same diameter both with and without sumps. Removal of an existing storm structure shall be considered as included in the price for the new storm structure construction if the new storm structure is being constructed in the same location as the existing structure.

The contract unit price shall also include payment in full for dewatering of the excavation as described in the technical sections. The contract unit price does not include dewatering by means of deep wells or well points. In the event that dewatering by means of deep wells or well points is required, as determined by the Engineer, then this work shall be paid for separately.

22. DETENTION OUTLET STRUCTURE (BID ITEM)
The completed work as measured for DETENTION OUTLET STRUCTURE will be paid for at the contract unit price for the following contract items (pay items):

Pay Item	Pay Unit
Detention Outlet Structure	each

The contract unit price shall be payment in full for all labor, materials and equipment necessary to construct the detention outlet structure. Each storm structure shall be complete with concrete base, CMP riser, steel grate, PVC discharge pipe and assemblies, 3" washed stone, and MDOT 6A stone as called for in the plan details. Payment for detention outlet structures shall include the following (except such items for which separate prices are received on the bid form): excavating; disposal of unsuitable or excess excavated materials; temporary sheeting, bracing and shoring of excavations; support, relocation, replacement, furnishing and placing of structure, jointing materials, fittings, bulkheads, and plugs; cleaning; furnishing and placing of required bedding, backfill and fill materials; final adjustment or reconstruction of casting to finished grade; complete cleanup and surface restoration.

The contract unit price shall also include payment in full for dewatering of the excavation as described in the technical sections. The contract unit price does not include dewatering by means of deep wells or well points. In the event that dewatering by means of deep wells or well points is required, as determined by the Engineer, then this work shall be paid for separately.

23. CULVERT END SECTIONS (BID ITEM)
The completed work as measured for CULVERT END SECTIONS will be paid for at the contract unit price for the following contract items (pay items):

Pay Item	Pay Unit
Culv End Sect, Conc, ___inch	each

The contract price shall be payment in full for all labor, material, and equipment necessary to furnish and install the end sections in accordance with the plan details. Excavation, trenching, bedding, backfill, and disposal of excess or unsuitable materials shall be included in the contract unit price for culvert end sections. If called for on the plans, concrete footings and bar screens shall be included as part of the end sections and shall not be paid for separately.

24. RIPRAP, HEAVY (BID ITEM)
The completed work as measured for RIPRAP, HEAVY will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Riprap, Heavy	square yard

Rip Rap shall be measured in place and payment shall be based upon the average length and width measurements of the riprap areas.

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to furnish and install the riprap in accordance with the plan details. If the rip rap placement details call for geotextile fabric and stone bedding, then these items shall be considered as incidental to the rip rap.

25. SANITARY SEWER (BID ITEM)
The completed work as measured for SANITARY SEWER will be paid for at the contract unit price for the following contract items (pay items):

Pay Item	Pay Unit
8" Sanitary Sewer	feet

Sanitary sewer shall be measured in place horizontally by linear feet along the sewer centerline from center of manhole to center of manhole. Stubs shall be measured from the center of manhole to the end of pipe.

The contract unit price shall be payment in full for all labor, materials and equipment necessary to construct the sewer. The payment for Sanitary Sewer shall include the following (except such items for which separate prices are received on the bid form): clearing; excavating; trenching; disposal of items from clearing; disposal of unsuitable or excess excavated materials; temporary sheeting, bracing and shoring

of excavations; support, relocation, replacement, connection or reconnection of existing pipe lines, building leads and utilities; furnishing and placing of pipe, jointing materials, fittings, bulkheads, plugs, adaptors and markers; cleaning and testing; furnishing and placing of required bedding, backfill and fill materials; complete cleanup and surface restoration.

Payment for sanitary sewer shall also include up to 18 inches of trench undercut and refill with compacted MDOT 6A crushed gravel or MDOT 6A crushed concrete unless otherwise shown in the plan details. If additional undercut is required beyond 18 inches, then it shall be paid for separately as Trench Undercut and Refill.

The contract unit price shall also include payment in full for dewatering of the excavation as described in the Earthwork section. The contract unit price does not include dewatering by means of deep wells or well points. In the event that dewatering by means of deep wells or well points is required, as determined by the Engineer, then this work shall be paid for separately.

26. SANITARY SEWER IN CASING PIPE, BORE, & JACK (BID ITEM)
The completed work as measured for SANITARY SEWER IN CASING PIPE, BORE & JACK will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
8" Sanitary Sewer in 16" Casing Pipe, Bore, & Jack	feet

Sanitary Sewer in Casing pipe shall be measured in place horizontally by linear feet along the centerline of the casing pipe from end to end.

The contract unit price shall be payment in full for all labor, materials and equipment necessary to install the complete sanitary sewer and casing pipe assembly. Payment for Sanitary Sewer in Casing Pipe shall include the following: shaft excavation and protection; temporary sheeting, bracing and shoring of excavation; disposal of unsuitable or excess excavated material; furnishing and placing of carrier and casing pipe; filling of the void between the carrier pipe and casing pipe (pressure grouting or sand, if required); skids; bulkheading of the casing pipe; backfilling of the shaft; all other work necessary for a complete job including submitting to the Engineer a drawing of the proposed installation details.

The contract unit price shall also include payment in full for dewatering of the excavation as described in the technical sections. The contract unit price does not include dewatering by means of deep wells or well points. In the event that dewatering by means of deep wells or well points is required, then this work shall be paid for separately

27. SANITARY MANHOLES (BID ITEM)
The completed work as measured for SANITARY MANHOLE will be paid for at the contract unit price for the following contract items (pay items):

Pay Item	Pay Unit
Sanitary Manhole	each

The contract unit price shall be payment in full for all labor, materials and equipment necessary to construct the manholes. Each manhole shall be complete with base, steps, frames and covers, stubs, pipe openings and channels. Payment for Sanitary Manholes shall include the following (except items for which separate prices are received on the bid form): excavating; disposal of unsuitable or excess excavated materials; temporary sheeting, bracing and shoring of excavations; support, relocation, replacement, connection or reconnection of existing pipe lines, building leads and utilities; furnishing and placing of structure, jointing materials, fittings, bulkheads, and plugs; cleaning; furnishing and placing of required bedding, backfill and fill materials; final adjustment or reconstruction of casting to finished grade; complete cleanup and surface restoration.

The contract unit price shall also include payment in full for dewatering of excavation as described in the technical sections. The contract unit price does not include dewatering by means of deep wells or well points. In the event that dewatering by means of deep wells or well points is required, as determined by the Engineer, then this work shall be paid for separately.

28. CONNECTION TO EXISTING SEWERS AND MANHOLES
The cost for connection of new sewers to existing sewers or manholes shall be considered incidental to the pay items for sewer. Connections and/or taps shall include the furnishing and installation of Kor-N-Seal or approved equal flexible watertight boot connection system.

29. WATER MAIN (BID ITEM)
The completed work as measured for WATER MAIN will be paid for at the contract unit price for the following contract items (pay items):

Pay Item	Pay Unit
8" Class 52 Ductile Iron Water Main	feet

Water main shall be measured in place horizontally by linear feet along the centerline of the pipe from center of end fittings or end-to-end, without deduction for intervening valves, gate wells or structures.

The contract unit price shall be payment in full for all labor, materials and equipment necessary to construct the water main. Payment for Water Main shall include the following (except such items for which separate prices are received on the bid form): excavating; trenching; disposal of unsuitable or excess excavated materials; temporary sheeting, bracing and shoring of excavations; support, relocation, replacement, connection or reconnection of existing pipe lines, building leads and utilities; furnishing and placing of pipe, jointing materials, fittings, bulkheads, plugs, sleeves, adaptors, joint restraint, corporation stops, necessary thrust blocks; connections to existing mains; flushing; cleaning; chlorination; sterilization; hydrostatic and bacteriological testing; furnishing and placing of required bedding, backfill and fill materials; complete cleanup and surface restoration.

Payment for water main shall also include up to 18 inches of trench undercut and refill with compacted MDOT 6A crushed gravel or MDOT 6A crushed concrete unless otherwise shown in the plan details. If additional undercut is required beyond 18 inches then it shall be paid for separately as Trench Undercut and Refill.

The contract unit price shall also include payment in full for dewatering of excavation as described in the technical sections. The contract unit price does not include dewatering by means of deep wells or well points. In the event that dewatering by means of deep wells or well points is required, as determined by the Engineer, then this work shall be paid for separately.

30. WATER MAIN IN CASING PIPE, BORE, & JACK (BID ITEM)
The completed work as measured for WATER MAIN IN CASING PIPE, BORE & JACK will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
8" Water Main in 16" Casing Pipe, Bore, & Jack	feet

Water Main in Casing pipe shall be measured in place horizontally by linear feet along the centerline of the casing pipe from end to end.

The contract unit price shall be payment in full for all labor, materials and equipment necessary to install the complete water main and casing pipe assembly. Payment for Water Main in Casing Pipe shall include the following: shaft excavation and protection; temporary sheeting, bracing and shoring of excavation; disposal of unsuitable or excess excavated material; furnishing and placing of carrier and casing pipe; filling of the void between the carrier pipe and casing pipe (pressure grouting or sand, if required);

skids; bulkheading of the casing pipe; backfilling of the shaft; all other work necessary for a complete job including submitting to the Engineer a drawing of the proposed installation details.

The contract unit price shall also include payment in full for dewatering of the excavation as described in the technical sections. The contract unit price does not include dewatering by means of deep wells or well points. In the event that dewatering by means of deep wells or well points is required, then this work shall be paid for separately.

31. GATE VALVE AND BOX (BID ITEM)
The completed work as measured for GATE VALVE and BOX will be paid for at the contract unit price for the following contract items (pay items):

Pay Item	Pay Unit
8" Gate Valve & Box	each

The contract unit price shall be payment in full for all labor, materials and equipment necessary to construct the gate valves and boxes. Payment for Gate Valves and Boxes shall include the following (except such items for which separate prices are received on the bid form): excavating; disposal of unsuitable or excess excavated materials; temporary sheeting, bracing and shoring of excavations; support, relocation, replacement, connection or reconnection of existing pipe lines, and utilities; furnishing and placing of box, jointing materials, valve, fittings, bulkheads, and plugs; cleaning; furnishing and placing of 6" of aggregate bedding, backfill and fill materials; complete cleanup and surface restoration.

The contract unit price shall also include payment in full for dewatering of excavation as described in the technical sections. The contract unit price does not include dewatering by means of deep wells or well points. In the event that dewatering by means of deep wells or well points is required, as determined by the Engineer, then this work shall be paid for separately.

32. TAPPING SLEEVE, VALVE AND BOX (BID ITEM)
The completed work as measured for TAPPING SLEEVE, VALVE and BOX will be paid for at the contract unit price for the following contract items (pay items):

Pay Item	Pay Unit
8" Tapping Sleeve, Valve & Box	each

The contract unit price shall be payment in full for all labor, materials and equipment necessary to construct the tapping sleeve, valve and box. Payment for Tapping Sleeve, Valve and Box shall include the following (except such items for which separate prices are received on the bid form): excavating; disposal of unsuitable or excess excavated materials; temporary sheeting, bracing and shoring of excavations; support, relocation, replacement, connection or reconnection of existing pipe lines, and utilities; tapping of existing main; furnishing and placing of box, jointing materials, valve, corporation stops, fittings, bulkheads, and plugs; cleaning; furnishing and placing of required bedding, backfill and fill materials; complete cleanup and surface restoration.

The contract unit price shall also include payment in full for dewatering of excavation as described in the technical sections. The contract unit price does not include dewatering by means of deep wells or well points. In the event that dewatering by means of deep wells or well points is required, as determined by the Engineer, then this work shall be paid for separately.

33. FIRE HYDRANT (BID ITEM)
The completed work as measured for FIRE HYDRANT will be paid for at the contract unit price for the following contract items (pay items):

Pay Item	Pay Unit
Fire Hydrant, Valve, and Lead	each

The contract unit price shall be payment in full for all labor, materials and equipment necessary to construct the Fire Hydrant assembly complete as shown on the plan details. Payment for Fire Hydrants shall include the following (except such items for which separate prices are received on the bid form): excavating; disposal of unsuitable or excess excavated materials; temporary sheeting, bracing and shoring of excavations; support, relocation, replacement, connection or reconnection of existing pipe lines, and utilities; furnishing and placing of fire hydrant, water main pipe, jointing materials, restrained joints, companion shut off valve and box, fittings, bend, bulkheads, plugs, and thrust blocks; cleaning; furnishing and placing of required bedding, backfill and fill materials; complete cleanup and surface restoration. The unit price for fire hydrants shall include all work from the water main to the location where the hydrant assembly is placed.

The contract unit price shall also include payment in full for dewatering of excavation as described in the technical sections. The contract unit price does not include dewatering by means of deep wells or well points. In the event that dewatering by means of deep wells or well points is required, as determined by the Engineer, then this work shall be paid for separately.

34. WATER MAIN FITTINGS

The cost of water main fittings (i.e. tees, reducers, bends, crosses, etc.) shall be considered incidental to the pay items for water main construction.

35. WATER MAIN PLUGS, BULKHEADS AND CAPS

The cost of water main plugs, bulkheads and caps shall be considered incidental to the pay items for water main construction.

36. CONNECTION TO EXISTING WATER MAIN (BID ITEM)

The completed work as measured for CONNECTION TO EXISTING WATER MAIN will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Connection to Existing Water Main	each

The contract unit price shall be payment in full for all labor, materials and equipment necessary to connect the new water main to the existing water main in accordance with the plan details. This pay item would apply to connections made to existing water mains at existing stubs or by cutting in tees. Payment for Connection to Existing Water Main shall include the following (except such items for which separate prices are received on the bid form): excavating; disposal of unsuitable or excess excavated materials; temporary sheeting, bracing and shoring of excavations; support, relocation, replacement, connection or reconnection of existing pipe lines, building leads and utilities; furnishing and placing of pipe, jointing materials, fittings, bulkheads, plugs, sleeves, adaptors, joint restraint, corporation stops, necessary thrust blocks; connections to existing mains; cleaning and testing; sterilization; furnishing and placing of required bedding, backfill and fill materials; complete cleanup and surface restoration.

The contractor shall not receive payment for this item if the connection to an existing main is made by means of a tapping sleeve, valve and well.

The contract unit price shall also include payment in full for dewatering of excavation as described in the technical sections. The contract unit price does not include dewatering by means of deep wells or well points. In the event that dewatering by means of deep wells or well points is required, as determined by the Engineer, then this work shall be paid for separately.

37. CONCRETE CURB & GUTTER (BID ITEM)
The completed work as measured for CONCRETE CURB & GUTTER will be paid for at the contract unit price for the following contract items (pay items):

Pay Item	Pay Unit
Concrete Curb & Gutter, Detail F4	feet

Concrete curb & gutter shall be measured in place by linear feet. The length shall be measured along the gutter line from end of curb to end of curb. Curb endings and curb drops shall all be measured and paid for as concrete curb and gutter, detail F4.

The contract price shall be payment in full for all labor, materials, and equipment necessary to construct the concrete curb and gutter in accordance with the plan details. Any excavation, subgrade compaction, backfilling behind the curb, disposal of excess materials, joints, curing compound, and placement of curb drops shall be considered as incidental to the curb and gutter construction.

38. HOT MIX ASPHALT (HMA) PAVEMENT (BID ITEM)
The completed work as measured for HOT MIX ASPHALT (HMA) PAVEMENT will be paid for at the contract unit price for the following contract items (pay items):

Pay Item	Pay Unit
HMA, (type)	tons

HMA pavement for mainline road paving shall be measured in tons based upon certified weight delivery tickets. The Contractor must provide certified weight delivery tickets to the Construction Observer.

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to construct the HMA pavement in accordance with the plan details. Furnishing and applying bond coats, pavement compaction, and protection of the work shall all be considered as incidental to HMA pavement construction.

39. AGGREGATE BASE COURSE (BID ITEM)
The completed work as measured for AGGREGATE BASE COURSE will be paid for at the contract unit price for the following contract items (pay items):

Pay Item	Pay Unit
Base Aggregate, 21AA	ton

Aggregate base course shall be measured in tons based upon certified weight delivery tickets.

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to place, grade, and compact the aggregate base course materials. Any earth excavation, subgrade preparation, or material disposal that is required for the aggregate base course placement shall be considered as incidental to the work unless separate pay items have been included in the bid form for earthwork.

40. RECYCLED CONCRETE AGGREGATE BASE COURSE (BID ITEM)
The completed work as measured for RECYCLED CONCRETE AGGREGATE BASE COURSE will be paid for at the contract unit prices for the following contract items (pay items):

Pay Item	Pay Unit
Recycled Concrete Aggregate Base Course, 21AA, 8" (per Airport Docs)	square yard

Aggregate surface courses shall be measured in place by square yards. The area shall be based upon the average length and width measurements of the aggregate placement area as determined by the En-

gineer. Depth measurements will be taken as necessary in order to verify the aggregate surface course thickness.

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to place, grade, and compact aggregate surface course material. Aggregate surface course shall be used for road surfaces, shoulder surfaces, and drive approaches as called for on the plans. Any earth excavation, subgrade preparation, or material disposal that is required for the surface course placement shall be considered as incidental to the work.

41. TRAFFIC MAINTENANCE AND CONTROL (BID ITEM)
The completed work as measured for TRAFFIC MAINTENANCE AND CONTROL will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Traffic Maintenance and Control	lump sum

The contract lump sum price shall be payment in full for all labor, materials, and equipment necessary to furnish, install, and maintain all signs, cones, barricades, flagging, etc. as required by the Michigan Manual of Uniform Traffic Control Devices and the technical specifications. Removal of any temporary signs or other traffic control equipment upon completion of the project shall be considered as incidental to the traffic maintenance and control work.

42. SITE RESTORATION (BID ITEM)
The completed work as measured for SITE RESTORATION will be paid for at the contract unit price for the following contract items (pay items):

Pay Item	Pay Unit
Site Restoration	acre

Surface Restoration with topsoil, seed, and mulch shall be measured in place by acre and shall be based upon measurements of the restored area as determined by the Construction Observer.

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to furnish and place topsoil or place stockpiled topsoil, seed, and mulch as called for on the plans and specifications. Watering seed until vigorous turf growth is established shall be considered as incidental to the surface restoration work unless a separate pay item for water is included in the Bid Form.

Application of mulch anchoring shall be considered as incidental to the placement of the mulch unless a separate pay item for the mulch anchoring has been included in the Bid Form.

43. STABILIZATION BLANKETS (BID ITEM)
The completed work as measured for STABILIZATION BLANKET will be paid for at the contract unit price for the following contract item (pay item):

Pay Item	Pay Unit
Stabilization Blanket	square yard

Stabilization blanket shall be measured in place and payment shall be based upon the average length and width measurements of the blanket placement areas.

The contract unit price shall be payment in full for all labor, materials, and equipment necessary to furnish and install the mulch blanket in accordance with the plan details and the manufacturer's recommendations. Furnishing and placing biodegradable plastic staples or stakes for anchoring the blankets shall be considered as incidental to the blanket placement work.

44. CLEAN OUT STORM STRUCTURES
Upon completion of the restoration work, the contractor shall clean out all storm structures, which are located within the project area. This work shall be considered as incidental to the project cost.

45. MISCELLANEOUS RESTORATION ITEMS
Restoration of miscellaneous items such as, but not limited to, street signs, traffic signs, shrubbery and other ornamental landscape items which are damaged, removed, or destroyed by the Contractor in the course of the work shall be repaired or replaced by the Contractor with new materials of equal quality as existed prior to the start of work. All such items for which specific bid items are not listed in the proposal shall be considered as incidental work and shall be replaced or repaired at the expense of the Contractor.

46. FINAL CLEAN UP
Final clean up of the job shall be considered as incidental. Items in this category include removal of debris and litter from the site, removal of surplus materials, sweeping, repair of any damages, and clean out of drainage structures located within the work area.

Surface Restoration shall commence immediately upon completion of final grading or as MDOT seasonal limitations dictate.

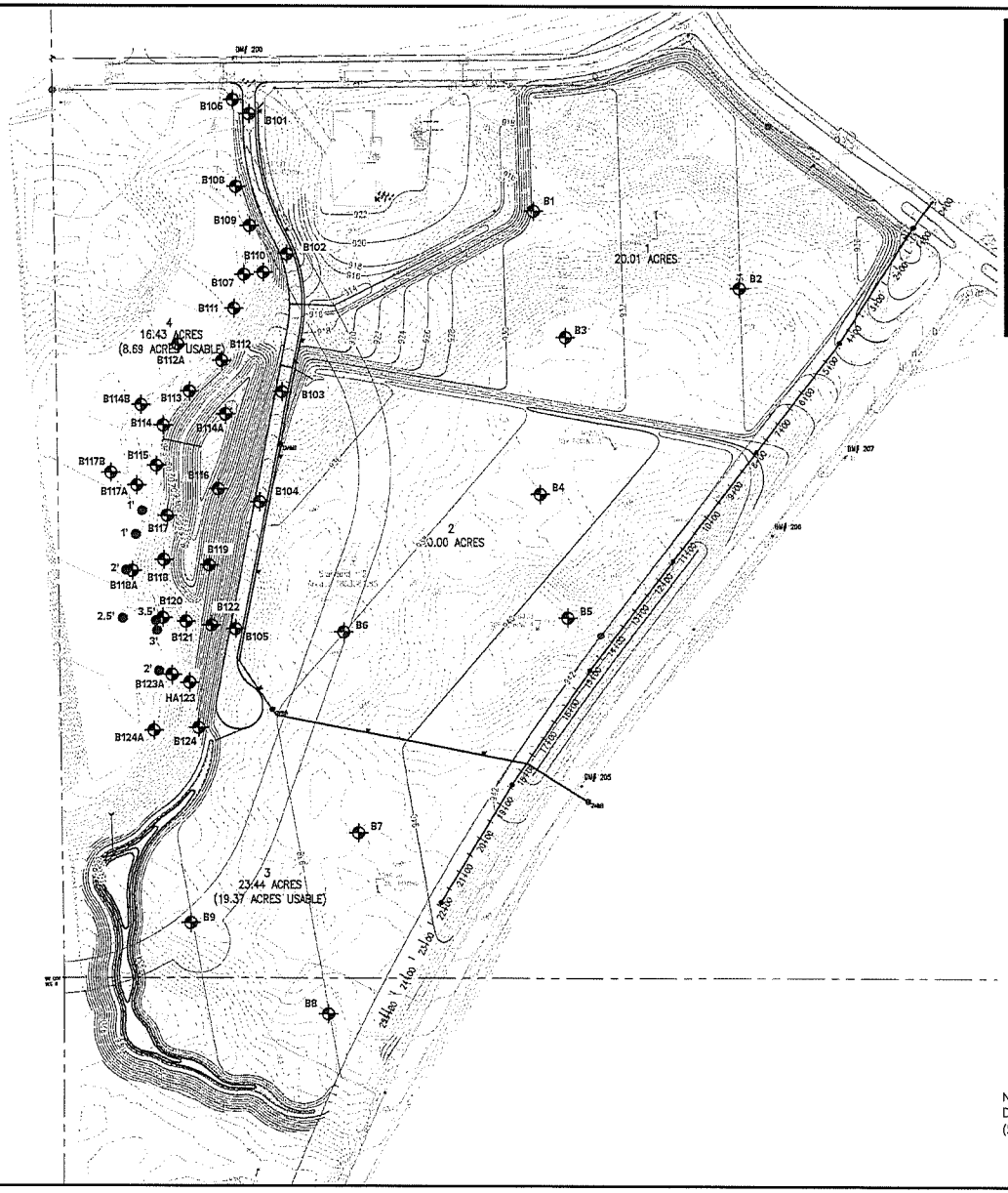
47. PRIVATE UTILITY ADJUSTMENT

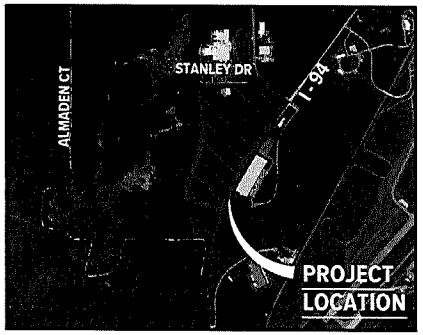
Adjustment and/or relocation of private utility structures such as gas valves, structure covers, riser boxes, etc. shall be considered as incidental to the project. The Contractor shall furnish all labor, materials, tools, and equipment required to adjust private utility structures to the finished elevations. If private utility structures are to be adjusted and/or relocated by their respective owners, then the Contractor shall be responsible for coordinating this work with the private utility owner as incidental to the project

END OF SECTION 01 22 00

Appendix A:

Geotechnical Information





LOCATION MAP

NTS

NORTH

0' 300' 600'

GRAPHIC SCALE: 1" = 300'

LEGEND

- APPROXIMATE BORING LOCATION
- APPROXIMATE HAND AUGER LOCATION
- APPROXIMATE MUCK PROBE LOCATION

NOTE:
DRAWING INFORMATION TAKEN FROM GRADING PLAN OVERALL (SHEET C-150) DATED 3-28-2017 PREPARED BY OHM.

SME

www.sme-usa.com

Project

CITY OF BATTLE CREEK SW QUAD OF HILL BRADY / SKYLINE DEVELOPMENT

Project Location

BATTLE CREEK, MICHIGAN

Sheet Name

BORING LOCATION DIAGRAM

No.	Revision Date

Date	03-29-17
CADD	GM
Designer	KG
Scale	1" = 300'
Project	075805.00
Figure No.	1

PLOT DATE: Apr 12, 2017 - 1:59pm - MANDRILA FILE LOCATION: \\Sme-in\cp\WIP\075805.00\CAD\DWGS\rev0\075805.00-01.dwg

SME

DRAFT

BORING B 1

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 4/4/17 **COMPLETED:** 4/4/17 **BORING METHOD:** Hollow-stem Augers
DRILLER: AM (Cook Drilling) **RIG NO.:** D-50 ATV **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		0.7 TOPSOIL							Occasional cobbles encountered from 0.7 feet to 3.4 feet below the existing ground surface.
			SB1	13	1 1 1	2			
			SB2	18	6 5 4	9			
5		Fine CLAYEY SAND- Brown- Moist- Very Loose to Loose (SC)	SB3	18	3 3 3	6			
			SB4	18	2 3 3	6			
10									
▽		13.2							
			SB5	14	3 3 4	7			
15									
▼									
			SB6	18	2 3 3	6			
20		Fine to Medium SAND with Gravel- Brown- Wet- Loose to Medium Dense (SP)							
			SB7	18	6 8 10	18			
25									
		28.5							
		Fine to Medium SAND- Brown- Wet- Medium Dense (SP) 30.0	SB8	18	6 8 8	16			
30		END OF BORING AT 30.0 FEET.							
35									

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	13.2
▼ AT END OF BORING:	16.4

CAVE-IN OF BOREHOLE AT: 11.8

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
2. Water level recorded at end of boring was observed prior to auger extraction.
3. The cave-in of the borehole at 11.8 feet was dry.

