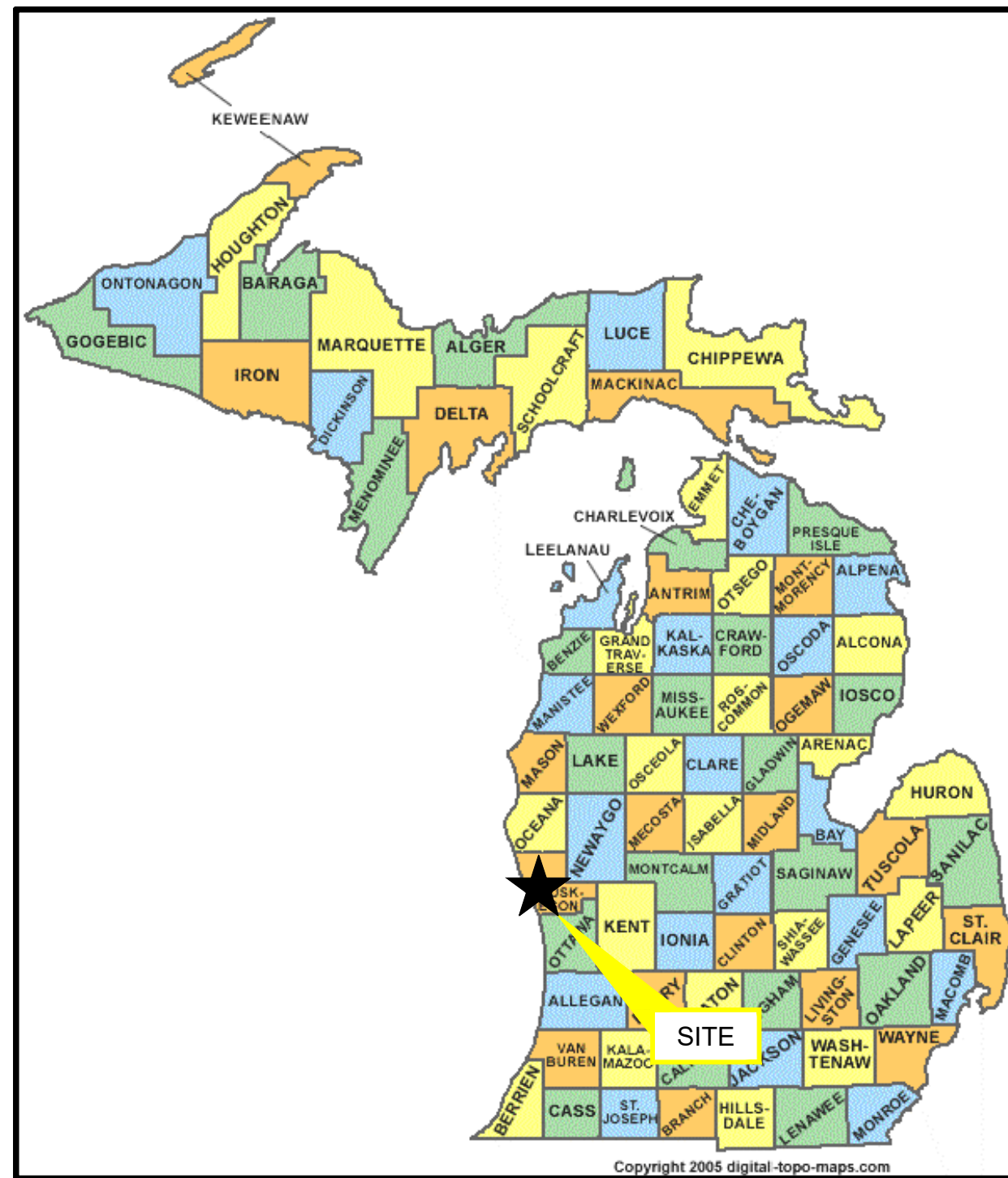


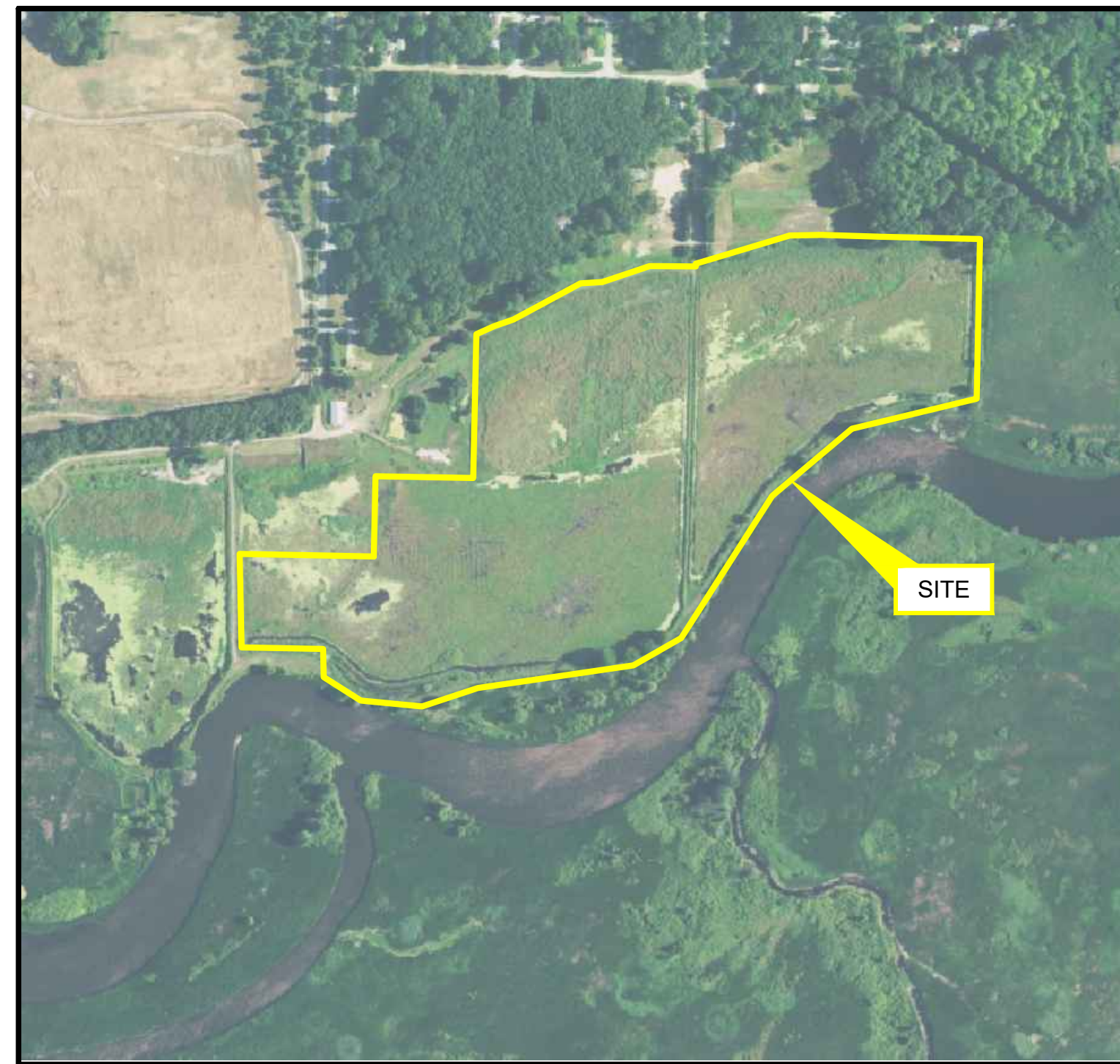
LOWER MUSKEGON RIVER

HYDROLOGIC RECONNECTION FISH & WILDLIFE HABITAT RESTORATION PROJECT CONSTRUCTION DRAWINGS



SOURCE:
GOOGLE™ IMAGES

STATE MAP
(NOT TO SCALE)



SOURCE:
GOOGLE™ EARTH

SITE LOCATION MAP
(NOT TO SCALE)

SHEET INDEX

SHEET NO.	DRAWING NO.	TITLE
1	G-01	COVER SHEET
2	A-01	OFF-SITE SOIL DISPOSAL LOCATION
3	C-01	EXISTING CONDITIONS
4	C-02	SOIL BORING DATA
5	C-03	PROPOSED ACCESS PLAN
6	C-04	DEMOLITION, SEQUENCING AND DEWATERING PLAN
7	C-05	PROPOSED GRADING PLAN
8	C-06	VISUAL DISPLAY OF PROPOSED EXCAVATION AND FILL
9	C-07	PROPOSED CROSS SECTIONS (1 OF 5)
10	C-08	PROPOSED CROSS SECTIONS (2 OF 5)
11	C-09	PROPOSED CROSS SECTIONS (3 OF 5)
12	C-10	PROPOSED CROSS SECTIONS (4 OF 5)
13	C-11	PROPOSED CROSS SECTIONS (5 OF 5)
14	C-12	SB-106 SOIL REMOVAL DIAGRAM
15	L-01	SOIL EROSION AND SEDIMENT CONTROL PLAN
16	L-02	LANDSCAPING PLAN
17	L-03	WILDLIFE HABITAT STRUCTURES
18	D-01	DETAILS (1 OF 3)
19	D-02	DETAILS (2 OF 3)
20	D-03