SME

DRAFT

BORING B 2

PAGE 1 OF 1

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation **PROJECT NUMBER:** 075805.00

CLIENT: City of Battle Creek **PROJECT LOCATION:** Battle Creek, Michigan

DATE STARTED: 3/20/17 **COMPLETED:** 3/20/17 **BORING METHOD:** Hollow-stem Augers

DRILLER: AM (Cook Drilling) **RIG NO.:** ATV-D50 **LOGGED BY:** ZLM **CHECKED BY:** AJR

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	SURFACE ELEVATION: 904± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120) MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC. COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
904	0		0.6 TOPSOIL 903.4							
			Sandy LEAN CLAY- Brown- Very Stiff (CL)	SB1	18	5 6 6	12	14	▽	
			3.2 900.8							
900	5			SB2	18	4 3 3	6			
				SB3	18	3 4 3	7			
			Fine to Medium SAND- Silty Clay Layer at 10.0 feet- Brown- Moist- Loose (SP)							
895	10			SB4	16	3 4 3	7			
			13.5 890.5							
890	15			SB5	18	5 8 10	18			
			Fine SAND- Light Brown- Moist- Medium Dense (SP)							
			18.5 885.5							
885	20		20.0 Fine to Medium SAND- Brown- Moist- Medium Dense (SP) 884.0	SB6	18	6 9 14	23			
			END OF BORING AT 20.0 FEET.							
880	25									
875	30									
870	35									

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B 3

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/20/17 **COMPLETED:** 3/20/17 **BORING METHOD:** Hollow-stem Augers
DRILLER: AM (Cook Drilling) **RIG NO.:** ATV-D50 **LOGGED BY:** ZLM **CHECKED BY:** AJR

SURFACE ELEVATION: 951± FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
950	0	0.9 TOPSOIL 950.1	SB1	18	2 2 2	4			
			SB2	18	3 2 2	4			
945	5		SB3	18	2 3 3	5			
		Fine SILTY SAND- Brown- Moist- Loose to Medium Dense (SM)	SB4	14	6 6 7	13			
940	10		SB5	18	5 5 5	10			
935	15	18.0 933.0							
			SB6	18	4 4 6	10			
930	20								
		Fine to Medium SAND- Light Brown- Moist- Medium Dense (SP)	SB7	18	7 8 10	18			
925	25								
	30	30.0 921.0	SB8	15	11 12 15	27			
920		END OF BORING AT 30.0 FEET.							
	35								

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B 4

PAGE 1 OF 1

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/20/17 **COMPLETED:** 3/20/17 **BORING METHOD:** Hollow-stem Augers
DRILLER: AM (Cook Drilling) **RIG NO.:** ATV-D50 **LOGGED BY:** ZLM **CHECKED BY:** AJR

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	SURFACE ELEVATION: 954± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE – O	DRY DENSITY (pcf) – ■ 90 100 110 120 MOISTURE & ATTERBERG LIMITS (%) PL MC LL	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC. COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF)	REMARKS
954	0		0.5 TOPSOIL 953.5							
			Fine SILTY SAND- Frequent Wood Pieces- Brown- Moist- Very Loose (SM)	SB1	9	1 2 1	3			
			3.4 950.6							
950	5		Fine to Medium SAND with Silt- Frequent Clayey Sand Layers and Seams- Brown- Moist- Loose (SP-SM)	SB2	14	2 2 3	5			
			6.0 948.0							
				SB3	5	3 2 3	5			Driller reported driving a rock for Sample SB3.
945			Fine to Medium SAND- Brown- Moist- Loose to Medium Dense (SP)	SB4	12	4 5 6	11			
	10		13.3 940.7							
940			Fine to Medium SAND with Silt- Frequent Silty Sand Seams- Brown- Moist- Loose (SP-SM)	SB5	15	3 3 4	7			
	15		19.1 934.9							
935				SB6	18	5 7 9	16			
	20		Fine to Medium SAND- Light Brown- Moist- Medium Dense to Loose (SP)	SB7	9	2 3 4	7			
930										
	25		27.5 926.5							
			Fine SAND- Light Brown- Moist- Medium Dense (SP)	SB8	18	9 13 17	30			
925			30.0 924.0							
	30		END OF BORING AT 30.0 FEET.							
920										
	35									

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B 5

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/20/17 **COMPLETED:** 3/20/17 **BORING METHOD:** Hollow-stem Augers
DRILLER: AM (Cook Drilling) **RIG NO.:** ATV-D50 **LOGGED BY:** ZLM **CHECKED BY:** AJR

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	SURFACE ELEVATION: 978± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120) MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
975	0		0.8 TOPSOIL 977.2							
			Fine to Medium SILTY SAND- Frequent Wood Pieces- Brown- Moist- Loose (SM)	SB1	7	4 3 3	6			Driller reported driving a rock for Sample SB1.
	3.5		974.5							
			Fine to Medium CLAYEY SAND- Brown- Moist- Very Loose (SC)	SB2	18	2 1 1	2			
970	5		6.0 972.0							
			Fine to Medium SILTY SAND- Occasional Roots- Brown- Moist- Loose (SM)	SB3	13	2 3 4	7			
	8.1		969.9							
				SB4	18	7 6 6	12			
965	10		Fine to Medium SILTY SAND- Brown- Moist- Medium Dense (SM)	SB5	18	7 8 10	18			
960	15									
	19.3		958.7	SB6	8	16 16 17	33			Driller reported driving a rock for Sample SB6.
			Fine SAND- Light Brown- Moist- Dense (SP)							Cobbles encountered from 19.3 feet to 23.2 feet below the existing ground surface.
955	20		23.2 954.8							
				SB7	18	17 19 23	42			
950	25		Fine to Medium SILTY SAND- Brown- Moist- Dense to Medium Dense (SM)	SB8	18	20 18 19	37			
945	30									
				SB9	15	9 11 16	27			
	35									

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

(Continued Next Page)

SME

DRAFT

BORING B 5

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation **PROJECT NUMBER:** 075805.00

CLIENT: City of Battle Creek **PROJECT LOCATION:** Battle Creek, Michigan

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	SURFACE ELEVATION: 978± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE – O 10 20 30 40	DRY DENSITY (pcf) – ■ 90 100 110 120 MOISTURE & ATTERBERG LIMITS (%) PL MC LL 10 20 30 40	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) 1 2 3 4	REMARKS
940	35									
	40		Fine to Medium SILTY SAND- Brown- Moist- Dense to Medium Dense (SM) *(continued)*	SB10	18	12 14 14	28			
935				SB11	18	10 14 15	29			
930	45			SB12	12	12 16 16	30			
	50		50.0 928.0 END OF BORING AT 50.0 FEET.							
925	55									
920	60									
915	65									
910	70									
905	75									
900	80									

SME

DRAFT

BORING B 6

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 4/4/17 **COMPLETED:** 4/4/17 **BORING METHOD:** Hollow-stem Augers
DRILLER: AM (Cook Drilling) **RIG NO.:** D-50 ATV **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNCONF. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		0.8 TOPSOIL							
		Fine SAND with Silt- Brown- Moist- Very Loose (SP-SM) 2.1	SB1	16	1 1 2	3			
		Fine SILTY SAND- Brown- Moist- Loose (SM)	SB2	18	3 4 3	7			
5		6.4							
		Fine to Medium SAND with Silt- Brown- Moist- Loose (SP-SM) 8.5	SB3	18	3 3 4	7			
			SB4	2	4 8 11	19			Driller reported driving a rock for Sample SB4.
10		Fine to Medium SILTY SAND- Brown- Moist- Medium Dense (SM)							
▽		13.2							
		Fine SILTY to CLAYEY SAND with Gravel- Brown- Wet- Medium Dense (SM/SC)	SB5	8	4 5 5	10			
15		17.8							
▼		Fine to Medium SAND with Silt- Brown- Wet- Medium Dense (SP-SM) 20.0	SB6	13	7 8 8	16			
20		END OF BORING AT 20.0 FEET.							
25									
30									
35									

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	13.2
▼ AT END OF BORING:	18.4
CAVE-IN OF BOREHOLE AT:	11.8
BACKFILL METHOD:	Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
2. Water level recorded at end of boring was observed prior to auger extraction.
3. The cave-in of the borehole at 11.8 feet was dry.

SME

DRAFT

BORING B 7

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/21/17 **COMPLETED:** 3/21/17 **BORING METHOD:** Hollow-stem Augers
DRILLER: AM (Cook Drilling) **RIG NO.:** ATV-D50 **LOGGED BY:** ZLM **CHECKED BY:** AJR

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	SURFACE ELEVATION: 949± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120) MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC. COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
945	0		TOPSOIL 1.3 — 947.7	SB1	14	1 2 2	4			
			Fine CLAYEY SAND- Brown- Moist- Very Loose (SC) 3.8 — 945.2	SB2	18	3 2 3	5			
940	5		Fine SILTY to CLAYEY SAND- Brown- Moist- Loose (SM/SC) 8.1 — 940.9	SB3	18	2 3 3	6			
				SB4	18	2 2 2	4			
935	10		Fine to Medium SILTY SAND- Brown- Moist to Wet- Very Loose (SM) 18.3 — 930.7	SB5	18	2 2 2	4			
930	15	▽		SB6	15	1 1 1	2			
925	20	▼	Fine CLAYEY SAND- Brown- Wet- Very Loose (SC) 23.5 — 925.5	SB7	18	13 14 14	28			
920	25		Fine SILTY to CLAYEY SAND- Frequent Wet Sand Seams- Brown- Moist- Medium Dense (SM/SC) 28.5 — 920.5	SB8	18	10 11 12	23	10	▽	
915	30		Sandy LEAN CLAY- Brown- Very Stiff (CL) 30.0 — 919.0 END OF BORING AT 30.0 FEET.							
	35									

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	18.3	930.7
▼ AT END OF BORING:	22.6	926.4
CAVE-IN OF BOREHOLE AT:	23.0	926.0

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
2. Driller reported encountering an obstruction about 17.0 feet below the existing ground surface. The boring was offset 2.5 feet west, blind drilled to 17.0 feet, and drilled to the explored depth.

SME

DRAFT

BORING B 8

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan
DATE STARTED: 3/21/17 **COMPLETED:** 3/21/17 **BORING METHOD:** Hollow-stem Augers
DRILLER: AM (Cook Drilling) **RIG NO.:** ATV-D50 **LOGGED BY:** ZLM **CHECKED BY:** AJR

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	SURFACE ELEVATION: 938± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE -- O	DRY DENSITY (pcf) -- ■ 90 100 110 120 MOISTURE & ATTERBERG LIMITS (%) PL MC LL 10 20 30 40	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNCONFINED COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) 1 2 3 4	REMARKS
	0		0.6 TOPSOIL 937.4							
935			Fine to Medium SILTY to CLAYEY SAND- Frequent Wood Pieces- Brown- Moist- Loose (SM/SC)	SB1	4	4 4 5	9			
	5		3.1 934.9	SB2	12	3 2 2	4			
930				SB3	16	1 2 2	4			
	10			SB4	15	3 3 3	5			
925			Fine SILTY to CLAYEY SAND- Brown- Moist- Loose to Medium Dense (SM/SC)	SB5	18	5 6 7	13			
920	15									
	20		20.0 918.0	SB6	18	8 9 11	20			
			END OF BORING AT 20.0 FEET.							
915										
	25									
910										
	30									
905										
	35									

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B 9

PAGE 1 OF 1

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 4/4/17 **COMPLETED:** 4/4/17 **BORING METHOD:** Hollow-stem Augers
DRILLER: AM (Cook Drilling) **RIG NO.:** D-50 ATV **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE – O (10 20 30 40)	DRY DENSITY (pcf) -- ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		0.6 TOPSOIL							
		Fine to Medium CLAYEY SAND- Brown- Moist- Loose (SC)	SB1	9	3 3 4	7			
		3.4							
5		Fine to Coarse SAND with Gravel- Brown- Moist- Medium Dense (SP)	SB2	13	5 10 9	19			
		6.3							
			SB3	18	6 7 8	15			
		Fine to Medium SILTY SAND- Brown- Moist- Medium Dense (SM)	SB4	18	7 7 8	15			Cobbles encountered from 0.6 feet to 6.3 feet below the exisiting ground surface.
10		12.8							
			SB5	14	7 8 10	18			Cobbles encountered from 12.8 feet to 20 feet below the existing ground surface.
15		Fine to Coarse SAND with Gravel- Brown- Moist- Medium Dense to Dense (SP)							
			SB6	18	10 15 16	31			
20		20.0 END OF BORING AT 20.0 FEET.							
25									
30									
35									

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B101

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/21/17 **COMPLETED:** 3/21/17 **BORING METHOD:** Hollow-stem Augers
DRILLER: AM (Cook Drilling) **RIG NO.:** ATV-D50 **LOGGED BY:** ZLM **CHECKED BY:** AJR

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	SURFACE ELEVATION: 903± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE – ○ (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120) MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
900	0		TOPSOIL- Fine to Medium SILTY SAND- Dark Brown- Moist (SM)	SB1	18	1 1 1	2			
			1.8 901.2	SB2	18	2 2 3	5			
	5		Fine SAND with Silt- Brown- Moist- Very Loose to Loose (SP-SM)	SB3	18	3 3 3	6			
895			8.1 894.9	SB4	15	2 3 3	6			
	10									
890				SB5	14	7 9 9	16			
	15		Fine to Medium SAND- Brown- Moist- Loose to Medium Dense (SP)							
885				SB6	18	8 9 11	20			
	20									
880				SB7	18	9 9 10	19			
	25		25.0 878.0							
875			END OF BORING AT 25.0 FEET.							
	30									
870										
	35									

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	13.8	889.2
▼ AT END OF BORING:	21.1	881.9
CAVE-IN OF BOREHOLE AT:	9.8	893.2

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
2. The groundwater reading recorded at the end of the boring was observed prior to auger extraction.
3. The cave-in of the borehole at 9.8 feet was dry.

SME

DRAFT

BORING B102

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 4/3/17 **COMPLETED:** 4/3/17 **BORING METHOD:** Hollow-stem Augers
DRILLER: AM (Cook Drilling) **RIG NO.:** D-50 ATV **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		0.4 TOPSOIL							
		Fine to Medium SILTY TO CLAYEY SAND- Brown- Moist- Very Loose (SM/SC)	SB1	18	1 0 2	2			
		3.0	SB2	15	3 2 2	4			
5		Fine to Medium SAND with Silt- Brown- Moist- Loose (SM)	SB3	13	2 3 2	5			
		9.0	SB4	12	4 4 3	7			
10		Fine to Medium SAND with Silt- Brown- Moist- Loose (SP-SM)							
▽		12.6							
▼ 15			SB5	4	5 6 4	10			Driller reported driving a rock for Sample SB5.
		Fine to Coarse SAND with Gravel- Occasional Clayey Silt Layers from 23.5 feet to 25.0 feet- Brown- Wet- Loose to Medium Dense (SP)	SB6	18	3 3 4	7			Cobbles encountered from 12.6 feet to 23.5 feet below the existing ground surface.
20						7			
		25.0	SB7	13	4 5 6	11	20	▽	
25		END OF BORING AT 25.0 FEET.							
30									
35									

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	12.6
▼ AT END OF BORING:	14.4
CAVE-IN OF BOREHOLE AT:	9.1
BACKFILL METHOD:	Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
2. The cave-in of the borehole at 9.1 feet was dry.
3. Water level observed at end of boring was recorded prior to auger extraction.

SME

DRAFT

BORING B103

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 4/3/17 **COMPLETED:** 4/3/17 **BORING METHOD:** Hollow-stem Augers
DRILLER: AM (Cook Drilling) **RIG NO.:** D-50 ATV **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TOR/VANE SHEAR ○ UNCONF. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		0.4 TOPSOIL							
		Fine SILTY SAND- Occasional Roots- Dark Brown- Moist- Very Loose (SM)	SB1	13	1 0 1	1			
		2.0 Fine CLAYEY SAND- Dark Brown- Moist- Very Loose (SC)							
		3.3	SB2	18	3 3 3	6			
5		Fine to Medium SILTY TO CLAYEY SAND- Brown- Moist- Loose to Very Loose (SM/SC)	SB3	18	2 2 2	4			
			SB4	15	1 0 3	3	22		
10		9.7							
			SB5	18	1 2 3	5			
15		Fine to Coarse SAND with Gravel- Brown- Wet- Loose (SP)							
			SB6	18	3 3 4	7			
20									
			SB7	18	2 3 4	7			
25		25.0 END OF BORING AT 25.0 FEET.							
30									
35									

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	8.1
▼ AT END OF BORING:	8.4

CAVE-IN OF BOREHOLE AT: 9.3

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B104

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 4/3/17 **COMPLETED:** 4/3/17 **BORING METHOD:** Hollow-stem Augers
DRILLER: AM (Cook Drilling) **RIG NO.:** D-50 ATV **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		1.0 TOPSOIL							
		Fine SILTY to CLAYEY SAND- Brown- Moist- Very Loose to Loose (SM/SC)	SB1	18	1 1 2	3			
			SB2	18	3 2 3	5			
5			SB3	18	3 3 3	6			
		7.8							
		Fine to Medium SAND with Silt- Brown- Moist- Loose (SP-SM)	SB4	15	4 5 4	9			
10		13.0							
		Fine to Coarse SAND with Gravel- Brown- Moist- Loose to Medium Dense (SP)	SB5	18	2 3 2	5			Cobbles encountered from 13 feet to 23.2 feet below the existing ground surface.
15									
			SB6	18	8 8 9	17			
20		23.2							
		Fine to Medium SILTY to CLAYEY SAND with Gravel- Brown- Moist- Medium Dense (SM/SC)	SB7	18	7 9 10	19			
25		25.0							
		END OF BORING AT 25.0 FEET.							
30									
35									

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B105

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 4/3/17 **COMPLETED:** 4/3/17 **BORING METHOD:** Hollow-stem Augers
DRILLER: AM (Cook Drilling) **RIG NO.:** D-50 ATV **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0	0.9 TOPSOIL							Cobbles from 0.9 feet to 3.1 feet and 13.3 feet to 17.7 feet below the ground surface.
	Fine to Medium SILTY to CLAYEY SAND- Occasional Roots from 0.9 feet to 3.0 feet- Brown- Moist- Very Loose to Loose (SM/SC)	SB1	16	1 1 2	3			
		SB2	18	3 3 4	7			
5	6.6	SB3	18	3 5 5	10			
	Fine SAND- Brown- Moist- Medium Dense (SP)	SB4	15	5 6 7	13			
10	13.3	SB5	16	5 10 13	23			
	Fine to Coarse SAND with Gravel- Brown- Moist- Medium Dense (SP)							
15	17.7	SB6	18	4 5 5	10			
	Fine CLAYEY SAND- Brown- Moist- Loose (SC)							
20	23.5	SB7	10	12 5 7	12			
	Sandy SILT- Occasional Sand Layers- Brown- Medium Dense (ML)							
25	27.8	SB8	16	3 3 3	6			
	Fine CLAYEY SAND- Brown to Gray at 33.2 feet- Moist- Loose (SC)							
30		SB9	4	2 2 3	5			Sample SB9 was too
35								

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	52.4
▼ AT END OF BORING:	Note 2

CAVE-IN OF BOREHOLE AT: 21.3

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
2. The cave-in of the borehole at 21.3 feet was dry.

(Continued Next Page)

SME

DRAFT

BORING B105

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation **PROJECT NUMBER:** 075805.00

CLIENT: City of Battle Creek **PROJECT LOCATION:** Battle Creek, Michigan

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE – O (10 20 30 40)	DRY DENSITY (pcf) -- ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
35									disturbed to perform shear strength test.
40		Fine CLAYEY SAND- Brown to Gray at 33.2 feet- Moist- Loose (SC) *(continued)*	SB10	18	2 2 2	4			
45			SB11	18	2 2 2	4			
		48.0							
50		SILTY CLAY- Brown- Very Stiff (CL/ML)	SB12	18	5 7 9	16	20	▽	
▽		52.4							
55		Fine to Medium SAND- Brown- Wet- Medium Dense (SP)	SB13	18	6 7 8	15			
60			SB14	15	7 7 8	15			
		62.1							
65			SB15	8	11 15 19	34			
70		Fine to Coarse SAND with Gravel- Brown- Wet- Dense to Medium Dense (SP)	SB16	18	10 13 16	28			
		75.0							
75		END OF BORING AT 75.0 FEET.							
80									

SME

DRAFT

BORING B106

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/16/17 **COMPLETED:** 3/16/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: TAB **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNCONF. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		0.5 TOPSOIL						
		Fine to Medium SAND with Silt- Brown- Moist (SP-SM)	AS1					
			AS2					
5		5.0 END OF BORING AT 5.0 FEET.						
10								
15								
20								
25								
30								
35								

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B107

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/17/17 **COMPLETED:** 3/17/17 **BORING METHOD:** Hand Auger

FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		0.6 TOPSOIL						
		Fine SILTY to CLAYEY SAND- Brown- Moist to Wet (SM/SC)	AS1					
▽		4.0 END OF BORING AT 4.0 FEET.						
5								
10								
15								
20								
25								
30								
35								

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	3.5
▼ AT END OF BORING:	3.5

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B108

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/16/17 **COMPLETED:** 3/16/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: TAB **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0		0.5 TOPSOIL		
		Fine SAND with Silt- Light Brown- Moist (SP-SM) 2.0	AS1	
		Fine SAND- Light Brown- Moist to Wet (SP)	AS2	
5		5.0 END OF BORING AT 5.0 FEET.		
10				
15				
20				
25				
30				
35				

DYNAMIC CONE PENETROMETER (DCP) – O: 10 20 30 40

DRY DENSITY (pcf) – ■: 90 100 110 120

MOISTURE & ATTERBERG LIMITS (%): PL MC LL; 10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF): 1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	4.5
▼ AT END OF BORING:	4.5

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B109

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/17/17 **COMPLETED:** 3/17/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) – ○ (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		0.5 TOPSOIL						
		Fine to Medium SAND with Silt- Brown- Moist (SP-SM)	AS1					
		3.0						
▽ 5		Fine to Medium SAND- Brown- Moist to Wet (SP)	AS2					
		6.0 END OF BORING AT 6.0 FEET.						
10								
15								
20								
25								
30								
35								

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	4.5
▼ AT END OF BORING:	4.5

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B110

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/16/17 **COMPLETED:** 3/16/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: TAB **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		1.0 TOPSOIL						
		Fine to Medium SILTY SAND- Brown- Moist (SM)	AS1					
		3.5 END OF BORING AT 3.5 FEET.						The driller reported refusal on a cobble at 3.5 feet below the existing ground surface.
5								
10								
15								
20								
25								
30								
35								

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B111

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/17/17 **COMPLETED:** 3/17/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0		TOPSOIL- Sandy CLAYEY SILT- Dark Gray (ML/CL)	AS1	
1.5		Fine SILTY to CLAYEY SAND- Brown- Moist to Wet (SM/SC)	AS2	
4.0		END OF BORING AT 4.0 FEET.	AS3	

DYNAMIC CONE PENETROMETER (DCP) – O: 10 20 30 40

DRY DENSITY (pcf) – ■: 90 100 110 120

MOISTURE & ATTERBERG LIMITS (%): PL MC LL; 10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF): 1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	3.0
▼ AT END OF BORING:	3.0

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B112

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/17/17 **COMPLETED:** 3/17/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0		0.5 TOPSOIL		
		Fine SILTY SAND- Dark Brown- Moist (SM)	AS1	
		2.5 Fine SAND with Silt- Brown- Moist (SP-SM)	AS2	
		4.0 END OF BORING AT 4.0 FEET.		
5				
10				
15				
20				
25				
30				
35				

DYNAMIC CONE PENETROMETER (DCP) – O: 10 20 30 40

DRY DENSITY (pcf) – ■: 90 100 110 120

MOISTURE & ATTERBERG LIMITS (%): PL MC LL; 10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNCONFINED COMPRESSION
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF): 1 2 3 4

REMARKS: The driller reported auger refusal on a cobble at 4.0 feet below the existing ground surface.

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B112A

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/17/17 **COMPLETED:** 3/17/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0				
		Amorphous PEAT- Black (PT)	AS1	
2.0				
2.5		Fine to Medium SAND with Silt- Gray- Wet (SP-SM)	AS2	
		END OF BORING AT 2.5 FEET.		
5				
10				
15				
20				
25				
30				
35				

DYNAMIC CONE PENETROMETER (DCP) – O
10 20 30 40

DRY DENSITY (pcf) – ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40
>> 250

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	1.0
▼ AT END OF BORING:	1.0

CAVE-IN OF BOREHOLE AT: 2.5

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B113

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/17/17 **COMPLETED:** 3/17/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0		0.8 TOPSOIL		
		2.0 Fine CLAYEY to SILTY SAND- Brown- Moist (SC/SM)	AS1	
		3.5 Fine to Medium SILTY SAND- Clay Layer at 2.5 feet- Gray and Dark Gray- Moist (SM)	AS2	
5		Fine to Medium SILTY SAND- Gray- Moist to Wet (SM)	AS3	
		7.0		
		8.0 Sandy LEAN CLAY- Gray- Soft (CL/ML)	AS4	
		END OF BORING AT 8.0 FEET.		
10				
15				
20				
25				
30				
35				

DYNAMIC CONE PENETROMETER (DCP) – O: 10 20 30 40

DRY DENSITY (pcf) – ■: 90 100 110 120

MOISTURE & ATTERBERG LIMITS (%): PL MC LL; 10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNCONFINED COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF): 1 2 3 4

12

REMARKS: Sample AS4 was too disturbed to perform a shear strength test.

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	4.0
▼ AT END OF BORING:	4.0

CAVE-IN OF BOREHOLE AT: 6.5

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B114

PAGE 1 OF 1

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/16/17 **COMPLETED:** 3/16/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- O (10 20 30 40)	DRY DENSITY (pcf) -- ■ (90 100 110 120) / MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		0.8 TOPSOIL						
		Fine to Medium SAND with Silt- Brown- Moist (SP-SM) 2.5	AS1					
		Fine to Medium CLAYEY SAND- Brown- Moist (SC) 5.0	AS2					
5		END OF BORING AT 5.0 FEET.						
10								
15								
20								
25								
30								
35								

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B114A

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/16/17 **COMPLETED:** 3/16/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0		0.8 TOPSOIL		
		2.0 Fine to Medium CLAYEY SAND- Brown- Moist (SC)	AS1	
		4.0 Fine to Medium SAND with Silt- Brown- Moist (SP-SM)	AS2	
		END OF BORING AT 4.0 FEET.		
5				
10				
15				
20				
25				
30				
35				

DYNAMIC CONE PENETROMETER (DCP) – O
10 20 30 40

DRY DENSITY (pcf) – ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B114B

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation **PROJECT NUMBER:** 075805.00

CLIENT: City of Battle Creek **PROJECT LOCATION:** Battle Creek, Michigan

DATE STARTED: 3/17/17 **COMPLETED:** 3/17/17 **BORING METHOD:** Hand Auger

FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0		0.5 TOPSOIL		
		1.5 Fine to Medium SAND with Silt- Brown- Moist (SP-SM)	AS1	
		Fine to Medium SAND with Silt- Brown- Moist to Wet (SP-SM)	AS2	
▽		4.0		
5		Fine to Medium SAND- Brown- Wet (SP)	AS3	
		7.0		
		8.0 Fine SILTY SAND- Brown- Wet (SM)	AS4	
		END OF BORING AT 8.0 FEET.		
10				
15				
20				
25				
30				
35				

DYNAMIC CONE PENETROMETER (DCP) – O: 10 20 30 40

DRY DENSITY (pcf) – ■: 90 100 110 120

MOISTURE & ATTERBERG LIMITS (%): PL MC LL; 10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF): 1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	3.5
▼ AT END OF BORING:	3.5
CAVE-IN OF BOREHOLE AT:	4.5
BACKFILL METHOD: Auger Cuttings	

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

D R A F T

BORING B115

PAGE 1 OF 1

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/16/17 **COMPLETED:** 3/16/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0		0.7 TOPSOIL		
		Fine to Medium SAND with Silt- Brown- Moist (SP-SM) 2.0	AS1	
		Fine to Medium SILTY SAND- Brown- Moist (SM) 3.0	AS2	
		END OF BORING AT 3.0 FEET.		
5				
10				
15				
20				
25				
30				
35				

DYNAMIC CONE PENETROMETER (DCP) – ○
10 20 30 40

DRY DENSITY (pcf) – ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B116

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/17/17 **COMPLETED:** 3/17/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0		0.6 TOPSOIL		
		Fine SILTY SAND- Brown- Moist (SM)	AS1	
		3.0		
		Fine CLAYEY SAND- Brown- Moist (SC) 4.0	AS2	
5		END OF BORING AT 4.0 FEET.		
10				
15				
20				
25				
30				
35				

DYNAMIC CONE PENETROMETER (DCP) – O
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B117

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/16/17 **COMPLETED:** 3/16/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: TAB **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0		0.5 TOPSOIL		
		Fine to Medium CLAYEY SAND- Brown- Moist (SC)	AS1	
		2.5 Fine to Medium SILTY SAND- Brown- Moist (SM)	AS2	
		4.0 END OF BORING AT 4.0 FEET.		
5				
10				
15				
20				
25				
30				
35				

DYNAMIC CONE PENETROMETER (DCP) -- O
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNCONFINED COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B117A

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan
DATE STARTED: 3/16/17 **COMPLETED:** 3/16/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: TAB **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0		0.8 TOPSOIL		
		2.0 Fine to Medium SILTY SAND- Brown- Moist (SM)	AS1	
		3.0 Fine to Medium CLAYEY SAND- Gray- Moist (SC)	AS2	
		4.0 Fine to Medium SILTY SAND- Gray- Moist (SM)	AS3	
5		END OF BORING AT 4.0 FEET.		
10				
15				
20				
25				
30				
35				

DYNAMIC CONE PENETROMETER (DCP) – O: 10 20 30 40

DRY DENSITY (pcf) – ■: 90 100 110 120

MOISTURE & ATTERBERG LIMITS (%): PL MC LL; 10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF): 1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B117B

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/16/17 **COMPLETED:** 3/16/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: TAB **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		Amorphous PEAT- Black (PT)	AS1			>> 537		
2.0		Fine to Medium CLAYEY to SILTY SAND- Gray- Wet (SC/SM)	AS2					
2.5		END OF BORING AT 2.5 FEET.						
5								
10								
15								
20								
25								
30								
35								

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	1.0
▼ AT END OF BORING:	1.0

CAVE-IN OF BOREHOLE AT: 2.5

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B118

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/17/17 **COMPLETED:** 3/17/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0		0.3 TOPSOIL		
		Fine SAND with Silt- Brown- Moist (SP-SM)	AS1	
		3.0		
5		Fine SAND- Brown- Moist (SP)	AS2	
		6.0		
		Fine CLAYEY SAND- Brown- Moist (SC)	AS3	
		7.0		
		Fine SAND with Silt- Brown- Moist (SP-SM)	AS4	
		8.0 END OF BORING AT 8.0 FEET.		
10				
15				
20				
25				
30				
35				

DYNAMIC CONE PENETROMETER (DCP) – O: 10 20 30 40

DRY DENSITY (pcf) – ■: 90 100 110 120

MOISTURE & ATTERBERG LIMITS (%): PL MC LL; 10 20 30 40

▽ HAND PENE.
⊠ TOR-VANE SHEAR
○ UNC. COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF): 1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B118A

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/17/17 **COMPLETED:** 3/17/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0				
		1.0 TOPSOIL- Sandy PEAT- Frequent Roots- Black (PT)	AS1	
		2.0 SILTY CLAY with Sand- Gray- Soft (CL/ML)	AS2	
		3.5 Fine SILTY SAND- Frequent Clayey Sand Seams- Gray- Moist to Wet (SM)	AS3	
		5.0 Fine to Medium SAND with Silt- Gray- Wet (SP-SM)	AS4	
5		END OF BORING AT 5.0 FEET.		
10				
15				
20				
25				
30				
35				

DYNAMIC CONE PENETROMETER (DCP) – O
10 20 30 40

DRY DENSITY (pcf) – ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	3.0
▼ AT END OF BORING:	3.0
CAVE-IN OF BOREHOLE AT:	3.5
BACKFILL METHOD: Auger Cuttings	

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B119

PAGE 1 OF 1

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation **PROJECT NUMBER:** 075805.00

CLIENT: City of Battle Creek **PROJECT LOCATION:** Battle Creek, Michigan

DATE STARTED: 3/17/17 **COMPLETED:** 3/17/17 **BORING METHOD:** Hand Auger

FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		0.6 TOPSOIL						
		Fine SAND with Silt- Brown- Moist (SP-SM) 2.0	AS1					
		Fine SAND- Brown- Moist (SP) 4.0	AS2					
		END OF BORING AT 4.0 FEET.						
5								
10								
15								
20								
25								
30								
35								

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B120

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/16/17 **COMPLETED:** 3/16/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) – O	DRY DENSITY (pcf) – ■ / MOISTURE & ATTERBERG LIMITS (%)	SHEAR STRENGTH (KSF) ▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU)	REMARKS
0				1	10 20 30 40	90 100 110 120 / PL MC LL / 10 20 30 40	1 2 3 4	
▽▼		Amorphous PEAT- Black (PT)	AS1	1 3 7	3, 7	>> 149		
1.5		Fine SAND with Silt- Gray- Wet- Medium Dense to Loose (SP-SM)	AS2	28 12	12, 28			
2.5		SILTY CLAY with Sand- Gray (CL/ML)	AS3	16 9	9, 16	31		Sample AS3 was too disturbed to perform a shear strength test.
3.5		Fine SILTY SAND- Brown- Wet- Loose to Medium Dense (SM)	AS4	12 9	12			
4.5		END OF BORING AT 4.5 FEET.		12 35 37	35, 37			
5								
10								
15								
20								
25								
30								
35								

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	1.0
▼ AT END OF BORING:	1.0

CAVE-IN OF BOREHOLE AT: 3.0

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B121

PAGE 1 OF 1

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/16/17 **COMPLETED:** 3/16/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) – O	DRY DENSITY (pcf) – ■ / MOISTURE & ATTERBERG LIMITS (%)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) / SHEAR STRENGTH (KSF)	REMARKS
0		0.5 TOPSOIL		2	2			
		Fine to Medium SAND with Silt- Brown- Moist- Loose (SP-SM)	AS1	6 14 8 10 10 12	6 14 8 10 10 12			
		4.0		10 12 13 18	13) 18 21			
5		Fine to Medium CLAYEY SAND- Brown- Moist- Medium Dense (SC) 6.0	AS2	18 21 22 25	22) 25			
		END OF BORING AT 6.0 FEET.						The driller reported auger refusal on a rock at 6.0 feet below the existing ground surface.
10								
15								
20								
25								
30								
35								

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B122

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/16/17 **COMPLETED:** 3/16/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) – ○ (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120) / MOISTURE & ATTERBERG LIMITS (%) FL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		0.3 TOPSOIL		1				
		Fine to Medium SILTY SAND- Brown- Moist- Very Loose to Loose (SM)	AS1	4 2 10 12				
		2.0		10 12				
		Fine to Medium CLAYEY SAND- Brown- Moist- Loose to Medium Dense (SC)	AS2	10 11 22 33				
5		5.0		29 22				
		Fine to Medium SILTY SAND- Brown- Moist- Loose to Medium Dense (SM)	AS3	11 32 22 32				
		7.5 END OF BORING AT 7.5 FEET.		22 25 22 30				The driller reported auger refusal on a rock at 7.5 feet below the existing ground surface.
10								
15								
20								
25								
30								
35								

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B123

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/17/17 **COMPLETED:** 3/17/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0		0.4 TOPSOIL		
		Fine SAND with Silt- Brown- Moist (SP-SM)	AS1	
		3.0		
5		Fine CLAYEY to SILTY SAND- Occasional Roots- Brown- Moist (SC/SM)	AS2	
		6.0		
		Fine SILTY SAND- Brown- Moist (SM)	AS3	
		8.0		
		END OF BORING AT 8.0 FEET.		
10				
15				
20				
25				
30				
35				

DYNAMIC CONE PENETROMETER (DCP) – O
10 20 30 40

DRY DENSITY (pcf) – ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B123A

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/17/17 **COMPLETED:** 3/17/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0				
		0.8 TOPSOIL and PEAT		
		2.0 Fine SILTY to CLAYEY SAND- Brown- Moist (SM/SC)	AS1	
		3.0 Sandy LEAN CLAY- Brown- Soft (CL)	AS2	
▽		4.0 SILTY CLAY- Gray- Soft (CL/ML)	AS3	
		5.0 Fine to Medium SILTY SAND- Gray- Wet (SM)	AS4	
5		END OF BORING AT 5.0 FEET.		
10				
15				
20				
25				
30				
35				

DYNAMIC CONE PENETROMETER (DCP) – O
10 20 30 40

DRY DENSITY (pcf) – ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40
21
22

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

Samples AS2 and AS3 were too disturbed to perform shear strength tests.

The driller reported auger refusal at 5.0 feet below the existing ground surface.

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	4.0
▼ AT END OF BORING:	4.0

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B124

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/17/17 **COMPLETED:** 3/17/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0		0.5 TOPSOIL		
		Fine SILTY SAND- Brown- Moist (SM)	AS1	
		3.0 Fine CLAYEY to SILTY SAND- Brown- Moist (SC/SM)	AS2	
5		5.0 END OF BORING AT 5.0 FEET.		
10				
15				
20				
25				
30				
35				

DYNAMIC CONE PENETROMETER (DCP) – O
10 20 30 40

DRY DENSITY (pcf) – ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

The driller reported auger refusal at 5.0 feet below the existing ground surface.

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

SME

DRAFT

BORING B124A

PROJECT NAME: Stanley Drive Preliminary Geotechnical Evaluation
PROJECT NUMBER: 075805.00
CLIENT: City of Battle Creek
PROJECT LOCATION: Battle Creek, Michigan

DATE STARTED: 3/17/17 **COMPLETED:** 3/17/17 **BORING METHOD:** Hand Auger
FIELD REPRESENTATIVE: ZLM **EQUIPMENT:** Hand Auger **LOGGED BY:** ZLM **CHECKED BY:** AJR

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) – O (10 20 30 40)	DRY DENSITY (pcf) – ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		0.7 TOPSOIL						
		Sandy LEAN CLAY- Brown- Medium (CL)	AS1			21	0.75 ⊠	
▽▼		3.5						
		SILTY CLAY- Gray- Soft (CL/ML)	AS2			23	0.4 ⊠	
5		5.0						
		Fine SILTY SAND- Brown- Wet (SM)	AS3					
		6.5 END OF BORING AT 6.5 FEET.						The driller reported auger refusal at 6.5 feet below the existing ground surface.
10								
15								
20								
25								
30								
35								

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	3.0
▼ AT END OF BORING:	3.0

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

Appendix B:

City of Battle Creek Special Provisions

CITY OF BATTLE CREEK
SPECIAL PROVISION
FOR
SANITARY SEWER

1) GENERAL

a. Description.

i) All labor, materials, equipment, tools and services required for the furnishing, installation and testing of all gravity sewers, drains, and appurtenances required by the City of Battle Creek shall be furnished and installed in compliance with the General Conditions, Special Provisions, General Project Specification and the Contract Drawings.

ii) This Special Provision covers the description of materials generally utilized in sewer construction and the installation of such materials. Project specifications and contract drawings designate the specific work, the materials, the lines, grades and details and the construction methods to be employed on the furnishing and installation of all Sanitary Sewers, and Appurtenances on this Contract.

iii) All work shall be done in accordance with the most recent version of the Michigan Department of Transportation (MDOT) Standard Specification for Construction except as noted below or elsewhere in the contract documents.

b) Shop Drawings

i) Prior to sanitary sewer installation the Contractor shall submit to the Engineer descriptive details, shop and setting drawings.

c) Soil Erosion and Sedimentation Controls

i) The Contractor shall obtain any required permit(s) necessary for compliance with the "Soil Erosion and Sedimentation Control Act of Michigan", (Michigan Act No. 347 of the Public Acts of 1972), as amended. All erosion and sedimentation control measures shall be performed by the Contractor and shall be in strict compliance with said Act No. 347, and all stipulations of the acquired permit.

2) CONSTRUCTION MATERIALS

a) General

An established and reputable manufacturer or supplier shall furnish all materials and equipment. All materials and equipment shall be new and shall be of first class material and construction, designed and guaranteed to perform the service required and shall conform with the following Standard Specifications or shall be the product of the listed manufacturers or similar and equal thereto as approved by the Engineer.

b) Reinforced Concrete Sewer Pipe

i) All sewer pipe 24" in diameter or larger shall be reinforced concrete pipe and shall furnished conform with applicable specification found in the most recent version of the Michigan Department of Transposition Specification for construction.

ii) An approved cement additive to protect the sewer from corrosion shall be included with the casting of concrete pipe.

c) Poly-Vinyl Chloride (PVC) Sewer Pipe

i) Sewer pipe under 24" in diameter shall be poly-vinyl chloride sewer pipe and have a standard dimension ration (SDR) of 35 or less. The pipe shall be clearly marked at intervals of 5 feet or less with the manufacturer's name or trademark, nominal pipe size, PVC call classification, SDR number and ASTM designation D-3034.

d) PVC Force Main Pipe

i) Conform to the requirements of AWWA C900 for sizes up to 12" in diameter and AWWA C905 for sizes over 12" in diameter meeting ASTM F477, and ASTM D313. Joints shall utilize elastomeric seals meeting ASTM D-3139 and ASTM F-477. PVC

force main pipe shall have a minimum wall thickness of DR 18. PVC material shall have a cell classification of 12454 as defined in ASTM D-1784.

e) Tracer Wire

i) Copper Tracer Wire: Place continuous 12-guage insulated solid copper tracer wire over all sanitary sewer force mains. Insulation color shall be green.

f) Type of Joints

i) Poly-vinyl Chloride Fittings (Sewer Pipe):
   (1) Fittings shall be made of PVC plastic having a cell classification of 12454-B or 12454-C as defined in Specification ASTM C1784.

ii) Ductile Iron Fittings:
   (1) Fittings shall be ductile iron of the mechanical joint type AWWA Class D for 3 inches to 12 inches of AWWA C-101 Class B or D for 14 inches to 24 inches fittings, and of size and type as shown on the plans.

g) Pipe Casing

i) Pipe casing shall be extra heavy, uncoated, steel pipe and shall conform to American Standards Association Specification B36.10. All casing joints shall be welded.

h) Air Release Valves

i) Air release valves shall be designed to be placed underground and constructed of stainless steel SAE 316 with a maximum working pressure of 250 psi. Valves shall contain an air gap between the wastewater and the sealing mechanism.

i) Gate Valves and Boxes

i) Gate valves shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C509 or Latest Revision and in accordance with the following specifications.

ii) Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve.

iii) The valves are to be non-rising stem with the stem made of cast, forged or rolled bronze. Two stem seals shall be provided and shall be of the O-ring type located above or below the stem collar.

iv) The stem nut, also made of bronze, may be independent of the gate or cast integrally with the gate. If the stem nut is independent of the gate, it shall be provided with a spherical bearing surface to eliminate binding of the stem and to provide a self-aligning seating mechanism. IF the stem nut is cast integrally, the treads shall be straight and true with the axis of the stem to avoid binding during opening or closing cycle.

v) The seating mechanism shall consist of a cast iron gate having a vulcanized synthetic rubber coating or a rubber mechanically retained on the gate. The resilient seating mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

vi) The gate design shall be such that no line fluid entrapment can take place within the gate while the gate is in a raised position.

vii) The valve body, bonnet and bonnet cover shall be case iron, ASTM A126, Class B. All internal and external surfaces shall be coated with epoxy to a minimum thickness of 4 mils. Approved coating shall be Pratt & Lambert Vitralon Powder Coating Epoxy or Mueller H P (R) Coating.

viii) Valves shall have a 2" square operating nut. Valves shall open to left (counter-clockwise).

ix) All valves are to be tested in strict accordance with AWWA C509, Section 6.

x) The City of Battle creek will accept American Flow Control, Clow Water Systems Company, East Jordan Iron Works, or Mueller Industries.

j) Thrust Blocks

i) Disjointing hydrostatic pressure at bends, plugs, tees, and wyes shall be counteracted by thrust blocks, restrained joints, or reinforced concrete anchorage as directed on the Drawings or specified.

ii) Thrust blocks shall be installed only where directed or specifically called for on the Drawings, unless otherwise specified. Installation shall be in conformance with Drawings.
iii) Approved joint restraints shall be installed in locations shown or scheduled on the Drawings.

k) Cleanouts

i) Cleanouts shall be installed where indicated on the plans and in accordance with the cleanout detail as shown on the detail drawing sheet.

l) Pipe Testing

i) At the discretion of the Engineer, pipe shall be tested for crushing strength, absorption and acid resistance as described in the current ASTM specifications for each pipe specified. The Engineer may choose one pipe per 1,000 feet of construction. The entire costs of testing shall be the Contractor's responsibility, whether performed by an independent testing lab, or as part of manufacturer's quality control, and shall be certified by a Registered Professional Engineer.

m) Manhole Rings and Covers

i) Rings and covers shall be specified on detail drawings and may be required to have locking mechanism. They shall be made of soft gray iron or fiber reinforced polymer and shall be free from any defects and have a smooth surface without lumps or rough areas. They shall be machined to fit so that they will have an even bearing.

n) Manholes

i) Manholes shall be of precast reinforced concrete and shall conform to the current requirements for Reinforced Concrete Pipe, ASTM Designation C-76 or C-478, or ASTM Designation C-139 for concrete blocks.
ii) An approved cement additive to protect the manhole from corrosion shall be included with the precast concrete sections as specified on the plans.

3) CONSTRUCTION METHODS

a) Scope of Work

i) This section of the specifications deals with placement of pipe, fittings, etc. and construction of the system. It is the basic task of the Contractor to proceed with the construction as rapidly and as expeditiously as possible, to present the Owner with a complete, sound and operable piping system.
ii) Safety: All current safety requirements shall be practiced by the Contractor to insure safe working conditions for the general public as well as his personnel. It shall be the responsibility of the Contractor to maintain safe conditions for his own personnel and the public. The Engineer and Owner will not accept liability of any kind for injury due to Contractor's construction operations.
iii) Maintenance and Protection of Existing Utilities:
(1) The Contractor shall be responsible for interference with or damage to any existing utilities and shall replace or repair same with the least possible delay.
(2) The approximate location of existing underground utilities and structures, such as water mains, sewers, valve vaults, manholes, etc., as shown on the Plans, have been determined from the best available information and are given for the convenience of the Contractor. However, the Owner does not assume responsibility that during construction, utilities and structures other than those shown may be encountered and that the actual locations of those which are shown, may be different from the location as shown on the Plans.
(3) It shall be the responsibility of the Contractor to determine ownership of all water, gas, electric, telephone and other utility lines, to contact these Owners, and determine location and required means of protecting and maintaining service and/or relocation of these utility lines. Any relocation of utilities required shall be considered incidental to construction of the affected facility.

iv) Any underground utility mains and conduits exposed, including municipal water mains shall be protected and backfill material hand compacted or mechanically compacted to 6 inches over top of main or conduit. Any means used to support a utility exposed or endangered by the Contractor's operations is considered incidental. Also, relocating, raising or lowering of a utility for the Contractor's convenience, repair of utilities damaged by the Contractor and related temporary service required by extended periods of service outages will not be paid for separately.

b) Tree Removal

i) Shall conform to the most recent edition of the Michigan Department of Transportation Standard Specification for Construction.

c) Power Poles:

i) The Contractor shall support, move or have moved all utility poles that interfere with the construction of the project. All costs connected with the movements or supporting such poles shall be the Contractor's responsibility.

d) Excavation

i) Shall conform to the most recent edition of the Michigan Department of Transportation Standard Specification for Construction.

e) Foundations, Strengthening

i) Shall conform to the most recent edition of the Michigan Department of Transportation Standard Specification for Construction.

f) Pipeline Installation

i) Shall conform to the most recent edition of the Michigan Department of Transportation Standard Specification for Construction.

ii) Tracer Wire: Install a continuous 12 gauge insulated tracing wire along pipelines. The wire shall be secured to the pipeline at 10' intervals. Access to the wire shall be provided at the pump station, air relief/vacuum breaker valves, and manholes. Color of wire insulation shall be green. Maximum tracing wire length shall be 500' without terminating in a valve box or intermediate detector site. Intermediate detector sites shall not be located in pavement areas. Splices shall be kept to a minimum, but if required, shall be made with an underground connector rated for direct burial service.

g) Ductile Iron Pipe Joints

i) Joints
   (1) Slip-on compression type joint or mechanical joint meeting AWWA C111
   (2) Rubber gaskets shall conform to ANSI A21.11, AWWA C111, and AWWA C115

ii) Fittings
   (1) Full Body meeting AWWA C110
   (2) Compact meeting AWWA C153
   (3) All fittings to have mechanical joints meeting AWWA C111 and restrained.

iii) Jointing of the various pipe materials and types shall be made in accordance with the manufacturer's recommendations.

h) Rubber Gasket Joints for Reinforced Concrete Low Head and Cylinder Pressure Pipe

i) In joining pipes of these types the ends of the pipes shall be thoroughly cleaned and the gasket furnished with the pipe placed in the groove or recess on the spigot, the gasket coated with a compatible bitumastic compound of a type recommended by the gasket manufacturer and the spigot entered into the bell and pipe forced home by means of a bar or mechanical winch. The remainder of the joint shall be filled with bituminous compound in the same manner as that specified for mortar and jute joints.

i) Connections for Service Pipes

i) General
   (1) Service connections for house sewer and/or drain connection openings shall be provided in the main sewers as shown on the Contract Drawings or as designated in the Project Specifications. The exact location shall be as directed by the Engineer during construction.

(2) Unless otherwise shown on the Contract Drawings or so designated in the Project Specifications all sewer connection openings on bell and spigot pipe shall be "wye" branches, with the outlet being six (6) inches in internal diameter. All sewer connection openings on concrete pipe of the tongue and groove type shall be cast in place with the shape, size and dimensions of the opening corresponding to the bell end of a standard sewer pipe six (6) inches in internal diameter.

(3) For sewer mains greater than 12 feet deep, risers shall be added to the connection at the main to keep lateral depth at 11 feet at the right-of-way line.

(4) All connection openings shall be closed with a vitrified tile or concrete stopper, in the case of PVC pipe, a PVC stopper securely held in place with the same joint materials as that specified for the main sewer.

ii) Construction

(1) All excavation shall conform to Section 402 of the MDOT 2012 Standard Specification for Construction.

(2) "Y" branches for bell and spigot pipe with less than 8 feet from the surface of the ground to the center of the branch shall be laid horizontal with a slight fall across the branch. Connection openings on concrete pipe of the tongue and groove type shall be laid with the opening in the upper quarter of the pipe.

(3) When the distance from the center of the connection openings is more than eight feet from the ground surfaces the connection openings shall be run outside the road at standard grade and then raised by means of riser pipes to a point less than 8 feet from the ground surface. Pipe risers for single connections shall be laid at an angle of from 45 degrees to 60 degrees with the horizontal depending on the side slope of the sewer trench, and shall be laid in undisturbed soil. Pipe risers for double connections shall be installed vertical with a double "Y" branch at the top with the branches placed crosswise of the main sewer. All openings shall be plugged with clay or concrete on PVC disks. Riser pipes and joints shall be of the same type as specified for the main sewer.

(4) When sidewalks are available opposite the Sewer being constructed, the Contractor shall notch the street side of the walk directly opposite each opening left in the sewer for connection to building drains. Where walks are not available for such marking, the Contractor shall place a hardwood stake on the property line directly opposite each opening left in the sewer. The hardwood stake shall be topped with a brass marker labeled "Sewer". Also, the Contractor shall locate and keep a record of all opening locations by measurement to the nearest downstream manhole. Such record shall be delivered to the Engineer monthly during progress of the work.

j) Precast Manholes

i) Precast Manholes (See Standard Detail Sheet in Drawings): Precast manholes shall be precast concrete sections, as specified in the material section. The top cone shall be an eccentric section. The manhole cover shall be placed directly over the pipe, if possible.

ii) Except for the one section on top, manholes shall all be 4 feet inside diameter. The base shall be leveled so that the manhole will be plumb and shall be low enough so the pipe may be constructed through the manhole. Holes for the pipe and intercepted laterals shall be cut in the sides of the manholes and thoroughly grouted.

iii) The Contractor shall use a jointing material which will prevent any leakage into the manhole. The manhole ring shall be adjusted over the cone section by the use of a minimum of 2 courses, and a maximum of four courses of sand lime brick, or approved equal well grouted, so that it will take up that portion of a foot necessary to be set to the grade, or future grade of the street, as directed by the Engineer. The manholes shall be sealed to not allow any infiltration. At the bottom of all manholes, a concrete trough shall be placed on the base (see Standard Detail Sheet). This

concrete invert shall be troweled smooth and exactly to flow grade through the manhole. Specific items such as manhole covers, rings, etc. are included on standard detail sheet.

k) Concrete Masonry Manholes

i) Manholes constructed of concrete blocks shall have their outer surface plastered from the bottom to the top with 1/2 inch of 1:2 cement mortar and shall have the following protection against infiltration:

ii) The block manholes shall be equipped with rings, covers, bricks, etc., as are the precast manholes described above.

l) Adjustment of Manholes

i) The contractor shall be responsible for the adjustment of all manholes so that they conform to the finish grade. These shall be adjusted to provide a water tight connection between the castings and the concrete structure of the manhole. This adjustment shall be incidental to the project.

m) Stubs Out of Manholes

i) The extension of all stubs out of the manholes shall be to a distance determined by the Engineer and/or as indicated on the plans. These stubs shall be securely plugged and water tight.

ii) All stubs shall be paid for according to the unit price per foot of sewer pipe and shall be payment in full for all labor and materials necessary for installation.

n) Appurtenances

i) Castings

ii) All castings shall be set on full mortar beds on top of concrete or masonry.

o) As-Built Data

(1) During construction, the Contractor with assistance from the Engineer or Engineer's representative shall make all measurements necessary for the preparation of a complete set of "As Built" drawings showing the exact location and elevation of all pipes, fittings, valves, hydrants, structures, sewers, manholes, and catch basins, in a manner acceptable to the Engineer.

(2) The contractor shall provide a video tape of the sewer pipe upon completion of the project prior to its use.

(3) The tape shall be supplied on a media acceptable to the city.

(4) The record shall indicate position of all taps and record the location from the manhole with a minimum of two measurements for accurate location.

4) RESTORATION OF DISTURBED FACILITIES

a) General

i) When the work is completed on construction of Sewers, and Appurtenances, all surplus material, earth, rubbish, etc., shall be removed from the site of the work. That portion of the surface of each street disturbed by construction under this Contract shall be left in as good condition as it was before the commencement of the work, and it shall be promptly and regularly maintained in such condition during a period of one year after the acceptance of the work. This work of maintenance shall apply only to items of materials and workmanship improperly installed under this Contract, and maintenance measures made necessary by the ordinary wear and tear occasioned by traffic shall not be at the expense of the Contractor. However, any repairs required because of the unsatisfactory trench backfilling shall be at the expense of the Contractor.

b) Pavement, Curbs, Curbs and Gutters

i) In all streets or parts of streets or other areas that paved or concrete surfaces all backfilling shall be compacted to 95% of maximum dry density. After the trench or excavation has been backfilled to the required height the subgrade for the new paving, curb and/or curb and gutter shall be further compacted by rolling and backfill

at subgrade elevation. After examination by the Engineer of the backfill and subgrade compaction, the pavement, curb and/or curb and gutter shall be replaced.

ii) All pavements curbs and curbs and gutters shall be replaced to the section and of the same materials as that removed in accordance with the Owners established standards or in their absence to the Standards of the Michigan Department of Transportation *2012 Standard Specifications for Construction.*

c) Driveways and Sidewalks

i) The backfill and subgrade for all driveways and sidewalk replacement shall be compacted in the same manner as that specified for pavements. All edges broken from driveways and sidewalks shall be sawed or cut off at right angles to the driveway or sidewalk and after approval of Engineer replaced.

ii) All driveways and sidewalks shall be replaced to the section and of the same materials as that removed in accordance with the Owners established standards for similar work.

d) Turf Establishment, Special

i) All specifications on seeding, sodding, etc. will be followed according to Section 816 "Turf Establishment, Special" in the 2012 or latest revision of the Standard Specifications for Construction, by Michigan Department of Transportation (MDOT). Methods of measurement and payment will be by other items in the Contract.

e) Trees

i) Contractor shall conform to Section 815 of the MDOT *2012 Standard Specification for Construction.*

5) SANITARY SEWER TESTING

a) General

i) It is the intent of these specifications to secure pipelines with a minimum amount of leakage. Ductile iron and reinforced concrete pressure pipe shall be hydrostatic pressure tested. All gravity pipe lines shall be tested for infiltration and/or for exfiltration, and/or air pressure tested. All PVC pipe will also be tests for deflection.

b) Water Infiltration Tests

i) If more than a trace of water is flowing, weirs will be placed at manholes to determine the amount of infiltration. The contractor shall provide the Engineer with labor and material for construction of these measuring devices. The maximum infiltration allowed will be 200 gallons per day per inch of pipe diameter per mile of pipe. If requested by the Engineer, the test shall be performed and the allowable computed for each manhole interval.

ii) If more than a trace of water is flowing between manholes a V-notch weir shall be used at the downstream end of each manhole and a reading taken and recorded. Only weirs that give the actual reading at the crest of the weir shall be sued and only the proper weir designated for the particular pipe size under test shall be used.

c) Water Exfiltration Tests

i) The maximum exfiltration allowed will be 200 gallons per day per inch of pipe diameter per mile of pipe, plus an additional allowance of 10 percent for each additional 2 feet of head above the initial 2 foot water level as set forth in Article 5.01 (c) 4 of these specifications.

ii) All wyes, tees and stubs shall be plugged with flexible jointed caps, or acceptable alternate, securely fastened to go withstand the internal test pressure. Such plugs or caps shall provide a socket suitable for making a flexible lateral connection or extension.

iii) The section of sewer to be tested shall be sealed by inserting inflatable rubber bags in the pipes or by other means approved by the Engineer, and then water shall be introduced into a manhole until the section is completely filled. The Contractor shall fill the pipe to the test level at least 4 hours prior to the time of exfiltration testing to

permit normal absorption into the pipe walls. All entrapped air must be removed from the test section prior to performing the test.

iv) Throughout the test period of at least 1 hour, the water level in the upper manhole shall be maintained at least 2 feet above the crown of the upper end of the pipe or at least 2 feet above the ground water table, whichever is higher. The length of pipe tested shall be limited so that the pressure on the center line of the lower end of the section tested shall not exceed 12 feet of water column.

d) Air Exfiltration Tests

i) The pipe shall be subjected to an initial pressure of not greater than 4 psi for a minimum of 2 minutes to stabilize temperatures of the compressed air. After stabilization has taken place, the pressure shall be 3.5 psi, or greater, but not more than 4 psi, and all air valves closed.

ii) Flushing a "ball" through the interval to be tested if the contractor so chooses may dampen the interior walls of the pipe.

iii) The maximum allowable air leakage shall be 0.0030 cmf per square feet of internal pipe surface tested at an average pressure of 3.0 psi greater than the average backpressure of any ground water that may submerge the pipe.

iv) In areas where ground water is known to exist, the contractor and Engineer shall determine the extent of ground water over the invert of the pipe and apply additional pressure to the test pressure as follows:

Extent of ground water over invert of pipe	Pounds of pressure to be added to test pressure
1 feet	0.5
2 feet	0.8
3 feet	1.3
4 feet	1.7
5 feet	2.1
6 feet	2.6
8 feet	3.4
10 feet	4.3
12 feet	5.2
14 feet	6.1
16 feet	6.9

v) If the pressure does not fall below 2.5 psi from 3.5 psi in the following situations, the pipe will be accepted. The length of pipe shall be any length between manholes. Additional time allowed for house service laterals shall be added to this time as computed by the formula shown below for the length and size present:

Size (inches)	Time allowed for pressure to drop from 3.5 to 2.5 psi
6	3 minutes
8	4 minutes
10	5 minutes
12	5-1/2 minutes
15	7-1/2 minutes
18	8-1/2 minutes
21	10 minutes
24	11-1/2 minutes
27	13 minutes
30	14-1/2 minutes
33	15-1/2 minutes
36	17 minutes

If the pipe does not meet the above test, the time shall be computed by the following expression:

time in seconds = T = k/c2 where k = 0.011 d L
c = 0.0003883 dL (if c is 1, or less, use value of 1 for c)
t = time in seconds for air pressure inside of pipe to decrease from 3.5 to 2.5 psi
d = inside pipe diameter of pipe under test (inches)
L = length of pipe under test (feet)

e) Force main

i) The Contractor shall pretest and be satisfied that all lines are ready for testing before requesting test inspection.

ii) Pressure testing

(1) The Contractor shall provide all necessary equipment and perform all work required in connection with the tests. All pipes shall be tested under a hydrostatic pressure range of 150 psi. Each section shall be slowly filled with water; care being taken to expel all air from the pipes. If necessary, pipes shall be tapped at high points to vent the air.

(2) The required pressure (150 psi) shall be applied for not less than 2 hours and all pipe, fittings, valves and joints shall be carefully examined for defects. Cracked or defective pipe fittings and valves shall be replaced by the Contractor with sound material at no cost to the Owner, and the test repeated. Where actual visual inspection of each joint cannot be made because of the necessity for immediate backfilling, or where the pipe is placed below water level, suitable means shall be provided by the Contractor for determining the quantity of water lost by leakage under the required test pressure.

(3) Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valve section thereof, to maintain the specified leakage test pressure after the air in the pipeline has been expelled and pipe has been filled with water.

(4) No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD\,(P)\,\frac{1}{2}}{148{,}000}$$

in which L is the allowable leakage, in gallons per hour; S is the length of the pipe tested; in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge in formula is based on an allowable leakage of 11.65 gpd, per mile, per inch nominal diameter at a pressure of 150 psi.

(5) For convenience, the following table of allowable leakage per 1,000 feet of pipeline in gallons per hour has been prepared:

Avg. Test Pressure	Nominal Pipe Diameter-In.					
(PSI)	6	8	10	12	16	20
150	0.55	0.74	0.92	1.10	1.47	1.84

f) Deflection Testing (PVC Pipe)

i) Deflection testing shall be performed on PVC sewer no less than thirty days after placement of the final backfill. No pipe shall exceed a deflection of 5 percent.

g) Responsibility

i) Sewers must be built so as to remain true to line and grade. The inclining grade of the bottom of the sewer after completion shall be such that after flooding the flood water will drain off so that no remaining puddle of water will be deeper than one-half (1/2) of an inch on pipe thirty-six (36) inches internal diameter or smaller, and three-quarters (3/4) of an inch on pipe larger than thirty-six (36) inches internal diameter. Any section of pipe that does not comply with the specifications at any time previous to final acceptance of the work shall be replaced or re-laid at the Contractor's expense.

ii) The Contractor will be held strictly responsible that all parts of the work shall bear the load of the backfill. If cracks one-hundredth (1/100) of an inch develops in the pipe within one year from the date of final acceptance of the work, the Contractor will be required to replace, at his expense, all such cracked pipe. To this end, the Contractor is advised to purchase pipe under a guarantee from the manufacturer, guaranteeing proper service of sewer pipe under conditions established by the Contract Drawings, Contract Specifications, and local conditioning at the site of the work.

6) MEASUREMENT FOR PAYMENT AND COMPENSATION

a) General

i) If any of all of the work to be performed under this Contract is on a unit price basis, the actual number of units of each unit price item of work actually performed may be more or less than the number stated in the Bidding Schedule of the Proposal, or included in the Contract, but no variation in the Contract unit price will be made on that account. Payment will be made only for the actual number of units of incorporated in the work, or for the actual number of units of work performed, and at the Contract unit price for each such unit with measurement for payment made as defined in the following paragraphs. Measurement for payment of work done on a unit price basis will be as follows.

b) Pressure Pipeline

i) Measurement of pressure pipelines and services, whether ductile iron, concrete, or other materials, will be made along the centerline of pipe, whether curved or straight, measured in place, and will include the laying length of valves, fittings and specials.

c) Fittings and Specials

i) Unless otherwise specifically provided in the Project Specifications the cost of furnishing and placing specials and fittings shown on the Contract Drawings and/or called for in the Project Specifications shall be merged in the unit prices for the pressure pipeline, and will not be paid for separately.

d) Gravity Sewers, Conduits, Culverts and Drains

i) Measurement of gravity sewer lines, conduits, culverts and drains will be made along the centerline of the line, whether curved or straight, measured in place.

ii) On sewers of thirty-six (36) inches or less internal diameter measurement will be made through manholes. On sewers larger than thirty-six (36) inches internal diameter measurement will start and terminate at the inside face of manholes or structures.

iii) Measurement on catch basin sewer connection leads will be made from the centerline of the basins to the centerline of the manholes or sewers; measurement of sewer leads between inlet boxes and catch basins will be made from the inside wall of the inlet box to the centerline of the catch basin. Half traps and running traps will be included in the above measurement and will not be paid for separately.

e) Manholes

i) Manhole included parts

(1) Bases from the underside of the foundation to the start of the circular sidewalls, including all fillets and flow channels, to the details shown on the Contract Drawings will be included with payment for each sanitary structure.

(2) Circular sidewalls measured from the top of the base to the underside of the cast iron frame, will be included with payment for each sanitary structure.
(3) Pipe openings for PVC piping will include resilient connectors as included with payment for each sanitary structure.
(4) Adjustment concrete block or brick will be included with payment for each sanitary structure.

ii) Manhole parts not included
(1) Frame and cover will be paid as Dr Structure Cover as measured in pound for specified frame and cover.
(2) Drop pipe assemblies will be paid for at the Contract unit price for each complete assembly installed including concrete encasement.

f) Rock Excavation

i) For structural work will be measured to a plan three (3) inches below the bottom of the structural foundation, and for a distance of one (2) foot outside the horizontal limiting dimensions of the foundation. Measurements for rock excavation for pipe or conduit will be a plan six (6) inches below the bottom of the outside of the pipe, and a width equal to four-thirds (4/3) the inside diameter of the pipe, plus twelve (12) inches. No allowance will be made for rock excavation in excess of the limits above described.

g) Timber Piling

i) Will be measured for the actual piling lengths furnished and installed. Cut off tops will not be included in footage measured for payment. The Contractor shall merge in the unit price bid for piling, the extra cost of furnishing and placing one (1) test pile.

h) Timber Sheeting, Bracing and Cradles

i) Will be measured in Feet Board Measure based on the nominal size of the plank or timber furnished multiplied by the lineal feet left in place. The cost of cutting, mortising, spiking or bolting shall be included in the price bid per thousand feet board measure of timber furnished and placed.

i) Concrete Cradle and Encasement

i) Will be measured in cubic yards, based on the lineal feet of cradle or encasement furnished and placed on each pipe size, multiplied by the cubic yards per lineal foot for each pipe size indicated in the cradle tabulation or shown on the encasement cross-sections included in the Contract Drawings. The unit bid and Contract price for cradle or encasement shall include the cost of removing and disposing of the added excavation required to accommodate these materials.

j) Crushed rock or Gravel Refill

i) Will be ordered placed under pipelines and/or structures will be measured on the basis of the actual number of cubic yards ordered furnished and placed.

k) Sand or Gravel Trench Backfill

i) Will be measured on the basis of the lineal feet of trench backfilled multiplied by the standard trench width in feet (4/3) the internal pipe diameter plus 8 inches), multiplied by the average depth of fill placed from a plane 12 inches above the top of the pipe. The unit bid and Contract price shall include the cost of disposition of the material excavated from the trench and the furnishing, placing and compacting of the sand or gravel backfill.

l) Pavement Replacement

i) Measured for the replacing of pavement disturbed during construction of sewers or pressure pipelines will be based on the width of the trench equal to twice the inside diameter of the pipe installed plus 12 inches. Payment for pavement replacement over manholes and structures will be made only for an area twelve (12) inches beyond the horizontal limiting dimensions of the base. Any pavement disturbed beyond the above-described limits must be replaced at the Contractor's expense.

m) Sidewalk, Driveways and Curb and Gutter Replacement

i) Measured for replacing sidewalks and/or driveways necessary to be disturbed during construction of sewers or pressure pipelines will be based on the actual number of square feet of sidewalk and/or driveways replaced. Similarly, concrete curb and gutter replaced will be paid for on the basis of the actual number of lineal feet of curb and gutter necessary to be disturbed and replaced.

n) Sanitary Sewer Lateral

i) Measurement for service laterals shall be per each and shall begin and include either a "wye" or "tee" connection at the main and continue with piping of size and type as called for on the plans and shall terminate at the right-of way with an included clean out and connection to exiting service lateral. Connection at the main shall be by a "wye" connection, or a "tee" with a saddle an tap per manufacture recommendations. Removal of existing lateral within the right-of-way is included with payment for the new Sanitary Sewer Lateral. Where there is no existing lateral the new lateral shall include a water tight removable plug.

o) San Sewer, Tap, __inch

i) Measurement for sewer taps will be per each tap made into a manhole per the size necessary for the pipe size indicated in the pay item. This item includes all work to bore into the manhole, resealing the manhole to be water tight with a resilient connector (ASTM C 923). Fastening sewer to the resilient connector will be included in the "Sanitary Sewer, __inch, Tr Det__" pay item. This work will include placing a new concrete invert in the structure as directed by the Engineer.

p) Sewer Bulkhead, Less Than 12 inch

i) Measurement for sewer bulkheads of any size 12-inches or less will be per each and will include all forming and concrete necessary to seal, water tight, a manhole or pipe as shown on plans.

7) PAYMENT

All work for Sanitary Sewer shall be paid at the appropriate contract unit prices for the following pay items:

PAY ITEM	PAY UNIT
Sanitary Sewer, __inch, Tr Det __	**Foot**
Sanitary Structure, __inch dia	**Each**
Sanitary Sewer Lateral	**Each**
San Sewer Tap, __inch	**Each**
Sewer Bulkhead, Less Than 12 inch	**Each**
Dr Structure Cover	**Pound**

8) TOLERANCES

In pavement sections, covers shall be installed so that no part of the box or cover extends above the pavement surface and no part is more than 0.02 feet below the elevation of the pavement surface. In turf establishment areas, valves boxes shall be even to or slightly below the topsoil elevation.

CITY OF BATTLE CREEK
SPECIAL PROVISION
FOR
WATER MAIN

CEF/City of Battle Creek March 2016

I GENERAL

1 Description

This work shall consist of installing and placing into operation water mains, water services, valves, hydrants, fittings, and other appurtenances of the required class and the specified sizes; and shall include excavation and backfilling. The Contractor shall furnish all labor, equipment and materials necessary to properly complete the work as shown on drawings and as specified herein.

All work and materials shall be in accordance to the requirements per Section 823 of the *2012 Standard Specifications for Construction* by the Michigan Department of Transportation.

II CONSTRUCTION MATERIALS AND PRODUCTS

1 Shop Drawings

a Shop drawings and manufacturers detailed literature shall be submitted to the Engineer for approval before any work may begin. These drawings shall detail the thrust restraint design for all fittings and pipe. Restraint shall be restraint joint pipe mechanism based on "Thrust Restraint Design for Ductile Iron" Sixth Edition 2006 as published by the Ductile Iron Pipe Research Association. Thrust blocks shall not be considered for calculating restraint design. The design shall be based on 150 psi or two times the working pressure, whichever is greater.

2 Pipe and Fitting Identification

a Each pipe, fitting or special section shall have plainly and permanently marked thereon:

- Pipe class.
- Thickness class.
- Manufacturer's name or trademark.
- On bends, the angle turned thereby.
- Identification of specials to show proper location in line.
- On beveled pipe, amount of bevel and point of maximum bevel.
- Each end of each bevel end pipe, fitting, or special shall be marked with a stripe of paint, approximately 1½ inches wide and 2 feet long applied along the top centerline.
- The Contractor shall be responsible for the handling and storing of all materials per manufacturer's recommendations and to prevent deterioration and contamination from exposure to the weather and other conditions.
- All damaged parts upon delivery or from storage shall be replaced at no cost to the owner.

3 Ductile Iron Pipe

a AWWA C151 minimum thickness Class 52 Pipe, cement – mortar lined and bituminous coated inside and outside in accordance with AWWA C104.

b Joints:
   i. Slip-on compression type joint or mechanical joint meeting AWWA C111
   ii. Rubber gaskets shall conform to ANSI A21.11, AWWA C111, and AWWA C115

c Fittings:

i. Full Body meeting AWWA C110
ii. Compact meeting AWWA C153
iii. All fittings to have mechanical joints meeting AWWA C111 and restrained.

See table at the end of this section for approved product listing for joint restraints, ductile iron pipe, and pipe fittings.

4 Polyvinyl Chloride (PVC) Pipe

a AWWA C900 DR14 PVC pressure pipe water main shall be manufactured from compounds conforming to PVC cell classification of 12454 as defined in ASTM D1784. Pipe shall be blue in color and carries approval of ANSI/NSF Standard 61.

b Joints
i Slip-on compression type joint shall conform to ASTM F477 and ASTM 3139
ii Restrained joints shall utilize either JM Eagle Eagle Loc 900™ restrained joint system or Northern American Certa-Lok™ restrained joint system or approved equal.

c Fittings
i Full Body meeting AWWA C110
ii Compact meeting AWWA C153
iii All fittings to have mechanical joints meeting AWWA C111 and restrained.

See table at the end of this section for approved product listing for joint restraints, PVC pipe, and pipe fittings

5 Valves and Boxes.

a Resilient Wedge Gate Valves.

i. Required on 4" mains to 12" mains.

ii. All gate valves shall conform to the latest revision of AWWA Standard C509 or C515 covering resilient seated gate valves. Valves shall be rated 250 psi. All ferrous components shall be ductile iron.

iii. Gate valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve.

iv. The valves shall be non-rising stem, opening by turning stem Left (counter clockwise) and provided with a 2" square operating nut with the word Open and an arrow cast in metal to indicate the direction to open. Operating nut shall be constructed of ductile iron and shall have four flats at the stem connection.

v. The wedge shall be of ductile iron completely encapsulated with rubber. The wedge shall be symmetrical and seal equally well with flow in either direction.

vi. The sealing rubber shall be permanently bonded to the cast iron wedge to meet ASTM tests for rubber metal bond ASTM D429.

vii. Valves shall be supplied with o-ring seats at all joints. No flat gaskets allowed.

viii. Stems shall be cast bronze with integral collars in full compliance with AWWA. The stem stuffing box shall be o-ring seal type with 2 o-rings located above the thrust collar and 1 o-ring below. The 2 o-rings above the collar shall be replaceable with the valve fully open and at its full working pressure.

ix. There shall be 2 low torque thrust bearings located above and below the thrust collar. The stem nut shall be independent of the wedge and shall be made of solid bronze. There shall be a smooth, unobstructed waterway free of all pockets, cavities and depressions in the seat area.

x. The body and bonnet shall be coated with fusion bonded epoxy both interior and exterior, complying with AWWA C550 and be NSF 61 approved. Each valve shall have the manufacturers' name, pressure rating and the year manufactured, cast on the body.

See table at the end of this section for approved product listing for resilient wedge gate valves.

b Butterfly Valves.

i. Required on 16" mains or larger.

ii. Butterfly valves shall comply with the latest revision of AWWA Standard C-504 Class 150B.

iii. Butterfly valves shall be built to withstand a 150 psi working pressure.

iv. Butterfly valve bodies shall be cast iron ASTM A126 Class B with mechanical joint ends complete with accessories (rubber, bolts, and glands).

v. Butterfly valve discs shall be ductile iron ASTM A536 Grade 65-45-12. All internal cast iron parts exposed to flowing water shall be coated with black asphaltic.

vi. Butterfly valve body seating surface shall be stainless steel ASTM A276, Type 304. The mating seating shall be natural rubber or "Buna N Rubber" meeting the requirements of ASTM D2000. Seating shall be a 360 degree resilient seat fully field adjustable and field replaceable without valve disassembly.

vii. Butterfly valve shafts shall be single solid stainless steel ASTM 276, Type 304. The shaft and disc shall be connected by means of O-ring sealed tapper pin held in place by a self-locking nut. The disc shall be held in the center of the valve by factory set thrust rings or collars. Shaft seals shall be of O-ring type or V-type packing.

viii. Installation is for buried service. The valve shall be key operated with a 2" square operating nut open left (counter clockwise) and shall be located on the main side nearest to the edge of road or curb.

See table at the end of this section for approved product listing for butterfly valves.

c Valve Boxes.

All buried valves shall be provided with valve boxes. Valve boxes shall be cast iron, 2-piece with screw type extension sleeve adjustment and suitable for the depth of cover required by the drawings. Valve box shafts shall be 5-1/4 inches in diameter and shall have a minimum thickness at any point of 3/16 inch. Valve box bases shall encapsulate the entire valve stem assembly, but not rest directly on the valve. Covers shall be of a round plug type suitable for easy removal, and shall have cast thereon the word "WATER."

i. All parts of valve boxes, bases and covers shall be coated by dipping in hot asphalt varnish.

See table at the end of this section for approved product listing for valve box castings.

d Service boxes.

Service boxes for 1 inch curb stops shall be two-piece 6500 Series Tyler Union 95-E; extensions shall be Tyler 151, 152, 153, or 154.

Service box for 2 inch curb stop shall be cast iron, 2-piece with screw type extension sleeve adjustment and suitable for the depth of cover required by the drawings. Valve box shafts shall be 5-1/4 inches in diameter and shall have a minimum thickness at any point of 3/16 inch. Valve box bases shall encapsulate the entire curb stop assembly, but not rest directly on the curb stop. Covers shall be of a round plug type suitable for easy removal, and shall have cast thereon the word "WATER."

6 Fire Hydrant Assemblies.

a. Hydrants shall conform to AWWA C502, as amended to date. All hydrants shall be "breakable" or "traffic" design, with replaceable sections or components of the barrel and stem.

b. Hydrants shall have a compression type shut-off, opening against the pressure and which will remain closed in the event of accident, damage or breaking of the hydrant barrel.

c. Hydrants are to have a minimum 5¼ inch valve opening with a 6 inch mechanical joint inlet and a 6 inch mechanical joint auxiliary gate valve between the water main and the hydrant. Auxiliary gate valves shall be provided with a valve box.

d. Hydrants shall be provided with two or more drain outlets, which are part of the main valve mechanism. The drain outlets are to be tapped and the drain plugs are to be threaded brass and installed at the time of delivery. Removal of drain plugs shall be done by the Contractor prior to backfill unless groundwater is encountered or the Engineer directs otherwise. Where necessary for drainage, aggregate meeting the requirements for MDOT Class 4G, 34R, or 34G as specified in Section 902 of the MDOT 2012 Standard Specifications for Construction, shall be placed at the base of the hydrant.

e. Hydrants shall have O-ring packing.

f. Hydrants, including tops and nozzle caps, shall be painted chrome yellow.

g. Hydrants shall open left (counter-clockwise). Hydrants shall have two standard 2½ inch hose nozzles and one 4½ inch pumper nozzle with National Standard Fire Hose threads and shall be equipped with caps, cap gaskets and chains.

h. Operating nuts are to be pentagon in shape, measuring 1½ inches from flat to point. Height of the nut shall be at least 1 inch.

i. Hydrants shall be designed so that the direction of the nozzles can be reoriented without digging up the assembly.

j. Hydrants shall be designed so that an extension to the barrel can be added above ground without excavation. Extensions shall be available in 6 inch increments.

k. Hydrants shall be designed so that no excavation is needed to remove the main valve and movable parts of the drain valve.

l. The bronze valve seat shall be threaded into a bronze drain ring or shoe bushing to provide ease of removal of the valve and valve seat on any hydrant that requires removal of the valve seat to replace the valve.

See table at the end of this section for approved product listing for fire hydrants.

7 Water Service Connections.

a. Copper pipe service connections of 1 inch or 2 inch, shall be in accordance with ASTM Specification B88, or Federal Specification WW-T-799; "Type K", soft tempered copper.

b. HDPE pipe service connections of 2 inch shall be in accordance with ASTM F876, F877, F2023, F2657, constructed per AWWA C 904, and meet ANSI/NSF Standard 61.

c. Corporation stops shall be bronze, AWWA C-800 Table 1 standard inlet with AWWA standard outlet for compression fitting.

d. Curb stops shall be bronze, AWWA C-800 standard for compression fittings.

e. Service clamps for 2 inch service connections shall be of the double strap type, ductile iron, with all stainless steel or galvanized parts, similar to Romac Style 202NU.

f. Fittings for copper water services shall be of the compression type. Soldered joints shall not be used where pipe is buried.

See table at the end of this section for approved product listing for service line components.

8 Pipe location devices

a. All buried PVC and HDPE piping to have an electrically conductive [14 gauge] tracer wire with HDPE jacket to locate the pipe from grade level. All grade level connection points for the purpose of locating buried pipe to be identified and submitted to the municipality.

b. Tracer wire to be secured to the PVC or HDPE pipe at [10 ft.] maximum intervals.

c. Solder tracer wire intersections to provide continuity and be electrically isolated from ground.

d. Subsurface waterproof connectors specifically designed for buried service to be used.

9 Manhole Covers.

Covers shall meet the requirements of MDOT "Q" cover and the City of Battle Creek's Standard Water Main Detail sheet that includes the city logo and the words "WATER" imprinted into the casting.

10 Pipe Testing.

At the discretion of the Engineer, pipe shall be tested for conformity with AWWA and ASTM specifications. The Engineer may choose one pipe per 1,000 feet of construction. The entire costs of testing shall be the Contractor's responsibility, whether performed by an independent testing lab or as part of the manufacturer's quality control.

11 Disinfection Materials.

a. **High Test Calcium Hypochlorite (HTH, "Perchloren", "Maxochlor", "Pittchlor").** - Powder and water shall be mixed to form a 1 percent chlorine solution (10,000 ppm), pumping solution at a constant rate into the water main while bleeding off the water at the extreme end.

b. **Liquid Chlorine.** - Liquid chlorine conforming to AWWA B-301 may be applied to the water main much the same way as the hypochlorite solution listed above.

c. **Chlorine Gas.** - Chlorine gas shall not be used.

City of Battle Creek Approval Table		
Pipe and Fittings	American Cast Iron Pipe Company	Fastite Joint Pipe
	Clow Water Systems Company	Tyton Joint Pipe
	U.S.Pipe and Foundry Company	Tyton Joint Pipe
	JM Eagle	Blue Brute C900
	North American Pipe	AWWA C900
Joint Restraints	EBAA Iron, Inc.	Mega Lugs
	Romagrip Industries	RomaGrip
Resilient Wedge Gate Valves MJ x MJ	American Flow Control	Series 2500
	Clow Water Systems Company	F6100
	East Jordan Iron Works	Flowmaster MJ x MJ
	Mueller Industries	A-2360-20
Resilient Wedge Tapping Valves	American Flow Control	2500 Series
	Clow Water Systems Company	F6114
	East Jordan Iron Works	Flowmaster MJ x Tapping
	Mueller Industries	T-2360
Resilient Wedge Cut In Valve	Clow Water Systems	F6111
	Muller Industries	C-2360
Butterfly Valves	Clow Water Systems Company	4500 Series
	Golden Anderson	GA AWWA C504 Butterfly Valve
	Pratt	Groundhog Butterfly Valve
Valve Box Castings	Tyler Union – USA only	6850 Two piece 664-S (26T & 36B)
	East Jordan Iron Works	8555 Two piece 668-S
Service Box Castings	Tyler Union – USA only	6500 Series, 95-E (30T & 39B)
Fire Hydrant Assemblies	American Flow Control	American Darling B-62-B-5 "Snow
	East Jordan Iron Works	Watermaster 5BR250

III Construction Methods

1 Scope of Work

This section consists of excavation and backfill; placement of pipe, fittings and appurtenances; and disinfection of the completed water system per Section 823 of MDOT 2012 Standard Specification for Construction and the following specifications. It is the Contractor's task to proceed with the construction as rapidly and as expeditiously as possible and to present the City with a complete, sound, and operable piping system.

a. The city will notify customer of shutoffs outside the project limit, but necessary to complete the work. The contractor will be required to notify residences within the project limits via door hangers that the city will provide, but contractor must complete the information for times and durations of shutoffs along with providing contact information for coordination of work.

b. Contractor will be allowed to operate valves within the project limits and as designated by the Engineer until acceptance of the completed water main system.

c. Salvaged material shall be made available to the City of Battle Creek at a designated location within the project limits or other location as agreed to in the Progress Meeting. Written notification of the material's availability shall be from the Contractor to the Project Engineer, at which the city will be given 14 days to remove the salvaged material after which it becomes the

property of the Contractor. Salvage material includes, but not limited to, hydrants, manhole castings, valves, boxes, and other appurtenances.

2 Trench Excavation.

Water pipe shall be laid according to Utility Trenches detail F or G, as shown on MDOT Standard Plans R-83-B unless otherwise noted. Pedestrian crossings shall be erected and maintained by the Contractor where designated by the Engineer. The Contractor shall provide access to homes, commercial, industrial, etc. establishments as soon as backfill is completed. Said access shall always be provided during periods when the Contractor is not performing construction operations.

No trench shall be left open and unattended when pipe work is not being executed within the trench unless under an emergency in which case the trench shall be closed by fencing, barricading, or other methods until the emergency is resolved. In no case shall the trench be left open overnight or on a weekend or holiday.

Undercutting unstable soil conditions within the trench shall be per Section 402.03.A of the current MDOT Standard Specifications for Construction and as directed by the Engineer.

3 Dewatering.

Dewatering of trenches shall be included as part of the water main installation with no separate payment. Dewatering shall be performed as necessary and shall conform to Section 402 of the current MDOT Standard Specifications for Construction, with the following additional requirements.

a The Contractor shall perform his dewatering operations whenever groundwater conditions create an unstable trench bottom. An unstable trench bottom is defined as "Conditions that prevent placement of pipes true to line and grade."

b The method of dewatering will be subject to review by the Engineer.

c The City will be responsible for temporary service of an individual water supply where these supplies are cut off due to lowering of the water table during construction. The Contractor shall not lower the water table unnecessarily.

d All dewatering wells that have a bore hole diameter of two inches or more shall be plugged and abandoned by the following method or any method that has been approved in writing by the Michigan Department of Public Health, in accordance with the State of Michigan's "Mineral Well Act," Public Act 315 of 1969.

e Once the casing and screen have been removed from the bore hole, an injector pipe shall be installed in the bore hole to the bottom of the gravel pack material. Neat cement or bentonite slurry shall be pumped through the injection pipe until the material is five feet above the gravel pack material or four feet below the existing gravel level. The remainder of the bore hole shall be plugged with native soil.

f Any water removed from the trench or the water main shall be disposed of in such a way as not to damage property, create a public nuisance or a health problem.

4 Joint Restraint.

Follow approved shop drawings and manufacturer's recommendations based on "Thrust Restraint Design for Ductile Iron" Sixth Edition 2006 as published by the Ductile Iron Pipe Research Association. Thrust blocks may be incorporated into the restraint system, but will not be considered for calculating restraint design

5 Installation of Pipe and Fittings

Before installation, the pipe shall be inspected for defects and any section of pipe or fittings found to be defective, before or after lying, will be rejected and replaced with sound pipe without additional expense to the City.

Water pipe shall be laid according to Utility Trench Detail F or G, as specified, on MDOT Standard Plans R-83-B. The interior of the pipe and fittings shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging the ends or by other approved methods. When work is not in progress, the open ends of the pipe and fittings shall be securely closed so that no trench water, earth, animals, or other substances will enter the pipes.

No pipe or fittings shall be placed in water or when the trench or weather conditions are unsuitable for work except by permission of the Engineer.

The full length of each section of pipe shall rest solely upon the pipe bed, with recesses provided to accommodate the bells and joints.

Deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, shall not exceed tolerances recommended by the pipe manufacturer. If the alignment requires deflections in excess of the manufacturer's recommendations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide the angular deflection required. Frequent or abrupt changes in the slope of the pipe, even if necessary to follow the existing ground surface elevations, will not be permitted.

Pipe shall be placed with bell ends facing in the direction of laying, unless otherwise approved by the Engineer.

Pipe shall be placed with at least 10-foot horizontal clearance from existing sewers and shall have a minimum clearance of 18-inches, as measured from outside edges of pipes, when crossing sewers.

Jointing of the various pipe materials and types shall be made in accordance with the manufacturer's recommendations.

6 Cutting Pipe

Cutting pipe for inserting valves, fittings, etc. shall be performed in a neat and workmanlike manner, without damage to the pipe or lining, and so as to leave a smooth end at right angles to the axis of the pipe.

For cast iron and ductile iron pipe, cutting shall be performed with a power saw, or a roller or shear type cutter for pipe sizes up to 20 inches in diameter. When machine cutting is not available for cutting pipe 20 inches in diameter or larger, the electric arc cutting method will be permitted, using a carbon or steel rod. Only qualified and experienced workmen shall perform this work.

For asbestos-cement or PVC pipe, cutting shall be performed by power saw, hand saw, abrasive disks or with a special asbestos-cement or PVC cutting tool. All piping cutting tools must be of the true cutting variety. Under no circumstances is the pipe to be cut with a roller or shear type cutting tool.

7 Connections to Existing Water Mains

Connections shall be made with line pressure on or off according to the Plans or Proposal. Existing pipelines shall be adequately supported during the cutting operations and prior to placement of backfill. Thrust blocks shall be placed behind all connected fittings.

Prior to cutting existing pipelines, the surface of the existing pipe shall be thoroughly cleaned by wire brushing and scraping. When cut-in is made under pressure, the existing pipe surface shall be washed

down with a 4 percent solution of chlorine prior to installing the cutting-in tee. All fittings, pipe, valves, etc. used in the connection that cannot be disinfected during normal water main chlorination shall be swabbed out with a 4 percent or stronger solution of chlorine, such as standard laundry bleach, during assembly. Care shall be exercised in order to prevent contamination of the existing water mains and failure to comply with this requirement will necessitate chlorination of the existing water mains at the Contractor's expense.

After the connection is made, the Contractor shall flush sufficient water through the connection to effect removal of the chlorine solution.

All valves will be turned to the open position at the final inspection.

8 Valve Boxes

The valve box shall not transmit shock or stress to the valve when the box cover is flush with the surface of the pavement or other such level as may be directed. The base section of the valve box shall be set two inches above the flanged bonnet joint of the valve and accurately centered on the valve operating nut.

9 Hydrants

Hydrants shall stand plumb and have hose nozzle parallel with the roadway, with the pumper nozzle facing the roadway.

Hydrants shall be installed in conformance with AWWA C-600 and AWWA M-17. Hydrants shall be set to the established grade, with the breakaway no more than 8 inches above the finished topsoil grade or as directed by the Engineer. Nozzles should be placed at least 20 inches above the finished topsoil grade. Hydrants set with elbow or hydrant tee shall be rotated 90 degrees to conform to the above specifications.

At least 3 feet of horizontal clearance shall be provided around each hydrant from any above ground obstacles such as utility poles, trees, signs, fencing, walls, etc.

Hydrants must be connected to the main with a 6-inch branch and controlled by an independent gate valve. In the case of relocated four-inch hydrants, four-inch valves shall be used. This Valve on Branch shall be located no less than 18 inches or greater than 36 inches from the hydrant unless otherwise shown on the plans. Each Valve on the branch shall be left open prior to pressure testing and disinfecting and shall be left open prior to final acceptance.

A drainage pit shall be placed on both sides of the bottom inlet at the drainage waste opening. The pit shall be 2 feet radial from the waste opening, at least 90 degrees in width, and 3 feet deep. The pit shall be completely filled with specified aggregate to an elevation 6 inches above the waste opening.

10 Water Service

All water services shall originate at and include the tap into the water main in the street with a corporation stop and terminate with the connection to the existing service with a curb stop and service box located within 7 feet outside of the property line. All services shall be tapped at the 2 o'clock or 10 o'clock positions. Services shall be installed at a depth of 5 feet below the final grade. Short services shall be installed by boring. Borings may be made by the "Augur" or "Missile" methods. Services installed under existing concrete or bituminous surfaces shall be installed by boring. Services installed under gravel surface may be by open trench or boring.

Where soil conditions in open trenches are not suitable for copper pipe, the pipe shall be embedded in Granular Material Class III and backfilled as specified.

All services shall be observed for leaks and disinfected (chlorinated) before they are covered.

11 Seasonal Suspension

In the event that hazardous or nuisance conditions arise during the winter from the previous construction season's water main work, and such conditions are not corrected by the Contractor, the City shall notify the Contractor through the Engineer, in writing, that a deficiency exists and the specific location thereof. The Contractor shall, immediately upon such notification, correct the defective condition to the satisfaction of the City. Should the Contractor not correct the defective condition promptly, the City may perform the required maintenance and deduct their incurred costs from the contract price.

If the Contractor so desires, and by prior written consent of the City, he may elect not to perform such inspections and/or maintenance, due to prohibitive travel distances or shortage of off season manpower. Should the Contractor desire to initiate this exception, the City may perform the winter inspections and maintenance itself and deduct his incurred costs from the contract price.

IV Hydrostatic Testing

1 General

The Contractor shall pretest and be satisfied that all lines are ready for testing before requesting test inspection. The Contractor shall provide all necessary equipment and perform all work required in connection with the tests.

2 Hydrostatic Testing

The test shall conform to AWWA C-600 and Section 823.03 T. of the 2012 Standard Specifications for Construction by MDOT for all newly laid pipe and fittings.

V Disinfection of the System

1 General

Disinfection shall be by chlorination and/or other methods as approved by the Engineer after pressure testing and flushing. The disinfection shall conform to the current AWWA C-651 standards.

2 Chlorination

All new water lines shall be chlorinated. The Contractor shall furnish all labor, equipment, and materials necessary for effective chlorination of the water mains.

3 Materials

a High Test Calcium Hypochlorite (HTH, "Perchloren", "Maxochlor", "Pittchlor"). - Powder and water shall be mixed to form a 1 percent chlorine solution (10,000 ppm), pumping solution at a constant rate into the water main while bleeding off the water at the extreme end.

b Liquid Chlorine. - Liquid chlorine conforming to AWWA B-301 may be applied to the water main much the same way as the hypochlorite solution listed above.

c Chlorine Gas. - Chlorine gas shall not be used.

4 Method of Chlorination

The chlorination agent shall be applied at the beginning of the section adjacent to the feeder main and shall be injected through a corporation cock, hydrant or other connection, insuring treatment of the entire line. Water shall be fed slowly into the new lines with chlorine applied to produce a dosage of not less than 50 ppm. Mains previously filled shall be treated to a concentrated dosage at intervals along the line and retained for a period of not less than 12 hours. A chlorine residual of not less than 5 ppm

shall be produced in all parts of the line. During chlorination, all new valves and accessories shall be operated.

After chlorination, the water shall be flushed from the line at its extremities until all of the heavily chlorinated water has been removed, leaving a residual chlorine content not greater than 1.0 ppm.

After the applicable retention period, heavily chlorinated water shall not remain in prolonged contact with the pipe. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the main is no higher than that generally prevailing in the distribution system or is acceptable for domestic use.

The chlorine concentrations in the discharged chlorination water shall not exceed the limits imposed by the Michigan Department of Environmental Quality and other regulatory agencies. Chlorine concentrations in discharges that occur over a period of 160 minutes or less shall not exceed 0.5 milligrams per liter. Chlorine concentrations in discharges that occur over a period longer than 160 minutes shall not exceed 0.038 milligrams per liter.

The environment into which the chlorinated water is to be discharged shall be inspected. If there is any possibility that the chlorinated discharge will cause damage to the environment, then a neutralizing chemical shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water. Where necessary, Federal, state and local regulatory agencies shall be contacted to determine special provisions for the disposal of heavily chlorinated water.

The Contractor shall collect water samples in sterile bottles containing sodium thiosulfate for bacteriological analysis from the end-most outlet of the pipeline. Two samples shall be taken 24 hours apart for each section of line tested. If both samples show safe results and meet the Safe Drinking Water Standards, the new pipeline may be placed in service. If, however, the results are unsafe, a repetition of the chlorine treatment is necessary. Samples will never be taken from hoses or fire hydrants. A suggested sampling tap is a corporation cock with a copper gooseneck assembly. The gooseneck assembly may be removed after use. At the option of the City, samples shall be taken during chlorination.

VI Measurement and Payment

The complete work as measured for Water Main will be paid for at the contract unit prices for the following items (pay items). Each item includes supplying all necessary material, equipment, and labor.

Pay Item	Pay Unit
Water Main, DI, __inch, Tr Det __	Foot
Water Main, PVC, __inch, Tr Det __	Foot
Trench Undercut	Cubic Yard
Rock Excavation	Cubic Yard
Fire Hydrant Assembly	Each
Water Serv	Each
Water Serv, Long	Each
Water Serv, 2 inch	Foot
Water Service, Rem	Each
Water Main, Rem	Foot
Hydrant, Rem	Each
Gate Well, Rem	Each
Pressure Test and Disinfect	Each
Shutoff Box, Adj, Case __	Each
Gate Box, Adj, Case __	Each

Water Main Tie in ..... Each
Water Main Conflict, 6 inch to 12 inch ..... Each
Gate Valve and Box, __inch ..... Each
Live Tap With Valve and Box, __inch by __inch ..... Each
Water Main Tee, __inch by __inch ..... Each
Water Main Cross, __inch by __inch ..... Each
Water Main Bend, __Deg, __inch ..... Each

1 General

The actual number of units of each unit price item of work actually performed may be more or less than the number stated in the Bidding Schedule of the Proposal, or included in the Contract, but no variation in the Contract unit price will be made on that account. Payment will be made only for the actual number of units incorporated in the work, or for the actual number of units of work performed, and at the Contract unit price for each such unit with measurement for payment made as defined in the following paragraphs. Measurement for payment of work done on a unit price basis will be as follows.

A Water Main

Water main, of the diameter, class, and trench detail specified, will be measured in place, by length in linear feet, from center to center of cross mains with no deductions in length for intermediate structures. Payment shall include any dewatering or trench bracing/sheeting necessary. Excavation and backfill will not be measured separately but shall be included as a part of the item of water main furnished and installed. Price shall include any necessary tracer wire.

B Trench Undercut

When unstable soil conditions, or obstructions, require that the trench be excavated below the elevation shown on the plans and backfilled with suitable material, such work shall be paid for as "Trench Undercut and Backfill" and be performed and measured as specified in Section 402 of the MDOT 2003 *Standard Specifications for Construction.*

C Rock Excavation

If rock excavation is required, it will be paid for separately in accordance with Section 206 of the MDOT 2003 *Standard Specifications for Construction.* Dewatering Systems will be installed and paid for as specified in Section 402.

D Fire Hydrants Assemblies

Fire hydrant assemblies will be paid for on an each basis. The payment for fire hydrant assemblies includes the hydrant, main line by 6 inch tee, 6" resilient wedge valve and box, rodding, thrust restraint, up to 10'-6" of Class 52 cement lined ductile iron pipe, aggregate, hydrant extension kits and other accessories necessary to complete the installation to proper grade and specifications.

E Services

Water Serv includes the tap, corporation, curb stop, service box and one-inch type K copper tubing from within 5' of the ROW to the short side of the water main.

Water Serv, Long includes the tap, corporation, curb stop, service box and one-inch type K copper tubing from within 5' of the ROW to the long side of the water main.

Water Serv, 2 inch shall be in addition with the **Water Serv** pay item for placing 2-inch type K copper tubing or 2-inch HDPE (PEX) and includes the saddle and attachment to the main. Tap, corporation, curb stop, and service box from within 5' of the ROW will be included with the **Water Serv** pay item.

One-inch water services will be paid for on an each basis. Two-inch water services will be paid by the foot of 2" type K copper laid with the **Water Serv** pay item for each two-inch service placed. Payment for the water services includes any jacking or boring under the existing pavement, as directed by the Engineer and any necessary tracer wire.

F Water Service, Rem

Removal of water service shall be from the corporation at the main to the right-of-way and will be paid for on an each basis. Salvaging existing curb boxes for the city's use shall also be included in this item.

G Water Main Removal

Removing water main will be paid per foot of water main removed and will include all excavation needed and hauling from site.

H Hydrant Removal

Removing Hydrants will be paid for on an each basis. All existing hydrants will remain the property of the City and will be salvaged.

I Gate Well Removal

Removing gate wells will include complete removal of the water valve pit and all surrounding heavy, saturated material.

J Testing

Pressure Test and Disinfect Water Main will be paid for only once per project. If the main fails to pass the first pressure and disinfectant tests, further tests shall be made at the Contractor's expense. Payment for flushing and disposal of the disinfectant chlorinated water in accordance with environmental regulations is included in this item.

K Box Adjustment

Shutoff and gate valve boxes shall be adjusted to match finish grade using the existing box. In pavement sections, boxes shall be adjusted so that no part of the box or cover extends above the pavement surface and no part is more than 0.02 feet below the elevation of the pavement surface. If boxes, as determined by the Engineer, are in poor shape or have no further adjustment available, the Contractor will provide a new box per MDOT Water Shutoff or Gate Box, Reconst, Case __ pay items.

L Cut-In Connection to Existing Water Main

Connection of a new water main to an existing water main will be paid on an each basis for each connection made. Payment includes all items necessary to complete the work including excavation and backfill, cutting and removing existing water main, all fittings, reducers, bends, and sleeves with restraint necessary to align new main with existing main.

Q Water Main Conflict, 6 inch to 12 inch

This item shall include all work necessary to relocate water main (6" - 12" diameter) in conflict with a new utility. This shall include all fittings, bends, and restraints that are required, along with all connections and the cost for removing and disposing of old water main. This item shall apply in cases where less than 25 linear feet of water main has to be relocated.

R Appurtenances

Water main tees, crossing, bends and other appurtenances shown on plans but not listed as bid items will be included with the water main items. Payment for all buried valves includes the valve box and cap. Payment for thrust restraint is included with payment for water main.

Appendix C:

Technical Specifications for W. K. Kellogg Airport

ITEM P-101 SURFACE PREPARATION

DESCRIPTION

101-1.1 This item shall consist of preparation of existing pavement surfaces for overlay, surface treatments, removal of existing pavement, and other miscellaneous items. The work shall be accomplished in accordance with these specifications and the applicable drawings.

EQUIPMENT

101-2.1 All equipment shall be specified here and in the following paragraphs or approved by the Engineer. The equipment shall not cause damage to the pavement to remain in place.

CONSTRUCTION

101-3.1 Removal of existing pavement.

a. **Concrete pavement.** The existing concrete pavement to be removed shall be freed from the pavement to remain by sawing through the complete depth of the slab one foot (30 cm) inside the perimeter of the final removal limits or outside the dowels, whichever is greater when the limits of removal are located on the joints. The pavement between the perimeter of the pavement removal and the saw cut shall be carefully broken up and removed using hand-held jackhammers, weighing 30 pounds (14 kg) or less, or other light-duty equipment which will not cause distress in the pavement which is to remain in place. The Contractor shall have the option of sawing through the dowels at the joint, removing the pavement and installing new dowels. Where the perimeter of the removal limits is not located on the joint and there are no dowels present, then the perimeter shall be saw cut the full depth of the pavement. The pavement inside the saw cut shall be removed by methods suitable to the Engineer which will not cause distress in the pavement which is to remain in place. If the material is to be wasted on the airport site, it shall be reduced to a maximum size designated by the Engineer. The Contractor's removal operation shall not cause damage to cables, utility ducts, pipelines, or drainage structures under the pavement. Concrete slabs that are damaged by under breaking shall be removed. Any damage shall be repaired at the Contractor's expense.

b. Asphalt concrete pavement. Asphalt concrete pavement to be removed shall be cut to the full depth of the bituminous material around the perimeter of the area to be removed. The pavement shall be removed so the joint for each layer of pavement replacement is offset 1 foot (30 cm) from the joint in the preceding layer. This does not apply if the removed pavement is to be replaced with concrete or soil. The material shall be disposed of off-site.

101-3.2 Preparation of joints and cracks. Remove all vegetation and debris from cracks to a minimum depth of 1 inch (25 mm). If extensive vegetation exists treat the specific area with a concentrated solution of a water-based herbicide approved by the Engineer. Fill all cracks, ignoring hairline cracks (< 1/4 inch (6 mm) wide) with a crack sealant per ASTM D6690. Wider cracks (over 1-1/2 inch wide (38 mm)), along with soft or sunken spots, indicate that the pavement or the pavement base should be repaired or replaced as stated below. Any excess joint or crack sealer on the surface of the pavement shall also be removed from the pavement surface.

101-3.3 Removal of paint and rubber. All paint and rubber over 1 foot (30 cm) wide that will affect the bond of the new overlay shall be removed from the surface of the existing pavement. Chemicals, high-pressure water, heater scarifier (asphaltic concrete only), cold milling, or sandblasting may be used. Any

methods used shall not cause major damage to the pavement. Major damage is defined as changing the properties of the pavement or removing pavement over 1/8 inch (3 mm) deep. If chemicals are used, they shall comply with the state's environmental protection regulations. No material shall be deposited on the runway shoulders. All wastes shall be disposed of in areas indicated in this specification or shown on the plans.

101-3.4 Concrete spall or failed asphaltic concrete pavement repair.

a. Repair of concrete spalls in areas to be overlaid with asphalt. The Contractors shall repair all spalled concrete as shown on the plans or as directed by the Engineer. The perimeter of the repair shall be saw cut a minimum of 2 inches (50 mm) outside the affected area and 2 inches (50 mm) deep. The deteriorated material shall be removed to a depth where the existing material is firm or cannot be easily removed with a geologist pick. The removed area shall be filled with asphaltic concrete with a minimum Marshall stability of 1,200 lbs (544 kg) and maximum flow of 20 (units of 0.01 in). The material shall be compacted with equipment approved by the Engineer until the material is dense and no movement or marks are visible. The material shall not be placed in lifts over 4 inches (100 mm) in depth. This method of repair applies only to pavement to be overlaid.

b. Asphaltic concrete pavement repair. The failed areas shall be removed as specified in paragraph 101-3.1b. All failed material including surface, base course, subbase course, and subgrade shall be removed. The base course and subbase shall be replaced if it has been infiltrated with clay, silt, or other material affecting the load-bearing capacity. Materials and methods of construction shall comply with the other applicable sections of this specification.

101-3.5 Cold milling. Milling shall be performed with a power-operated milling machine or grinder, capable of producing a finished surface that provides a good bond to the new overlay. The milling machine or grinder shall operate without tearing or gouging the under laying surface. The milling machine or grinder shall be equipped with automatic grade and slope controls. All millings shall be removed and disposed off Airport property, unless otherwise specified. If the Contractor mills or grinds deeper or wider than the plans specify, the Contractor shall replace the material that was removed with new material at no additional cost to the Owner.

a. Patching. The milling machine shall be capable of cutting a vertical edge without chipping or spalling the edges of the remaining pavement and it shall have a positive method of controlling the depth of cut. The Engineer shall layout the area to be milled with a straightedge in increments of 1 foot (30 cm) widths. The area to be milled shall cover only the failed area. Any excessive area that is milled because the Contractor doesn't have the appropriate milling machine, or areas that are damaged because of his negligence, shall not be included in the measurement for payment.

b. Profiling, grade correction, or surface correction. The milling machine shall have a minimum width of 7 feet(2 m) and it shall be equipped with electronic grade control devices that will cut the surface to the grade and tolerances specified. The machine shall cut vertical edges. A positive method of dust control shall be provided. The machine shall have the ability to remove the millings or cuttings from the pavement and load them into a truck.

c. Clean-up. The Contractor shall sweep the milled surface daily and immediately after the milling until all residual aggregate and fines are removed from the pavement surface. Prior to paving, the Contractor shall wet down the milled pavement and thoroughly sweep and/or blow the surface to remove any remaining aggregate or fines.

101-3.6. Preparation of asphalt pavement surfaces. Existing asphalt pavements indicated to be treated with a surface treatment shall be prepared as follows:

a. Patch asphalt pavement surfaces that have been softened by petroleum derivatives or have failed due to any other cause. Remove damaged pavement to the full depth of the damage and replace with new asphalt concrete similar to that of the existing pavement in accordance with paragraph 101-3.4.

b. Repair joints and cracks in accordance with paragraph 101-3.2.

c. Remove oil or grease that has not penetrated the asphalt pavement by scraping or by scrubbing with a detergent, then wash thoroughly with clean water. After cleaning, treat these areas with an oil spot primer.

d. Clean pavement surface immediately prior to placing the surface treatment by sweeping, flushing well with water leaving no standing water, or a combination of both, so that it is free of dust, dirt, grease, vegetation, oil or any type of objectionable surface film.

101-3.7 Maintenance. The Contractor shall perform all maintenance work necessary to keep the pavement in a satisfactory condition until the full section is complete and accepted by the Engineer. The surface shall be kept clean and free from foreign material. The pavement shall be properly drained at all times. If cleaning is necessary or if the pavement becomes disturbed, any work repairs necessary shall be performed at the Contractor's expense.

101-3.8 Preparation of Joints in Rigid Pavement.

101-3.8.1 Removal of Existing Joint Sealant. All existing joint sealants will be removed by plowing or use of hand tools. Any remaining sealant and or debris will be removed by use of wire brushes or other tools as necessary. Resaw joints removing no more than 1/16 inch (2 mm) from each joint face. Immediately after sawing, flush out joint with water and other tools as necessary to completely remove the slurry. Allow sufficient time to dry out joints prior to sealing.

101-3.8.2 Cleaning prior to sealing. Immediately before sealing, joints shall be cleaned by removing any remaining laitance and other foreign material. Clean joints by sandblasting, or other method approved by the Engineer, on each joint face with nozzle held at an angle and not more than three inches (75 mm) from face. Following sandblasting, clean joints with air free of oil and water. Joint surfaces will be surface-dry prior to installation of sealant.

101-3.9 Preparation of Cracks in Flexible Pavement.

101-3.9.1 Preparation of Crack. Widen crack with router by removing a minimum of 1/16 inch (2 mm) from each side of crack. Immediately before sealing, joints will be blown out with a hot air lance combined with oil and water-free compressed air.

101-3.9.2 Removal of Existing Sealant. Existing sealants will be removed by routing. Following routing any remaining debris will be removed by use of a hot lance combined with oil and water-free compressed air.

METHOD OF MEASUREMENT

101-4.1 Pavement removal. The unit of measurement for pavement removal shall be the number of square yards (square meters) removed by the Contractor. Any pavement removed outside the limits of removal because the pavement was damaged by negligence on the part of the Contractor shall not be included in the measurement for payment.

BASIS OF PAYMENT

101-5.1 Payment. Payment shall be made at contract unit price for the unit of measurement as specified above. This price shall be full compensation for furnishing all materials and for all preparation, hauling,

and placing of the material and for all labor, equipment, tools, and incidentals necessary to complete this item.

Item 101001 Apshalt Pavement Removal – Per the Square Yard

MATERIAL REQUIREMENTS

ASTM D6690 Standard Specification For Joint And Crack Sealants, Hot Applied, For Concrete And Asphalt Pavements

END OF ITEM P-101

Intentionally Left Blank

ITEM P-151 CLEARING AND GRUBBING

DESCRIPTION

151-1.1 This item shall consist of clearing or clearing and grubbing, including the disposal of materials, for all areas within the limits designated on the plans or as required by the Engineer.

a. Clearing shall consist of the cutting and removal of all trees, stumps, brush, logs, hedges, the removal of fences and other loose or projecting material from the designated areas. The grubbing of stumps and roots will not be required.

b. Clearing and grubbing shall consist of clearing the surface of the ground of the designated areas of all trees, stumps, down timber, logs, snags, brush, undergrowth, hedges, heavy growth of grass or weeds, fences, structures, debris, and rubbish of any nature, natural obstructions or such material which in the opinion of the Engineer is unsuitable for the foundation of strips, pavements, or other required structures, including the grubbing of stumps, roots, matted roots, foundations, and the disposal from the project of all spoil materials resulting from clearing and grubbing.

CONSTRUCTION METHODS

151-2.1 General. The areas denoted on the plans to be cleared or cleared and grubbed shall be staked on the ground by the Engineer. The clearing and grubbing shall be done at a satisfactory distance in advance of the grading operations.

All spoil materials removed by clearing or by clearing and grubbing shall be disposed of outside the Airport's limits at the Contractor's responsibility, except when otherwise directed by the Engineer. As far as practicable, waste concrete and masonry shall be placed on slopes of embankments or channels. When embankments are constructed of such material, this material shall be placed in accordance with requirements for formation of embankments. Any broken concrete or masonry that cannot be used in construction and all other materials not considered suitable for use elsewhere, shall be disposed of by the Contractor. In no case shall any discarded materials be left in windows or piles adjacent to or within the airport limits. The manner and location of disposal of materials shall be subject to the approval of the Engineer and shall not create an unsightly or objectionable view. When the Contractor is required to locate a disposal area outside the airport property limits, the Contractor shall obtain and file with the Engineer permission in writing from the property owner for the use of private property for this purpose.

Blasting shall not be allowed. The removal of existing structure and utilities required to permit orderly progress of work shall be accomplished by local agencies, unless otherwise shown on the plans. Whenever a telephone or telegraph pole, pipeline, conduit, sewer, roadway, or other utility is encountered and must be removed or relocated, the Contractor shall advise the Engineer who will notify the proper local authority or owner to secure prompt action.

151-2.2 Clearing. The Contractor shall clear the staked or indicated area of all objectionable materials. Trees unavoidably falling outside the specified clearing limits must be cut up, removed, and disposed of in a satisfactory manner. To minimize damage to trees that are to be left standing, trees shall be felled toward the center of the area being cleared. The Contractor shall preserve and protect from injury all trees not to be removed. The trees, stumps, and brush shall be cut flush with the original ground surface. The grubbing of stumps and roots will not be required.

Fences shall be removed and disposed of as directed by the Engineer. Fence wire shall be neatly rolled and the wire and posts stored on the airport if they are to be used again, or stored at a location designated by the Engineer if the fence is to remain the property of a local owner or authority.

151-2.3 Clearing and grubbing. In areas designated to be graded, all stumps, roots, buried logs, brush, grass, and other unsatisfactory materials shall be removed.

Any buildings and miscellaneous structures that are shown on the plans to be removed shall be demolished or removed, and all materials shall be disposed of by removal from the site. The cost of removal is incidental to this item. The remaining or existing foundations, wells, cesspools, and like structures shall be destroyed by breaking down the materials of which the foundations, wells, cesspools, etc., are built to a depth at least 2 feet (60 cm) below the existing surrounding ground. Any broken concrete, blocks, or other objectionable material that cannot be used in backfill shall be removed and disposed of at the Contractor's expense. The holes or openings shall be backfilled with acceptable material and properly compacted.

All holes under embankment areas remaining after the grubbing operation shall have the sides of the holes flattened to facilitate filling with acceptable material and compacting as required in Item P-152. The same procedure shall be applied to all holes remaining after grubbing in areas where the depth of holes exceeds the depth of the proposed excavation.

METHOD OF MEASUREMENT

151-3.1 Clearing and grubbing are incidental to unclassified excavation.

BASIS OF PAYMENT

151-4.1 No direct payment will be made for clearing and grubbing. It shall be incidental to unclassified excavation.

END OF ITEM P-151

ITEM P-152 EXCAVATION, SUBGRADE, AND EMBANKMENT

DESCRIPTION

152-1.1 This item covers excavation, disposal, placement, and compaction of all materials within the limits of the work required to construct safety areas, runways, taxiways, aprons, and intermediate areas as well as other areas for drainage, building construction, parking, or other purposes in accordance with these specifications and in conformity to the dimensions and typical sections shown on the plans.

152-1.2 Classification. All material excavated shall be classified as defined below:

a. Unclassified excavation. Unclassified excavation shall consist of the excavation, redistribution or disposal of all material, regardless of its nature which is not otherwise classified and paid for under one of the following items.

b. Borrow placement. Borrow placement shall consist of approved material required for the construction of embankments or for other portions of the work in excess of the quantity of usable material available from required excavations. Borrow material shall be obtained from areas outside the airport boundaries and shall meet the requirements of MDOT class III granular material.

152-1.3 Unsuitable excavation. Any material containing vegetable or organic matter, such as muck, peat, organic silt, or sod shall be considered unsuitable for use in embankment construction. Material suitable for topsoil may be used on the embankment slope when approved by the Engineer.

CONSTRUCTION METHODS

152-2.1 General. Before beginning excavation, grading, and embankment operations in any area, the area shall be completely cleared and grubbed in accordance with Item P-151.

The suitability of material to be placed in embankments shall be subject to approval by the Engineer. All unsuitable material shall be disposed of off-site.

When the Contractor's excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued and the Engineer notified. At the direction of the Engineer, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.

Those areas outside of the limits of the pavement areas where the top layer of soil material has become compacted by hauling or other Contractor activities shall be scarified and disked to a depth of 4 inches (100 mm), to loosen and pulverize the soil.

If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. When such facilities are encountered, the Contractor shall notify the Engineer, who shall arrange for their removal if necessary. The Contractor, at his or her expense, shall satisfactorily repair or pay the cost of all damage to such facilities or structures that may result from any of the Contractor's operations during the period of the contract.

152-2.2 Excavation. No excavation shall be started until the work has been staked out by the Engineer. All areas to be excavated shall be stripped of vegetation and topsoil. Topsoil shall be reused for restoration of the graded site. All suitable excavated material shall be used in the formation of embankment, subgrade, or other purposes shown on the plans. All unsuitable material shall be disposed of off-site.

When the volume of the excavation exceeds that required to construct the embankments to the grades indicated, the excess shall be used to grade the areas of ultimate development or disposed as directed by the Engineer. When the volume of excavation is not sufficient for constructing the embankments to the grades indicated, the deficiency shall be obtained from borrow areas.

The grade shall be maintained so that the surface is well drained at all times. When necessary, temporary drains and drainage ditches shall be installed to intercept or divert surface water that may affect the work. Such temporary drains and drainage ditches shall be the responsibility of the Contractor and shall not be paid for separately but shall be included in other items of work. Any de-watering required shall be the responsibility of the Contractor.

a. Selective grading. *Not Applicable.*

b. Undercutting. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades, roads, shoulders, or any areas intended for turf shall be excavated to a minimum depth of 12 inches (300 mm) below the subgrade or to the depth specified by the Engineer. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed of off the airport. The cost is incidental to this item. This excavated material shall be paid for at the contract unit price per cubic yard (per cubic meter) for unclassified excavation. The excavated area shall be backfilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary backfill will constitute a part of the embankment. Where rock cuts are made, backfill with select material. Any pockets created in the rock surface shall be drained in accordance with the details shown on the plans.

c. Overbreak. Overbreak, including slides, is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the Engineer. All overbreak shall be graded or removed by the Contractor and disposed of as directed by the Engineer. The Engineer shall determine if the displacement of such material was unavoidable and his or her decision shall be final. Payment will not be made for the removal and disposal of overbreak that the Engineer determines as avoidable. Unavoidable overbreak will be classified as "Unclassified Excavation."

d. Removal of utilities. The removal of existing structures and utilities required to permit the orderly progress of work will be accomplished by someone other than the Contractor; for example, the utility unless otherwise shown on the plans. All existing foundations shall be excavated at least 2 feet (60 cm) below the top of subgrade or as indicated on the plans, and the material disposed of as directed by the Engineer. All foundations thus excavated shall be backfilled with suitable material and compacted as specified.

e. Compaction requirements. The subgrade under all areas shall be compacted to a depth of 8 and to a density of not less than 95 percent of the maximum density as determined by ASTM D698. The material to be compacted shall be within ±2% of optimum moisture content before being rolled to obtain the prescribed compaction (except for expansive soils).

The in-place field density shall be determined in accordance with ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. Stones or rock fragments larger than 4 inches (100 mm) in their greatest dimension will not be permitted in the top 6 inches (150 mm) of the subgrade. The finished grading operations, conforming to the typical cross-section, shall be completed and maintained at least 1,000 feet (300 m) ahead of the paving operations or as directed by the Engineer.

All loose or protruding rocks on the back slopes of cuts shall be pried loose or otherwise removed to the slope finished grade line. All cut-and-fill slopes shall be uniformly dressed to the slope, cross-section, and alignment shown on the plans or as directed by the Engineer.

Blasting shall not be allowed.

f. Proof rolling. After compaction is completed, the subgrade area shall be proof rolled with a heavy pneumatic-tired roller having four or more tires abreast, each tire loaded to a minimum of 30,000 pounds (13.6 metric tons) and inflated to a minimum of 125 psi (0.861 MPa) in the presence of the Engineer. Apply a minimum of 25% coverage, or as specified by the Engineer, to all paved areas. A coverage is defined as the application of one tire print over the designated area. Soft areas of subgrade that deflect more than 1 inch (25 mm) or show permanent deformation greater than 1 inch (25 mm) shall be removed and replaced with suitable material or reworked to conform to the moisture content and compaction requirements in accordance with these specifications.

152-2.3 Borrow placement. The Contractor shall notify the Engineer at least 15 days prior to beginning the excavation so necessary measurements and tests can be made. All borrow sites shall be opened up to expose the various strata of acceptable material to allow obtaining a uniform product. All unsuitable material shall be disposed of by the Contractor. Prior to any borrow source being utilized on the project, the Contractor shall submit test reports of material properties for the borrow source. The Engineer shall approve all sources and test results prior to any material from the borrow source being installed.

152-2.4 Drainage excavation. *Not Applicable*

152-2.5 Preparation of embankment area. Where an embankment is to be constructed all sod and vegetative matter shall be removed from the surface upon which the embankment is to be placed. The cleared surface shall be broken up by plowing or scarifying to a minimum depth of 6 inches (150 mm) and shall then be compacted as indicated in paragraph 152-2.6.

Sloped surfaces steeper than one (1) vertical to four (4) horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches (300 mm) and compacted as specified for the adjacent fill.

No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the respective items of work.

152-2.6 Formation of embankments. Embankments shall be formed in successive horizontal layers of not more than 12 inches (300 mm) in loose depth for the full width of the cross-section, unless otherwise approved by the Engineer.

The layers shall be placed, to produce a soil structure as shown on the typical cross-section or as directed by the Engineer. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.

Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained because of rain, freezing, or other unsatisfactory weather conditions in the field. Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. The Contractor shall drag, blade, or slope the embankment to provide surface drainage at all times.

The material in each layer shall be within ±2% of optimum moisture content before rolling to obtain the prescribed compaction. To achieve a uniform moisture content throughout the layer, the material shall be moistened or aerated as necessary. The contractor shall take density measurements once per 3,000 square yards per lift.

Rolling operations shall be continued until the embankment is compacted to not less than 95% of maximum density for noncohesive soils, and 90% of maximum density for cohesive soils as determined by ASTM D698.

On all areas outside of the pavement areas, no compaction will be required on the top 4 inches (100 mm).

The in-place field density shall be determined in accordance with ASTM 6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. The Contractor's laboratory shall perform all density tests in the Engineer's presence and provide the test results upon completion to the Engineer for acceptance.

Compaction areas shall be kept separate, and no layer shall be covered by another layer until the proper density is obtained.

During construction of the embankment, the Contractor shall route all construction equipment evenly over the entire width of the embankment as each layer is placed. Layer placement shall begin in the deepest portion of the embankment fill. As placement progresses, the layers shall be constructed approximately parallel to the finished pavement grade line.

When rock and other embankment material are excavated at approximately the same time, the rock shall be incorporated into the outer portion of the embankment and the other material shall be incorporated under the future paved areas. Stones or fragmentary rock larger than 4 inches (100 mm) in their greatest dimensions will not be allowed in the top 6 inches (150 mm) of the subgrade. Rockfill shall be brought up in layers as specified or as directed by the Engineer and the finer material shall be used to fill the voids with forming a dense, compact mass. Rock or boulders shall not be disposed of outside the excavation or embankment areas, except at places and in the manner designated on the plans or by the Engineer.

When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in layers of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material may be placed in the embankment as directed in layers not exceeding 2 feet (60 cm) in thickness. Each layer shall be leveled and smoothed with suitable equipment by distribution of spalls and finer fragments of rock. The layer shall not be constructed above an elevation 4 feet (1.2 m) below the finished subgrade.

There will be no separate measurement of payment for compacted embankment. All costs incidental to placing in layers, compacting, discing, watering, mixing, sloping, and other operations necessary for construction of embankments will be included in the contract price for excavation, borrow, or other items.

152-2.7 Finishing and protection of subgrade. After the subgrade is substantially complete, the Contractor shall remove any soft or other unstable material over the full width of the subgrade that will not compact properly. All low areas, holes or depressions in the subgrade shall be brought to grade with suitable select material. Scarifying, blading, rolling and other methods shall be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the plans.

Grading of the subgrade shall be performed so that it will drain readily. The Contractor shall protect the subgrade from damage and limit hauling over the finished subgrade to only traffic essential for construction purposes. All ruts or rough places that develop in the completed subgrade shall be graded and recompacted.

No subbase, base, or surface course shall be placed on the subgrade until the subgrade has been approved by the Engineer.

152-2.8 Haul. All hauling of will be considered a necessary and incidental part of the work. The Contractor shall include the cost in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

152-2.9 Tolerances. In those areas upon which a subbase or base course is to be placed, the top of the subgrade shall be of such smoothness that, when tested with a Contractor-furnished 12-foot (3.7-m) straightedge applied parallel and at right angles to the centerline, it shall not show any deviation in excess of 1/2 inch (12 mm), or shall not be more than 0.05 feet (15 mm) from true grade as established by grade hubs. Any deviation in excess of these amounts shall be corrected by loosening, adding, or removing materials; reshaping; and recompacting.

On safety areas, intermediate and other designated areas, the surface shall be of such smoothness that it will not vary more than 0.10 feet (30 mm) from true grade as established by grade hubs. Any deviation in excess of this amount shall be corrected by loosening, adding or removing materials, and reshaping.

152-2.10 Topsoil. When topsoil is specified or required as shown on the plans or under specification T-905, it shall be salvaged from stripping or other grading operations. The topsoil shall meet the requirements of Item T-905. If, at the time of excavation or stripping, the topsoil cannot be placed in its final section of finished construction, the material shall be stockpiled at approved locations. Stockpiles shall not be placed within 400 feet of runway pavement or 93 feet of taxiway pavement and shall not be placed on areas that subsequently will require any excavation or embankment fill. If, in the judgment of the Engineer, it is practical to place the salvaged topsoil at the time of excavation or stripping, the material shall be placed in its final position without stockpiling or further rehandling.

Upon completion of grading operations, stockpiled topsoil shall be handled and placed as directed, or as required in Item T-905.

No direct payment will be made for topsoil under Item P-152. The quantity removed and placed directly or stockpiled shall be included in the payment for "Unclassified Excavation."

METHOD OF MEASUREMENT

152-3.1 The quantity of excavation to be paid for shall be the number of cubic yards (cubic meters) measured in its original position. Measurement shall not include the quantity of materials excavated without authorization beyond normal slope lines, or the quantity of material used for purposes other than those directed.

152-3.2 Borrow material placement shall be paid for on the basis of the number of cubic yards (cubic meters) measured in its final position.

BASIS OF PAYMENT

152-4.1 "Unclassified excavation" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

152-4.5 "Borrow Placement" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item 152001	Unclassified Excavation - per cubic yard (cubic meter)
Item 152002	Borrow Placement - per cubic yard (cubic meter)

TESTING REQUIREMENTS

ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2700 kN-m/m^3))

ASTM D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

END OF ITEM P-152

ITEM P-156 TEMPORARY AIR AND WATER POLLUTION, SOIL EROSION, AND SILTATION CONTROL

DESCRIPTION

156-1.1 This item shall consist of temporary control measures as shown on the plans or as ordered by the Engineer during the life of a contract to control water pollution, soil erosion, and siltation through the use of silt fences, berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

The temporary erosion control measures contained herein shall be coordinated with the permanent erosion control measures specified as part of this contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

Temporary control may include work outside the construction limits such as borrow pit operations, equipment and material storage sites, waste areas, and temporary plant sites.

Temporary control measures shall be design, installed and maintained to minimize the creation of wildlife attractants that have the potential to attract hazardous wildlife on or near public-use airports.

MATERIALS

156-2.1 Grass. Grass that will not compete with the grasses sown later for permanent cover per Item T-901 shall be a quick-growing species (such as ryegrass, Italian ryegrass, or cereal grasses) suitable to the area providing a temporary cover. Selected grass species shall not create a wildlife attractant.

156-2.2 Mulches. Mulches may be hay, straw, fiber mats, netting, bark, wood chips, or other suitable material reasonably clean and free of noxious weeds and deleterious materials per Item T-908. Mulches shall not create a wildlife attractant.

156-2.3 Fertilizer. Fertilizer shall be a standard commercial grade and shall conform to all Federal and state regulations and to the standards of the Association of Official Agricultural Chemists.

156-2.4 Slope drains. Slope drains may be constructed of pipe, fiber mats, rubble, Portland cement concrete, bituminous concrete, or other materials that will adequately control erosion.

156-2.5 Silt fence. The silt fence shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life. Silt fence shall meet the requirements of ASTM D6461.

156-2.6 Other. All other materials shall meet commercial grade standards and shall be approved by the Engineer before being incorporated into the project.

CONSTRUCTION REQUIREMENTS

156-3.1 General. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other Federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.

The Engineer shall be responsible for assuring compliance to the extent that construction practices, construction operations, and construction work are involved.

156-3.2 Schedule. Prior to the start of construction, the Contractor shall submit schedules for accomplishment of temporary and permanent erosion control work for clearing and grubbing; grading; construction; paving; and structures at watercourses. The Contractor shall also submit a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials. Work shall not be started until the erosion control schedules and methods of operation for the applicable construction have been accepted by the Engineer.

156-3.3 Construction details. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the accepted schedule. Except where future construction operations will damage slopes, the Contractor shall perform the permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available. Temporary erosion and pollution control measures will be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

Where erosion may be a problem, clearing and grubbing operations should be scheduled and performed so that grading operations and permanent erosion control features can follow immediately if project conditions permit; otherwise, temporary erosion control measures may be required.

The Engineer shall limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent control measures current with the accepted schedule. If seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified as directed by the Engineer.

The Contractor shall provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment as directed by the Engineer. If temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or directed by the Engineer, the work shall be performed by the Contractor and the cost shall be incidental to this item.

The Engineer may increase or decrease the area of erodible earth material that can be exposed at any time based on an analysis of project conditions.

The erosion control features installed by the Contractor shall be acceptably maintained by the Contractor during the construction period.

Whenever construction equipment must cross watercourses at frequent intervals, temporary structures should be provided.

Pollutants such as fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials shall not be discharged into any waterways, impoundments or into natural or manmade channels.

156-3.4 Installation, maintenance and removal of silt fences. Silt fences shall extend a minimum of 16 inches (41 cm) and a maximum of 34 inches (86 cm) above the ground surface. Posts shall be set no more than 10 feet (3 m) on center. Filter fabric shall be cut from a continuous roll to the length required minimizing joints where possible. When joints are necessary, the fabric shall be spliced at a support post with a minimum 12-inch (300-mm) overlap and securely sealed. A trench shall be excavated approximately 4 inches (100 mm) deep by 4 inches (100 mm) wide on the upslope side of the silt fence. The trench shall be backfilled and the soil compacted over the silt fence fabric. The Contractor shall remove and dispose of silt that accumulates during construction and prior to establishment of permanent erosion control. The fence shall be maintained in good working condition until permanent erosion control is established. Silt fence

shall be removed upon approval of the Engineer. The Contractor is responsible for the removal/disposal of all temporary erosion/pollution control items and the restoration of those sites upon approval of the Engineer. This work will include the repair of any trenching for silt fence, removal of silt build-up, removal of fencing, barriers and silt bales and the associated stakes and the placing of seed or sod to restore those sites.

156-3.5 Installation, maintenance and removal of check dams. Check dams shall be made of hay or straw bales lined end to end and staked in place with wooden stakes. No gaps shall be allowed between the bales at the ground surface. Check dams shall be 20' in length centered on the ditch line. The check dams shall be maintained in good working condition by the contractor until permanent erosion control is established. The Contractor is responsible for the removal/disposal of all temporary erosion/pollution control items and the restoration of those sites upon approval of the Engineer. This work will include the repair of grade, removal of silt build-up, removal of bales and the associated stakes and the placing of seed or sod to restore those sites.

METHOD OF MEASUREMENT

156-4.1 Temporary erosion and pollution control work required will be performed as scheduled or directed by the Engineer. Completed and accepted work will be measured as follows:

a. Installation and removal of silt fence will be measured by the linear foot (meter).

156-4.2 Control work performed for protection of construction areas outside the construction limits, such as borrow and waste areas, haul roads, equipment and material storage sites, and temporary plant sites, will not be measured and paid for directly but shall be considered as a subsidiary obligation of the Contractor.

BASIS OF PAYMENT

156-5.1 Accepted quantities of temporary water pollution, soil erosion, and siltation control work ordered by the Engineer and measured as provided in paragraph 156-4.1 will be paid for under:

Item 156001	Installation and removal of silt fence per linear feet (meter)

Where other directed work falls within the specifications for a work item that has a contract price, the units of work shall be measured and paid for at the contract unit price bid for the various items.

Temporary control features not covered by contract items that are ordered by the Engineer will be paid for as Extra work.

MATERIAL REQUIREMENTS

ASTM D6461	Standard Specification for Silt Fence Materials
AC 150/5200-33	Hazardous Wildlife Attractants

END OF ITEM P-156

Intentionally Left Blank

ITEM P-219 RECYCLED CONCRETE AGGREGATE BASE COURSE

DESCRIPTION

219-1.1 This item consists of a base course composed of recycled concrete aggregate, crushed to meet a particular gradation, constructed on a prepared course per these specifications and in conformity to the dimensions and typical cross-sections shown on the plans.

MATERIALS

219-2.1 Aggregate. Recycled concrete aggregate shall consist of Portland cement concrete (PCC) or other concrete containing pozzolanic binder material. The recycled concrete material shall be free of reinforcing steel and expansion material. Asphalt concrete overlays shall be removed from the PCC surface prior to pavement removal and crushing. Any full-slab asphalt concrete panels (used as a replacement for a removed PCC slab) shall also be removed. An incidental amount of recycled asphalt concrete pavement and other foreign material may be present in the recycled concrete aggregate.

Recycled concrete aggregate base course shall consist of at least 90%, by weight, Portland cement concrete, with the remaining 10% consisting of the following materials:

Wood	0.1% maximum
Brick, mica, schist, or other friable materials	4% maximum
Asphalt concrete	10% maximum

Virgin aggregates may be added to meet the 90% minimum PCC requirement.

The percentage of wood, brick, mica, schist, other friable materials, and asphalt concrete shall be determined by weighing that material retained on the No. 4 sieve, and dividing by the total weight of recycled concrete aggregate material retained on the No. 4 sieve.

The fine aggregate shall be produced by crushing stone, gravel, slag, or recycled concrete that meet the requirements for wear and soundness specified for coarse aggregate. Fine aggregate may be added to produce the correct gradation.

The amount of flat and elongated particles in recycled concrete aggregate shall not exceed 20% for the fraction retained on the 1/2 inch (12 mm) sieve nor 20% for the fraction passing the 1/2 inch (12 mm) sieve when tested per ASTM D4791. A flat particle is one having a width to thickness ratio greater than 3; an elongated particle is one having a length to width ratio greater than 3.

The percentage of wear shall not be greater than 45% when tested per ASTM C131. The sodium sulfate soundness test (ASTM C88) requirement is waived for recycled concrete aggregate.

The fraction passing the No. 40 (0.42-mm) sieve shall have a liquid limit no greater than 25 and a plasticity index of not more than four (4) when tested per ASTM D4318. The fine aggregate shall have a minimum sand equivalent value of 35 when tested per ASTM D2419.

a. Sampling and testing. Recycled concrete aggregate samples for preliminary testing shall be furnished by the Contractor prior to the start of base construction. All tests for initial aggregate submittals necessary to determine compliance with the specification requirements will be made by the Engineer at no expense to the Contractor.

Samples of recycled concrete aggregate shall be furnished by the Contractor at the start of production and at intervals during production. The sampling points and intervals will be designated by the Engineer.

The samples will be the basis of approval of specific lots of recycled concrete aggregate for the quality requirements.

Samples of recycled concrete aggregate to check gradation shall be taken at least once daily. Sampling shall be per ASTM D75, and testing shall be per ASTM C136 and ASTM C117.

b. Gradation requirements. The gradation of the final mixture shall fall within the design range of MDOT 21AA dense graded aggregate, when tested per ASTM C117 and ASTM C136. The final gradation shall be continuously graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on an adjacent sieve or vice versa.

Requirements for Gradation Of Recycled Concrete Aggregate Base

Sieve Size	Percentage by Weight Passing Sieves
1-1/2 inch (38 mm)	100
1 inch (25 mm)	85 - 100
1/2 inch (18 mm)	50 - 75
No. 8 (9.50 mm)	20 - 45
No. 200 (0.075 mm)	4 - 8

EQUIPMENT

219-3.1 General. All equipment necessary to mix, transport, place, compact, and finish the recycled concrete aggregate base course shall be furnished by the Contractor. The Contractor shall provide written certification to the Engineer that all equipment meets the requirements for this section. The equipment shall be inspected by the Engineer at the job site prior to the start of construction operations.

219-3.2 Mixing equipment. Base course shall be thoroughly mixed in a plant suitable for recycled concrete aggregate. The mixer shall be a batch or continuous-flow type equipped with a calibrated metering and feeding device that introduce the aggregate and water into the mixer in specified quantities. If necessary, a screening device shall be installed to remove oversized material greater than 2 inches (50 mm) from the recycled concrete aggregate feed.

The Engineer shall have access to the plant at all times for inspection of the plant's equipment and operation and for sampling the mixed recycled concrete aggregate materials.

219-3.3 Hauling equipment. The mixed recycled concrete aggregate base course shall be transported from the plant to the job site in hauling equipment having beds that are smooth, clean, and tight. Truck bed covers shall be provided and used to protect the mixed recycled concrete aggregate base course from rain during transport.

219-3.4 Placing equipment. Recycled concrete aggregate shall be placed using a mechanical spreader or machine capable of receiving, spreading, and shaping the material into a uniform layer or lift without segregation. The placing equipment shall be equipped with a strike off plate that can be adjusted to the layer thickness.

219-3.5 Compaction equipment. Recycled concrete aggregate base course shall be compacted using one or a combination of the following pieces of equipment: steel-wheeled roller; vibratory roller; pneumatic-tire roller; and/or hand-operated power tampers (for areas inaccessible to rollers).

219-3.6 Finishing equipment. Trimming of the compacted recycled concrete aggregate to meet surface requirements shall be accomplished using a self-propelled grader or trimming machine, with a mold board cutting edge of 12 feet (3.7 m) minimum width automatically controlled by sensors in conjunction with an independent grade control from a taut stringline. Stringline will be required on both sides of the sensor controls for all lanes.

CONSTRUCTION METHODS

219-4.1 Weather limitations. Construction is allowed only when the atmospheric temperature is at or above 35°F (2°C). When the temperature falls below 35°F (2°C), the Contractor shall protect all completed areas against detrimental effects of freezing. The Contractor shall repair any areas damaged by freezing, rainfall, or other weather conditions.

219-4.2 Preparing underlying course. The underlying course shall be checked by the Engineer before placing and spreading operations are started. Any ruts or soft yielding places caused by improper drainage conditions, hauling, or any other cause shall be corrected at the Contractor's expense before the base course is placed there. Material shall not be placed on frozen material.

To protect the existing layers and to ensure proper drainage, the spreading of the recycled concrete aggregate base course shall begin along the centerline of the pavement on a crowned section or on the greatest contour elevation of a pavement with a variable uniform cross slope.

219-4.3 Grade control. Grade control between the edges of the recycled concrete aggregate base course lanes shall be accomplished by grade stakes, steel pins, or forms placed in lanes parallel to the centerline and at intervals of 50 feet (15 m) or less on the longitudinal grade and 25 feet (7.5 m) or less on the transverse grade.

219-4.4 Mixing. The recycled concrete shall be uniformly blended during crushing operations and mixed with water in a mixing plant suitable for recycled concrete aggregate. The plant shall blend and mix the materials to meet the specifications and to secure the proper moisture content for compaction.

219-4.5 Placing. The recycled concrete aggregate base material shall be placed on the moistened subgrade or base in layers of uniform thickness with an approved mechanical spreader.

The maximum depth of a compacted layer shall be 6 inches (150 mm). If the total depth of the compacted material is more than 6 inches (150 mm), it shall be constructed in two or more layers. In multi-layer construction, the material shall be placed in approximately equal-depth layers.

The previously constructed layer shall be cleaned of loose and foreign material prior to placing the next layer. The surface of the compacted material shall be kept moist until covered with the next layer.

Adjustments in placing procedures or equipment shall be made to obtain grades, to minimize segregation grading, to adjust the water content, and to ensure an acceptable recycled concrete aggregate base course.

219-4.6 Compaction. Immediately after completion of the spreading operations, the recycled concrete aggregate shall be compacted. The number, type, and weight of rollers shall be sufficient to compact the material to the required density.

Each layer of the recycled concrete aggregate base course shall be compacted to the required density using the compaction equipment. The moisture content of the material during placing operations shall be within ±1-1/2 percentage points of the optimum moisture content as determined by ASTM D698.

The compaction shall continue until each layer has reached compaction that is at least 100% of the laboratory maximum density through the full depth of the layer. The Contractor shall make adjustments in compacting or finishing techniques to obtain true grades, to minimize segregation and degradation, to reduce or increase water content and to ensure a satisfactory base course. Any unsatisfactory materials shall be removed and replaced with satisfactory material or reworked, to meet the requirements of this specification.

219-4.7 Acceptance sampling and testing for density. The Contractor's laboratory shall perform all density tests in the Engineer's presence and provide the test results upon completion daily to the Engineer for acceptance. Recycled concrete aggregate shall be accepted for density on a lot basis. A lot will consist of one day's production where it does not exceed 2,400 square yards (2000 sq m) per lift. A lot will consist of one-half day's production, where a day's production is between 2,400 and 4,800 square yards (2000 and 4000 sq m) per lift.

Each lot shall be divided into two equal sublots. One density test shall be made for each sublot and shall consist of the average of two random locations for density determination. Sampling locations will be determined by the Engineer on a random basis per ASTM D3665.

Each lot will be accepted for gradation when it falls within the limits and tolerances shown in the table above when tested per ASTM C117 and ASTM C131. If the proper gradation is not attained the gradation test will be repeated. If the re-test does not indicate gradations within the limits of the table above, the entire lot shall be rejected and replaced by the Contractor at the Contractor's expense.

Each lot will be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens prepared from samples of the base course material. The specimens shall be compacted and tested per ASTM D698. The in-place field density shall be determined per ASTM D6938. The field density shall be determined in accordance with ASTM D6938 using Procedure A, the direct transmission method and the machines shall be calibrated in accordance with per ASTM D6938. When using the nuclear method, ASTM D4643 shall be used to determine the moisture content of the material. If the specified density is not attained, the entire lot shall be reworked and two additional random tests made. This procedure shall be followed until the specified density is reached.

219-4.8 Finishing. The surface of the recycled concrete aggregate base course shall be finished by equipment designed for this purpose.

Adding a thin layer of material to the top of the base course to meet grade shall not be allowed. If the elevation of the layer is 1/2 inch (12 mm) or more below grade, the layer shall be scarified to a depth of at least 3 inches (75 mm), new material added, and the layer shall be recompacted. If the finished surface is above plan grade, it shall be cut back to grade and rerolled. The grade shall be measured on a maximum 25-foot (7.5-m) grid (longitudinal and transverse). Thickness results shall be furnished to the Engineer daily for acceptance determination.

Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, and recompacted or replaced at the Contractor's expense.

219-4.9 Surface tolerances. The finished surface shall not vary more than 3/8 inch (9 mm) when tested with a 12-foot (3.7-m) straightedge applied parallel with or at right angles to the centerline. The Contractor shall correct any deviation in excess of this amount, at the Contractor's expense.

219-4.10 Thickness control. The completed thickness of the base course shall be within 1/2 inch (12 mm) of the design thickness. Four thickness determinations shall be made for each lot of material placed. Each lot shall be divided into four equal sublots and one test shall be made for each sublot. Sampling locations will be determined per ASTM D3665. Where the thickness is more than 1/2 inch (12 mm) deficient, the Contractor, at his or her expense, shall correct the areas by excavating to the required depth and replacing with new material. Additional test holes may be required to identify the limits of deficient areas.

219-4.11 Traffic. Equipment used in construction may be routed over completed portions of the base course, provided there is no damage to the base course. The equipment shall be routed evenly over the full width of the base course to avoid rutting or uneven compaction.

219-4.12 Maintenance. The base course shall be maintained until the base course is completed and accepted. Maintenance will include immediate repairs to any defects and shall be repeated as often as necessary to keep the completed work intact. The Contractor, at his or her expense, will rework any area of the recycled concrete aggregate base course that is damaged.

METHOD OF MEASUREMENT

219-5.1 The quantity of recycled concrete aggregate base course will be determined by measurement of the number of cubic yards (cubic meters) of material actually constructed and accepted as complying with the plans and specifications.

BASIS OF PAYMENT

219-6.1 Payment shall be made at the contract unit price per cubic yard (cubic meter) for recycled concrete aggregate base course. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all labor, equipment tools, and incidentals necessary to complete the item.

Payment will be made under:

Item 219001	Recycled Concrete Aggregate Base Course per cubic yard (cubic meter)

TESTING REQUIREMENTS

ASTM C29	Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D75	Standard Practice for Sampling Aggregates
ASTM C117	Standard Test Method for Materials Finer than 75 μm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregate
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2700 kN-m/m^3))
ASTM D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber-Balloon Method
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D3665	Standard Practice for Random Sampling of Construction Materials

ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4643	Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Heating
ASTM D4718	Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

END OF ITEM P-219

ITEM D-705 PIPE UNDERDRAINS FOR AIRPORTS

DESCRIPTION

705-1.1 This item shall consist of the construction of pipe drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.

MATERIALS

705-2.1 General. Materials shall meet the requirements shown on the plans and specified below.

705-2.2 Pipe. The pipe shall be of the type called for on the plans or in the proposal and shall be in accordance with the following appropriate requirements.

American Association of State Highway and Transportation Officials (AASHTO) M196	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe
AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter
AASHTO M304	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter
AASHTO MP20	Standard Specification for Steel Reinforced Polyethylene (PE) Ribbed Pipe, 300- to 900-mm (12- to 36-in.) Diameter
ASTM A760	Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
ASTM A762	Standard Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM C444	Standard Specification for Perforated Concrete Pipe
ASTM C654	Standard Specification for Porous Concrete Pipe
ASTM F758	Standard Specification for Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
ASTM F794	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe & Fittings Based on Controlled Inside Diameter
ASTM F949	Standard Specification for Poly (Vinyl Chloride)(PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings
ASTM F2562	Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage

705-2.3 Joint mortar. Pipe joint mortar shall consist of one part by volume of Portland cement and two parts sand. The Portland cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

705-2.4 Elastomeric seals. Elastomeric seals shall conform to the requirements of ASTM F477.

705-2.5 Porous backfill. Porous backfill shall be free of clay, humus, or other objectionable matter, and shall conform to the gradation in Table 1 when tested in accordance with ASTM C136.

Table 1. Gradation of Porous Backfill

Sieve Designation (square openings)	Percentage by Weight Passing Sieves
	Porous Material No. 2
1-1/2 inch (38 mm)	100
1 inch (25 mm)	90 - 100
3/8 inch (9 mm)	25 - 60
No. 4 (4.75 mm)	5 - 40
No. 8 (2.36 mm)	0 - 20
No. 16 (1.18 mm)	
No. 50 (0.30 mm)	
No. 100 (0.15 mm)	

When two courses of porous backfill are specified in the plans, the finer of the materials shall conform to particle size tabulated herein for porous material No. 1. The coarser granular material shall meet the gradation given in the tabulation for porous material No. 2.

705-2.6. Granular material. Granular material used for backfilling shall conform to the requirements of ASTM D2321 for Class IA, IB, or II materials, or shall meet the requirements of AASHTO Standard Specification for Highway Bridges Section 30.

705-2.7. Filter fabric. The filter fabric shall conform to the requirements of AASHTO M288 Class 2.

Table 2

Fabric Property	Test Method	Test Requirement
Grab Tensile Strength, lbs	ASTM D4632	125 min
Grab Tensile Elongation %	ASTM D4632	50 min
Burst Strength, psi	ASTM D3785	125 min
Trapezoid Tear Strength, lbs	ASTM D4533	55 min
Puncture Strength, lbs	ASTM D4833	40 min
Abrasion, lbs	ASTM D4886	15 max loss
Equivalent Opening Size	ASTM D4751	70-100
Permittivity sec^{-1}	ASTM D4491	0.80
Accelerated Weathering (UV Stability) (Strength Retained - %)	ASTM D4355 *(500 hrs exposure)	70

705-2.8. Controlled low-strength material (CLSM). CLSM is not allowed.

CONSTRUCTION METHODS

705-3.1 Equipment. All equipment required for the construction of pipe underdrains shall be on the project, in good working condition, and approved by the Engineer before construction is permitted to start.

705-3.2 Excavation. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but shall not be less than the external diameter of the pipe plus 6 inches (150 mm) on each side of the pipe. The trench walls shall be approximately vertical.

Where rock, hardpan, or other unyielding material is encountered, it shall be removed below the foundation grade for a depth of at least 4 inches (100 mm). The excavation below grade shall be backfilled with selected fine compressible material, such as silty clay or loam, and lightly compacted in layers not over 6 inches (150 mm) in uncompacted depth to form a uniform but yielding foundation.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil shall be removed and replaced with approved granular material for the full trench width. The Engineer shall determine the depth of removal necessary. The granular material shall be compacted to provide adequate support for the pipe.

Excavated material not required or acceptable for backfill shall be disposed of by the Contractor as directed by the Engineer. The excavation shall not be carried below the required depth; if this occurs, the trench shall be backfilled at the Contractor's expense with material approved by the Engineer and compacted to the density of the surrounding material.

The pipe bed shall be shaped so at least the lower quarter of the pipe shall be in continuous contact with the bottom of the trench. Spaces for the pipe bell shall be excavated to allow the pipe barrel to support the entire weight of the pipe.

The Contractor shall do trench bracing, sheathing, or shoring necessary to perform and protect the excavation as required for safety and conformance to Federal, state and local laws. Unless otherwise provided, the bracing, sheathing, or shoring shall be removed by the Contractor after the backfill has reached at least 12 inches (300 mm) over the top of the pipe. The sheathing or shoring shall be pulled as the granular backfill is placed and compacted to avoid any unfilled spaces between the trench wall and the backfill material. The cost of bracing, sheathing, or shoring, and the removal of same, shall be included in the unit price bid per foot (meter) for the pipe.

705-3.3 Laying and installing pipe.

a. Concrete pipe. The laying of the pipe in the finished trench shall be started at the lowest point and proceed upgrade. When bell and spigot pipe is used, the bells shall be laid upgrade. If tongue and groove pipe is used, the groove end shall be laid upgrade. Holes in perforated pipe shall be placed down, unless otherwise shown on the plans. The pipe shall be firmly and accurately set to line and grade so that the invert will be smooth and uniform. Pipe shall not be laid on frozen ground.

Pipe which is not true in alignment, or which shows any settlement after laying, shall be taken up and relaid by the Contractor at no additional expense.

b. Metal pipe. The metal pipe shall be laid with the separate sections joined firmly together with bands, with outside laps of circumferential joints pointing upgrade, and with longitudinal laps on the sides. Any metal in the pipe or bands that is not protected thoroughly by galvanizing shall be coated with a suitable asphaltum paint.

During installation, the asphalt-protected pipe shall be handled without damaging the asphalt coating. Any breaks in the bitumen or treatment of the pipe shall be refilled with the type and kind of bitumen used in coating the pipe originally.

c. PVC or polyethylene pipe. PVC or polyethylene pipe shall be installed in accordance with the requirements of ASTM D2321 or AASHTO Standard Specification for Highway Bridges Section 30. Perforations shall meet the requirements of AASHTO M252 or AASHTO M294 Class 2, unless otherwise indicated on the plans. The pipe shall be laid accurately to line and grade.

d. All types of pipe. The upgrade end of pipelines, not terminating in a structure, shall be plugged or capped as approved by the Engineer.

Unless otherwise shown on the plans, a 4 inch (100 mm) bed of granular backfill material shall be spread in the bottom of the trench throughout the entire length under all perforated pipe underdrains.

Pipe outlets for the underdrains shall be constructed when required or shown on the plans. The pipe shall be laid with tight-fitting joints. Porous backfill is not required around or over pipe outlets for underdrains. All connections to other drainage pipes or structures shall be made as required and in a satisfactory manner. If connections are not made to other pipes or structures, the outlets shall be protected and constructed as shown on the plans.

e. Filter fabric. The filter fabric shall be installed in accordance with the manufacturer's recommendations, or in accordance with AASHTO M288 Appendix, unless otherwise shown on the plans.

705-3.4 Mortar. The mortar shall be of the desired consistency for caulking and filling the joints of the pipe and for making connections to other pipes or to structures. Mortar that is not used within 45 minutes after water has been added shall be discarded. Retempering of mortar shall not be permitted.

705-3.5 Joints in concrete pipe. When open or partly open joints are required or specified, they shall be constructed as indicated on the plans. The pipe shall be laid with the ends fitted together as designed. If bell and spigot pipe is used, mortar shall be placed along the inside bottom quarter of the bell to center the following section of pipe.

The open or partly open joints shall be surrounded with granular material meeting requirements of porous backfill No. 2 in Table 1 or as indicated on the plans. This backfill shall be placed so its thickness will be not less than 3 inches (75 mm) nor more than 6 inches (150 mm), unless otherwise shown on the plans.

When the original material excavated from the trench is impervious, commercial concrete sand or granular material meeting requirements of porous backfill No. 1 shall surround porous backfill No. 2 (Table 1), as shown on the plans or as directed by the Engineer.

When the original material excavated from the trench is pervious and suitable, it may be used as backfill in lieu of porous backfill No. 1, when indicated on the plans or as directed by the Engineer.

705-3.6 Backfilling.

a. Earth. All trenches and excavations shall be backfilled soon after the pipes are installed, unless additional protection of the pipe is directed. The backfill material shall be select material from excavation or borrow and shall be approved by the Engineer. The select material shall be placed on each side of the pipe out to a distance of the nominal pipe diameter and one foot (30 cm) over the top of the pipe and shall be readily compacted. It shall not contain stones 3 inches (75 mm) or larger in size, frozen lumps, chunks of highly plastic clay, or any other material that is objectionable to the Engineer. The material shall be moistened or dried, as required to aid compaction. Placement of the backfill shall not cause displacement of the pipe. Thorough compaction under the haunches and along the sides to the top of the pipe shall be obtained.

The backfill shall be placed in loose layers not exceeding 6 inches (150 mm) in depth under and around the pipe, and not exceeding 8 inches (200 mm) over the pipe. Successive layers shall be added and thoroughly compacted by hand and pneumatic tampers, approved by the Engineer, until the trench is completely filled and brought to the planned elevation. Backfilling shall be done to avoid damaging top or side pressures on the pipe.

In embankments and other unpaved areas, the backfill shall be compacted per Item P-152 to the density required for embankments in unpaved areas. Under paved areas, the subgrade and any backfill shall be compacted per Item P-152 to the density required for embankments for paved areas.

b. Granular backfill. When granular backfill is required, placement in the trench and about the pipe shall be as shown on the plans. The granular backfill shall not contain an excessive amount of foreign matter, nor shall soil from the sides of the trench or from the soil excavated from the trench be allowed to filter into the granular backfill. When required by the Engineer, a template shall be used to properly place and separate the two sizes of backfill. The backfill shall be placed in loose layers not exceeding 6 inches (150 mm) in depth. The granular backfill shall be compacted by hand and pneumatic tampers to the requirements as given for embankment. Backfilling shall be done to avoid damaging top or side pressure on the pipe. The granular backfill shall extend to the elevation of the trench or as shown on the plans.

When perforated pipe is specified, granular backfill material shall be placed along the full length of the pipe. The position of the granular material shall be as shown on the plans. If the original material excavated from the trench is pervious and suitable, it shall be used in lieu of porous backfill No. 1.

If porous backfill is placed in paved or adjacent to paved areas before grading or subgrade operations is completed, the backfill material shall be placed immediately after laying the pipe. The depth of the granular backfill shall be not less than 12 inches (300 mm), measured from the top of the underdrain. During subsequent construction operations, a minimum depth of 12 inches (300 mm) of backfill shall be maintained over the underdrains. When the underdrains are to be completed, any unsuitable material shall be removed exposing the porous backfill. Porous backfill containing objectionable material shall be removed and replaced with suitable material. The cost of removing and replacing any unsuitable material shall be at the Contractor's expense.

If a granular subbase blanket course is used which extends several feet beyond the edge of paving to the outside edge of the underdrain trench, the granular backfill material over the underdrains shall be placed in the trench up to an elevation of 2 inches (50 mm) above the bottom surface of the granular subbase blanket course. Immediately prior to the placing of the granular subbase blanket course, the Contractor shall blade this excess trench backfill from the top of the trench onto the adjacent subgrade where it can be incorporated into the granular subbase blanket course. Any unsuitable material that remains over the underdrain trench shall be removed and replaced. The subbase material shall be placed to provide clean contact between the subbase material and the underdrain granular backfill material for the full width of the underdrain trench.

c. Controlled low-strength material (CLSM). CLSM is not allowed.

d. Deflection testing. The Engineer may at any time, notwithstanding previous material acceptance, reject or require re-installation of pipe that exceeds 5% deflection when measured in accordance with ASTM D2321, including Appendices.

705-3.7 Connections. When the plans call for connections to existing or proposed pipe or structures, these connections shall be watertight and made to obtain a smooth uniform flow line throughout the drainage system.

705-3.8 Cleaning and restoration of site. After the backfill is completed, the Contractor shall dispose of all surplus material, soil, and rubbish from the site. Surplus soil may be deposited in embankments, shoulders, or as directed by the Engineer. Except for paved areas of the airport, the Contractor shall restore all disturbed areas to their original condition.

METHOD OF MEASUREMENT

705-4.1 The length of pipe shall be the number of linear feet (meters) of pipe underdrains in place, completed, and approved; measured along the centerline of the pipe from end or inside face of structure to the end or inside face of structure, whichever is applicable. The several classes, types, and sizes shall be measured separately. All fittings, porous backfill and filter fabric shall be included in the footage as typical pipe sections in the pipeline being measured.

BASIS OF PAYMENT

705-5.1 Payment will be made at the contract unit price per linear foot, (meter) Complete (including fittings, porous backfill and filter fabric) for pipe underdrains of the type, class, and size designated.

These prices shall be full compensation for furnishing all materials and for all preparation, excavation, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item 705001	6- Inch Perforated Polyethylene Underdrain pipe Schedule 40, Complete - per linear foot

MATERIAL REQUIREMENTS

ASTM A760	Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains
ASTM A762	Standard Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C444	Standard Specification for Perforated Concrete Pipe
ASTM C654	Standard Specification for Porous Concrete Pipe
ASTM D2321	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D3034	Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F758	Standard Specification for Smooth Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
ASTM F794	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe & Fittings Based on Controlled Inside Diameter
ASTM F949	Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings
ASTM F2562	Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage
AASHTO M190	Standard Specification for Bituminous - Coated Corrugated Metal Culvert Pipe and Pipe Arches
AASHTO M196	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe
AASHTO M288	Standard Specification for Geotextile Specification for Highway Applications

AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500- mm (12- to 60-in.) Diameter
AASHTO M304	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter
AASHTO MP20	Standard Specification for Steel-Reinforced Polyethylene (PE) Ribbed Pipe, 300- to 900-mm (12- to 36-in.) diameter
AASHTO	Standard Specifications for Highway Bridges

END OF ITEM D-705

Intentionally Left Blank

ITEM D-751 MANHOLES, CATCH BASINS, INLETS AND INSPECTION HOLES

DESCRIPTION

751-1.1 This item shall consist of construction of manholes, catch basins, inlets, and inspection holes, in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the Engineer.

MATERIALS

751-2.1 Brick. The brick shall conform to the requirements of ASTM C32, Grade MS.

751-2.2 Mortar. Mortar shall consist of one part Portland cement and two parts sand. The Portland cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

751-2.3 Concrete. Plain and reinforced concrete used in structures, connections of pipes with structures, and the support of structures or frames shall conform to the requirements of Item P-610.

751-2.4 Precast concrete pipe manhole rings. Precast concrete pipe manhole rings shall conform to the requirements of ASTM C478. Unless otherwise specified, the risers and offset cone sections shall have an inside diameter of not less than 36 inches (90 cm) nor more than 48 inches (120 cm). There shall be a gasket between individual sections and sections cemented together with mortar on the inside of the manhole.

751-2.5 Corrugated metal. Corrugated metal shall conform to the requirements of American Association of State Highway and Transportation Officials (AASHTO) M36.

751-2.6 Frames, covers, and grates. The castings shall conform to one of the following requirements:

a. ASTM A48, Class 35B: Gray iron castings

b. ASTM A47: Malleable iron castings

c. ASTM A27: Steel castings

d. ASTM A283, Grade D: Structural steel for grates and frames

e. ASTM A536, Grade 65-45-12: Ductile iron castings

f. ASTM A897:Austempered ductile iron castings

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings, aircraft gear configuration and/or direct loading, specified.

Each frame and cover or grate unit shall be provided with fastening members to prevent it from being dislodged by traffic but which will allow easy removal for access to the structure.

All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A123.

751-2.7 Steps. The steps or ladder bars shall be gray or malleable cast iron or galvanized steel. The steps shall be the size, length, and shape shown on the plans and those steps that are not galvanized shall be given a coat of bituminous paint, when directed.

751-2.8 Precast inlet structures. Manufactured in accordance with and conforming to ASTM C1433.

CONSTRUCTION METHODS

751-3.1 Unclassified excavation.

a. The Contractor shall excavate for structures and footings to the lines and grades or elevations, shown on the plans, or as staked by the Engineer. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximately only; and the Engineer may direct, in writing, changes in dimensions or elevations of footings necessary for a satisfactory foundation.

b. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the Engineer. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. Where concrete will rest on a surface other than rock, the bottom of the excavation shall not be disturb and excavation to final grade shall not be made until immediately before the concrete or reinforcing is placed.

c. The Contractor shall do all bracing, sheathing, or shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for the structure.

d. All bracing, sheathing, or shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall not disturb or damage finished masonry. The cost of removal shall be included in the unit price bid for the structure.

e. After excavation is completed for each structure, the Contractor shall notify the Engineer. No concrete or reinforcing steel shall be placed until the Engineer has approved the depth of the excavation and the character of the foundation material.

751-3.2 Brick structures.

a. Foundations. A prepared foundation shall be placed for all brick structures after the foundation excavation is completed and accepted. Unless otherwise specified, the base shall consist of reinforced concrete mixed, prepared, and placed in accordance with the requirements of Item P-610.

b. Laying brick. All brick shall be clean and thoroughly wet before laying so that they will not absorb any appreciable amount of additional water at the time they are laid. All brick shall be laid in freshly made mortar. Mortar not used within 45 minutes after water has been added shall be discarded. Retempering of mortar shall not be permitted. An ample layer of mortar shall be spread on the beds and a shallow furrow shall be made in it that can be readily closed by the laying of the brick. All bed and head joints shall be filled solid with mortar. End joints of stretchers and side or cross joints of headers shall be fully buttered with mortar and a shoved joint made to squeeze out mortar at the top of the joint. Any bricks that may be loosened after the mortar has taken its set, shall be removed, cleaned, and relaid with fresh mortar. No broken or chipped brick shall be used in the face, and no spalls or bats shall be used except where necessary to shape around irregular openings or edges; in which case, full bricks shall be placed at ends or corners where possible, and the bats shall be used in the interior of the course. In making closures, no piece of brick shorter than the width of a whole brick shall be used; and wherever practicable, whole brick shall be used and laid as headers.

c. Joints. All joints shall be filled with mortar at every course Exterior faces shall be laid up in advance of backing. Exterior faces shall be plastered or parged with a coat of mortar not less than 3/8 inch (9 mm) thick before the backing is laid up. Prior to parging, all joints on the back of face courses shall be cut flush. Unless otherwise noted, joints shall be not less than 1/4 inch (6 mm) nor more than 1/2 inch (12 mm) wide and the selected joint width shall be maintained uniform throughout the work.

d. Pointing. Face joints shall be neatly struck, using the weather-struck joint. All joints shall be finished properly as the laying of the brick progresses. When nails or line pins are used the holes shall be immediately plugged with mortar and pointed when the nail or pin is removed.

e. Cleaning. Upon completion of the work all exterior surfaces shall be thoroughly cleaned by scrubbing and washing with water. If necessary to produce satisfactory results, cleaning shall be done with a 5% solution of muriatic acid which shall then be rinsed off with liberal quantities of water.

f. Curing and cold weather protection. The brick masonry shall be protected and kept moist for at least 48 hours after laying the brick. Brick masonry work or pointing shall not be done when there is frost on the brick or when the air temperature is below 50°F (10°C) unless the Contractor has, on the project ready to use, suitable covering and artificial heating devices necessary to keep the atmosphere surrounding the masonry at a temperature of not less than 60°F (16°C) for the duration of the curing period.

751-3.3 Concrete structures. Concrete structures shall be built on prepared foundations, conforming to the dimensions and shape indicated on the plans. The construction shall conform to the requirements specified in Item P-610. Any reinforcement required shall be placed as indicated on the plans and shall be approved by the Engineer before the concrete is placed.

All invert channels shall be constructed and shaped accurately to be smooth, uniform, and cause minimum resistance to flowing water. The interior bottom shall be sloped to the outlet.

751-3.4 Precast concrete structures. Precast concrete structures shall conform to ASTM C478. Precast concrete structures shall be constructed on prepared or previously placed slab foundations conforming to the dimensions and locations shown on the plans. All precast concrete sections necessary to build a completed structure shall be furnished. The different sections shall fit together readily. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure. The top of the upper precast concrete section shall be suitably formed and dimensioned to receive the metal frame and cover or grate, or other cap, as required. Provision shall be made for any connections for lateral pipe, including drops and leads that may be installed in the structure. The flow lines shall be smooth, uniform, and cause minimum resistance to flow. The metal steps that are embedded or built into the side walls shall be aligned and placed at vertical intervals of 12 inches (300 mm). When a metal ladder replaces the steps, it shall be securely fastened into position.

751-3.5 Corrugated metal structures. Corrugated metal structures shall be prefabricated. All standard or special fittings shall be furnished to provide pipe connections or branches with the correct dimensions and of sufficient length to accommodate connecting bands. The fittings shall be welded in place to the metal structures. The top of the metal structure shall be designed so that either a concrete slab or metal collar may be attached to allow the fastening of a standard metal frame and grate or cover. Steps or ladders shall be furnished as shown on the plans. Corrugated metal structures shall be constructed on prepared foundations, conforming to the dimensions and locations as shown on the plans. When indicated, the structures shall be placed on a reinforced concrete base.

751-3.6 Inlet and outlet pipes. Inlet and outlet pipes shall extend through the walls of the structures a sufficient distance beyond the outside surface to allow for connections. They shall be cut off flush with the wall on the inside surface of the structure, unless otherwise directed. For concrete or brick structures, mortar shall be placed around these pipes to form a tight, neat connection.

751-3.7 Placement and treatment of castings, frames, and fittings. All castings, frames, and fittings shall be placed in the positions indicated on the plans or as directed by the Engineer, and shall be set true to line and elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

When frames or fittings are placed on previously constructed masonry, the bearing surface of the masonry shall be brought true to line and grade and shall present an even bearing surface so the entire face or back of the unit will come in contact with the masonry. The unit shall be set in mortar beds and anchored to the masonry as indicated on the plans or as directed by the Engineer. All units shall set firm and secure.

After the frames or fittings have been set in final position, the concrete or mortar shall be allowed to harden for seven (7) days before the grates or covers are placed and fastened down.

751-3.8 Installation of steps. The steps shall be installed as indicated on the plans or as directed by the Engineer. When the steps are to be set in concrete, they shall be placed and secured in position before the concrete is placed. When the steps are installed in brick masonry, they shall be placed as the masonry is being built. The steps shall not be disturbed or used until the concrete or mortar has hardened for at least seven (7) days. After seven (7) days, the steps shall be cleaned and painted, unless they have been galvanized.

When steps are required with precast concrete structures, they shall be cast into the side of the sections at the time the sections are manufactured or set in place after the structure is erected by drilling holes in the concrete and cementing the steps in place.

When steps are required with corrugated metal structures, they shall be welded into aligned position at a vertical spacing of 12 inches (300 mm).

Instead of steps, prefabricated ladders may be installed. For brick or concrete structures, the ladder shall be held in place by grouting the supports in drilled holes. For metal structures, the ladder shall be secured by welding the top support to the structure and grouting the bottom support into drilled holes in the foundation or as directed by the Engineer.

751-3.9 Backfilling.

a. After a structure has been completed, the area around it shall be backfilled with approved material, in horizontal layers not to exceed 8 inches (200 mm) in loose depth, and compacted to the density required in Item P-152. Each layer shall be deposited evenly around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the Engineer.

b. Backfill shall not be placed against any structure until approved by the Engineer. For concrete structures, approval shall not be given until the concrete has been in place seven (7) days, or until tests establish that the concrete has attained sufficient strength to withstand any pressure created by the backfill and placing methods.

c. Backfill shall not be measured for direct payment. Performance of this work shall be considered an obligation of the Contractor covered under the contract unit price for the structure involved.

751-3.10 Cleaning and restoration of site. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as approved by the Engineer. The Contractor shall restore all disturbed areas to their original condition. The Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

METHOD OF MEASUREMENT

751-4.1 Manholes reconstruction shall be measured by the unit, completed in place and accepted. All required excavation, sheeting and bracing, backfilling, connections, dewatering and the restoration of all surfaces shall be included as part of the unit completed.

BASIS OF PAYMENT

751-5.1 The accepted quantities of manholes reconstructions will be paid for at the contract unit price per each in place when completed. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of the materials; furnishing and installation of such specials and connections to pipes and other structures as may be required to complete the item as shown on the plans; and for all labor equipment, tools and incidentals necessary to complete the structure.

Payment will be made under:

Item 751001	Manhole reconstruction - per each

MATERIAL REQUIREMENT

ASTM A27	Standard Specification for Steel Castings, Carbon, for General Application
ASTM A47	Standard Specification for Ferritic Malleable Iron Castings
ASTM A48	Standard Specification for Gray Iron Castings
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A283	Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A536	Standard Specification for Ductile Iron Castings
ASTM A897	Standard Specification for Austempered Ductile Iron Castings
ASTM C32	Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C478	Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C1433	Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
AASHTO M36	Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains

END OF ITEM D-751

Intentionally Left Blank

Item T-901 Seeding

DESCRIPTION

901-1.1 This item shall consist of soil preparation, seeding and fertilizing the areas shown on the plans or as directed by the Engineer in accordance with these specifications.

MATERIALS

901-2.1 Seed. The species and application rates of grass, legume, and cover-crop seed furnished shall be those stipulated herein. Seed shall conform to the requirements of Federal Specification JJJ-S-181, Federal Specification, Seeds, Agricultural.

Seed shall be furnished separately or in mixtures in standard containers labeled in conformance with the Agricultural Marketing Service (AMS) Seed Act and applicable state seed laws with the seed name, lot number, net weight, percentages of purity and of germination and hard seed, and percentage of maximum weed seed content clearly marked for each kind of seed. The Contractor shall furnish the Engineer duplicate signed copies of a statement by the vendor certifying that each lot of seed has been tested by a recognized laboratory for seed testing within six (6) months of date of delivery. This statement shall include: name and address of laboratory, date of test, lot number for each kind of seed, and the results of tests as to name, percentages of purity and of germination, and percentage of weed content for each kind of seed furnished, and, in case of a mixture, the proportions of each kind of seed. Wet, moldy, or otherwise damaged seed will be rejected.

Seeds shall be applied as follows:

Seed	Minimum Seed Purity (Percent)	Minimum Germination (Percent)	Rate of Application lb/acre
Kentucky Blue Grass	98	85	22
Perennial Ryegrass	96	85	44
Hard Fescue	97	85	44
Creeping Red Fescue	97	85	88
Fults Salt Grass	98	85	22

Seeding shall be performed during the period between April 1 and May 20 as well as September 1 to October 5 inclusive, unless otherwise approved by the Engineer.

901-2.2 Lime. *Not Applicable*

901-2.3 Fertilizer. Fertilizer shall be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphoric acid, and water-soluble potash. They shall be applied at the rate and to the depth specified, and shall meet the requirements of applicable state laws. They shall be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime shall be permitted in mixed fertilizers.

The fertilizers may be supplied in one of the following forms:

a. A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader;

b. A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or

c. A granular or pellet form suitable for application by blower equipment.

Fertilizers shall be 12-12-12 commercial fertilizer and shall be spread at the rate of 500 lbs per acre.

901-2.4 Soil for repairs. The soil for fill and topsoiling of areas to be repaired shall be at least of equal quality to that which exists in areas adjacent to the area to be repaired. The soil shall be relatively free from large stones, roots, stumps, or other materials that will interfere with subsequent sowing of seed, compacting, and establishing turf, and shall be approved by the Engineer before being placed.

CONSTRUCTION METHODS

901-3.1 Advance preparation and cleanup. After grading of areas has been completed and before applying fertilizer and ground limestone, areas to be seeded shall be raked or otherwise cleared of stones larger than 2 inches (50 mm) in any diameter, sticks, stumps, and other debris that might interfere with sowing of seed, growth of grasses, or subsequent maintenance of grass-covered areas. If any damage by erosion or other causes has occurred after the completion of grading and before beginning the application of fertilizer and ground limestone, the Contractor shall repair such damage include filling gullies, smoothing irregularities, and repairing other incidental damage.

An area to be seeded shall be considered a satisfactory seedbed without additional treatment if it has recently been thoroughly loosened and worked to a depth of not less than 5 inches (125 mm) as a result of grading operations and, if immediately prior to seeding, the top 3 inches (75 mm) of soil is loose, friable, reasonably free from large clods, rocks, large roots, or other undesirable matter, and if shaped to the required grade.

When the area to be seeded is sparsely sodded, weedy, barren and unworked, or packed and hard, any grass and weeds shall first be cut or otherwise satisfactorily disposed of, and the soil then scarified or otherwise loosened to a depth not less than 5 inches (125 mm). Clods shall be broken and the top 3 inches (75 mm) of soil shall be worked into a satisfactory seedbed by discing, or by use of cultipackers, rollers, drags, harrows, or other appropriate means.

901-3.2 Dry application method.

a. Liming. *Not Applicable*

b. Fertilizing. Following advance preparations and cleanup fertilizer shall be uniformly spread at the rate that will provide not less than the minimum quantity stated in paragraph 901-2.3.

c. Seeding. Grass seed shall be sown at the rate specified in paragraph 901-2.1 immediately after fertilizing. The fertilizer and seed shall be raked within the depth range stated in the special provisions. Seeds of legumes, either alone or in mixtures, shall be inoculated before mixing or sowing, in accordance with the instructions of the manufacturer of the inoculant. When seeding is required at other than the seasons shown on the plans or in the special provisions, a cover crop shall be sown by the same methods required for grass and legume seeding.

d. Rolling. After the seed has been properly covered, the seedbed shall be immediately compacted by means of an approved lawn roller, weighing 40 to 65 pounds per foot (60 to 97 kg per meter) of width for clay soil (or any soil having a tendency to pack), and weighing 150 to 200 pounds per foot (223 to 298 kg per meter) of width for sandy or light soils.

901-3.3 Wet application method.

a. General. The Contractor may elect to apply seed and fertilizer (and lime, if required) by spraying them on the previously prepared seedbed in the form of an aqueous mixture and by using the methods and equipment described herein. The rates of application shall be as specified in the special provisions.

b. Spraying equipment. The spraying equipment shall have a container or water tank equipped with a liquid level gauge calibrated to read in increments not larger than 50 gallons (190 liters) over the entire range of the tank capacity, mounted so as to be visible to the nozzle operator. The container or tank shall also be equipped with a mechanical power-driven agitator capable of keeping all the solids in the mixture in complete suspension at all times until used.

The unit shall also be equipped with a pressure pump capable of delivering 100 gallons (380 liters) per minute at a pressure of 100 lb / sq inches (690 kPa). The pump shall be mounted in a line that will recirculate the mixture through the tank whenever it is not being sprayed from the nozzle. All pump passages and pipe lines shall be capable of providing clearance for 5/8 inch (16 mm) solids. The power unit for the pump and agitator shall have controls mounted so as to be accessible to the nozzle operator. There shall be an indicating pressure gauge connected and mounted immediately at the back of the nozzle.

The nozzle pipe shall be mounted on an elevated supporting stand in such a manner that it can be rotated through 360 degrees horizontally and inclined vertically from at least 20 degrees below to at least 60 degrees above the horizontal. There shall be a quick-acting, three-way control valve connecting the recirculating line to the nozzle pipe and mounted so that the nozzle operator can control and regulate the amount of flow of mixture delivered to the nozzle. At least three different types of nozzles shall be supplied so that mixtures may be properly sprayed over distance varying from 20 to 100 feet (6 to 30 m). One shall be a close-range ribbon nozzle, one a medium-range ribbon nozzle, and one a long-range jet nozzle. For case of removal and cleaning, all nozzles shall be connected to the nozzle pipe by means of quick-release couplings.

In order to reach areas inaccessible to the regular equipment, an extension hose at least 50 feet (15 m) in length shall be provided to which the nozzles may be connected.

c. Mixtures. Lime, if required, shall be applied separately, in the quantity specified, prior to the fertilizing and seeding operations. Not more than 220 pounds (100 kg) of lime shall be added to and mixed with each 100 gallons (380 liters) of water. Seed and fertilizer shall be mixed together in the relative proportions specified, but not more than a total of 220 pounds (100 kg) of these combined solids shall be added to and mixed with each 100 gallons (380 liters) of water.

All water used shall be obtained from fresh water sources and shall be free from injurious chemicals and other toxic substances harmful to plant life. Brackish water shall not be used at any time. The Contractor shall identify to the Engineer all sources of water at least two (2) weeks prior to use. The Engineer may take samples of the water at the source or from the tank at any time and have a laboratory test the samples for chemical and saline content. The Contractor shall not use any water from any source that is disapproved by the Engineer following such tests.

All mixtures shall be constantly agitated from the time they are mixed until they are finally applied to the seedbed. All such mixtures shall be used within two (2) hours from the time they were mixed or they shall be wasted and disposed of at approved locations.

d. Spraying. Lime, if required, shall be sprayed only upon previously prepared seedbeds. After the applied lime mixture has dried, the lime shall be worked into the top 3 inches (75 mm), after which the seedbed shall again be properly graded and dressed to a smooth finish.

Mixtures of seed and fertilizer shall only be sprayed upon previously prepared seedbeds on which the lime, if required, shall already have been worked in. The mixtures shall be applied by means of a high-pressure spray that shall always be directed upward into the air so that the mixtures will fall to the ground like rain in a uniform spray. Nozzles or sprays shall never be directed toward the ground in such a manner as might produce erosion or runoff.

Particular care shall be exercised to ensure that the application is made uniformly and at the prescribed rate and to guard against misses and overlapped areas. Proper predetermined quantities of the mixture in accordance with specifications shall be used to cover specified sections of known area.

Checks on the rate and uniformity of application may be made by observing the degree of wetting of the ground or by distributing test sheets of paper or pans over the area at intervals and observing the quantity of material deposited thereon.

On surfaces that are to be mulched as indicated by the plans or designated by the Engineer, seed and fertilizer applied by the spray method need not be raked into the soil or rolled. However, on surfaces on which mulch is not to be used, the raking and rolling operations will be required after the soil has dried.

901-3.4 Maintenance of seeded areas. The Contractor shall protect seeded areas against traffic or other use by warning signs or barricades, as approved by the Engineer. Surfaces gullied or otherwise damaged following seeding shall be repaired by regrading and reseeding as directed. The Contractor shall mow, water as directed, and otherwise maintain seeded areas in a satisfactory condition until final inspection and acceptance of the work.

When either the dry or wet application method outlined above is used for work done out of season, it will be required that the Contractor establish a good stand of grass of uniform color and density to the satisfaction of the Engineer. A grass stand shall be considered adequate when bare spots are one square foot (0.01 sq m) or less, randomly dispersed, and do not exceed 3% of the area seeded.

METHOD OF MEASUREMENT

901-4.1 The quantity of seeding to be paid for shall be the number of units acre (sq m) measured on the ground surface, completed and accepted.

BASIS OF PAYMENT

901-5.1 Payment shall be made at the contract unit price per acre (sq m) or fraction thereof, which price and payment shall be full compensation for furnishing and placing all material and for all labor, equipment, tools, and incidentals necessary to complete the work prescribed in this item.

Payment will be made under:

Item 901001	Seeding - per acre (sq m)

MATERIAL REQUIREMENTS

ASTM C602	Standard Specification for Agricultural Liming Materials
ASTM D977	Standard Specification for Emulsified Asphalt
FED SPEC	JJJ-S-181, Federal Specification, Seeds, Agricultural

END OF ITEM T-901

ITEM T-905 TOPSOILING

DESCRIPTION

905-1.1 This item shall consist of preparing the ground surface for topsoil application, removing topsoil from designated stockpiles or areas to be stripped on the site or from approved sources off the site, and placing, spreading and amending the topsoil on prepared areas in accordance with this specification at the locations shown on the plans or as directed by the Engineer.

MATERIALS

905-2.1 Topsoil. Topsoil shall be the surface layer of soil with no admixture of refuse or any material toxic to plant growth, and it shall be reasonably free from subsoil and stumps, roots, brush, stones (2 inches (50 mm) or more in diameter), and clay lumps or similar objects. Brush and other vegetation that will not be incorporated with the soil during handling operations shall be cut and removed. Ordinary sod and herbaceous growth such as grass and weeds are not to be removed, but shall be thoroughly broken up and intermixed with the soil during handling operations. Heavy sod or other cover, which cannot be incorporated into the topsoil by discing or other means, shall be removed.

Natural topsoil may be amended by the Contractor with approved materials and methods to meet the above specifications.

905-2.2 Inspection and tests. *Not Applicable*

CONSTRUCTION METHODS

905-3.1 General. Areas to be topsoiled shall be shown on the plans. If topsoil is available on the site, the location of the stockpiles or areas to be stripped of topsoil and the stripping depths shall be shown on the plans.

Suitable equipment necessary for proper preparation and treatment of the ground surface, stripping of topsoil, and for the handling and placing of all required materials shall be on hand, in good condition, and approved by the Engineer before the various operations are started.

905-3.2 Preparing the ground surface. Immediately prior to dumping and spreading the topsoil on any area, the surface shall be loosened by discs or spike-tooth harrows, or by other means approved by the Engineer, to a minimum depth of 2 inches (50 mm) to facilitate bonding of the topsoil to the covered subgrade soil. The surface of the area to be topsoiled shall be cleared of all stones larger than 2 inches (50 mm) in any diameter and all litter or other material which may be detrimental to proper bonding, the rise of capillary moisture, or the proper growth of the desired planting. Limited areas, as shown on the plans, which are too compact to respond to these operations shall receive special scarification.

Grades on the area to be topsoiled, which have been established by others as shown on the plans, shall be maintained in a true and even condition. Where grades have not been established, the areas shall be smooth-graded and the surface left at the prescribed grades in an even and compacted condition to prevent the formation of low places or pockets where water will stand.

905-3.3 Obtaining topsoil. Prior to the stripping of topsoil from designated areas, any vegetation, briars, stumps and large roots, rubbish or stones found on such areas, which may interfere with subsequent operations, shall be removed using methods approved by the Engineer. Heavy sod or other cover, which cannot be incorporated into the topsoil by discing or other means shall be removed.

When suitable topsoil is available on the site, the Contractor shall remove this material from the designated areas and to the depth as directed by the Engineer. The topsoil shall be spread on areas already tilled and smooth-graded, or stockpiled in areas approved by the Engineer. Any topsoil stockpiled by the Contractor shall be rehandled and placed without additional compensation. Any topsoil that has been stockpiled on the site by others, and is required for topsoiling purposes, shall be removed and placed by the Contractor. The sites of all stockpiles and areas adjacent thereto which have been disturbed by the Contractor shall be graded if required and put into a condition acceptable for seeding.

When suitable topsoil is secured off the airport site, the Contractor shall locate and obtain the supply, subject to the approval of the Engineer. The Contractor shall notify the Engineer sufficiently in advance of operations in order that necessary measurements and tests can be made. The Contractor shall remove the topsoil from approved areas and to the depth as directed. The topsoil shall be hauled to the site of the work and placed for spreading, or spread as required. Any topsoil hauled to the site of the work and stockpiled shall be rehandled and placed without additional compensation.

905-3.4 Placing topsoil. The topsoil shall be evenly spread on the prepared areas to a uniform depth of 3" inches (50 mm) after compaction, unless otherwise shown on the plans or stated in the special provisions. Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Spreading shall be carried on so that turfing operations can proceed with a minimum of soil preparation or tilling.

After spreading, any large, stiff clods and hard lumps shall be broken with a pulverizer or by other effective means, and all stones or rocks (2 inches (50 mm) or more in diameter), roots, litter, or any foreign matter shall be raked up and disposed of by the Contractor. after spreading is completed, the topsoil shall be satisfactorily compacted by rolling with a cultipacker or by other means approved by the Engineer. The compacted topsoil surface shall conform to the required lines, grades, and cross-sections. Any topsoil or other dirt falling upon pavements as a result of hauling or handling of topsoil shall be promptly removed.

METHOD OF MEASUREMENT

905-4.1 Topsoil stripping and placement are incidental to unclassified excavation.

BASIS OF PAYMENT

905-5.1 No direct payment will be made for topsoiling. It shall be incidental to unclassified excavation.

TESTING MATERIALS

ASTM C117	Materials Finer than 75 μm (No. 200) Sieve in Mineral Aggregates by Washing

END OF ITEM T-905

ITEM T-908 MULCHING

DESCRIPTION

908-1.1 This item shall consist of furnishing, hauling, placing, and securing mulch on surfaces indicated on the plans or designated by the Engineer.

MATERIALS

908-2.1 Mulch material. Acceptable mulch shall be the materials listed below or any approved locally available material that is similar to those specified. Mulch shall be free from noxious weeds, mold, and other deleterious materials. Mulch materials, which contain matured seed of species that would volunteer and be detrimental to the proposed overseeding, or to surrounding farm land, will not be acceptable. Straw or other mulch material which is fresh and/or excessively brittle, or which is in such an advanced stage of decomposition as to smother or retard the planted grass, will not be acceptable.

a. Hay. Hay shall be native hay in an air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Hay shall be sterile, containing no fertile seed.

b. Straw. Straw shall be the stalks from threshed plant residue of oats, wheat, barley, rye, or rice from which grain has been removed. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw shall contain no fertile seed.

c. Hay mulch containing seed. Hay mulch shall be mature hay containing viable seed of native grasses or other desirable species stated in the special provisions or as approved by the Engineer. The hay shall be cut and handled so as to preserve the maximum quantity of viable seed. Hay mulch that cannot be hauled and spread immediately after cutting shall be placed in weather-resistant stacks or baled and stored in a dry location until used.

d. Manufactured mulch. Cellulose-fiber or wood-pulp mulch shall be products commercially available for use in spray applications.

e. Asphalt binder. Asphalt binder material shall conform to the requirements of ASTM D977, Type SS-1 or RS-1.

908-2.2 Inspection. The Engineer shall be notified of sources and quantities of mulch materials available and the Contractor shall furnish him with representative samples of the materials to be used 30 days before delivery to the project. These samples may be used as standards with the approval of the Engineer and any materials brought on the site that do not meet these standards shall be rejected.

CONSTRUCTION METHODS

908-3.1 Mulching. Before spreading mulch, all large clods, stumps, stones, brush, roots, and other foreign material shall be removed from the area to be mulched. Mulch shall be applied immediately after seeding. The spreading of the mulch may be by hand methods, blower, or other mechanical methods, provided a uniform covering is obtained.

Mulch material shall be furnished, hauled, and evenly applied on the area shown on the plans or designated by the Engineer. Straw or hay shall be spread over the surface to a uniform thickness at the rate of 2 to 3 tons per acre (1800 - 2700 kg per acre) to provide a loose depth of not less than 1-1/2 inches (38 cm) nor more than 3 inches (75 mm). Other organic material shall be spread at the rate directed by the Engineer. Mulch may be blown on the slopes and the use of cutters in the equipment for this purpose will be permitted to the extent that at least 95% of the mulch in place on the slope shall be 6 inches (150 mm) or more in

length. When mulches applied by the blowing method are cut, the loose depth in place shall be not less than one inch (25 mm) nor more than 2 inches (50 mm).

908-3.2 Securing mulch. The mulch shall be held in place by light discing, a very thin covering of topsoil, pins, stakes, wire mesh, asphalt binder, or other adhesive material approved by the Engineer. Where mulches have been secured by either of the asphalt binder methods, it will not be permissible to walk on the slopes after the binder has been applied. When an application of asphalt binder material is used to secure the mulch, the Contractor must take every precaution to guard against damaging or disfiguring structures or property on or adjacent to the areas worked and will be held responsible for any such damage resulting from the operation.

If the "peg and string" method is used, the mulch shall be secured by the use of stakes or wire pins driven into the ground on 5-foot (1.5-m) centers or less. Binder twine shall be strung between adjacent stakes in straight lines and crisscrossed diagonally over the mulch, after which the stakes shall be firmly driven nearly flush to the ground to draw the twine down tight onto the mulch.

908-3.3 Care and repair.

a. The Contractor shall care for the mulched areas until final acceptance of the project. Care shall consist of providing protection against traffic or other use by placing warning signs, as approved by the Engineer, and erecting any barricades that may be shown on the plans before or immediately after mulching has been completed on the designated areas.

b. The Contractor shall be required to repair or replace any mulch that is defective or becomes damaged until the project is finally accepted. When, in the judgment of the Engineer, such defects or damages are the result of poor workmanship or failure to meet the requirements of the specifications, the cost of the necessary repairs or replacement shall be borne by the Contractor.

c. If the "asphalt spray" method is used, all mulched surfaces shall be sprayed with asphalt binder material so that the surface has a uniform appearance. The binder shall be uniformly applied to the mulch at the rate of approximately 8 gallons (32 liters) per 1,000 square feet (100 sq m), or as directed by the Engineer, with a minimum of 6 gallons (24 liters) and a maximum of 10 gallons (40 liters) per 1,000 square feet (100 sq m) depending on the type of mulch and the effectiveness of the binder securing it. Bituminous binder material may be sprayed on the mulched slope areas from either the top or the bottom of the slope. An approved spray nozzle shall be used. The nozzle shall be operated at a distance of not less than 4 feet (1.2 m) from the surface of the mulch and uniform distribution of the bituminous material shall be required. A pump or an air compressor of adequate capacity shall be used to ensure uniform distribution of the bituminous material.

d. If the "asphalt mix" method is used, the mulch shall be applied by blowing, and the asphalt binder material shall be sprayed into the mulch as it leaves the blower. The binder shall be uniformly applied to the mulch at the rate of approximately 8 gallons (32 liters) per 1,000 square feet (100 sq m) or as directed by the Engineer, with a minimum of 6 gallons (24 liters) and a maximum of 10 gallons (40 liters) per 1,000 square feet (100 sq m) depending on the type of mulch and the effectiveness of the binder securing it.

METHOD OF MEASUREMENT

908-4.1 Mulching shall be measured in acres (square meters) on the basis of the actual surface area acceptably mulched.

BASIS OF PAYMENT

908-5.1 Payment will be made at the contract unit price per acre (square meter) for mulching. The price shall be full compensation for furnishing all materials and for placing and anchoring the materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item 908001	Mulching - per acre (square meter)

MATERIAL REQUIREMENTS

ASTM D977	Standard Specification for Emulsified Asphalt

END OF ITEM T-908

Intentionally Left Blank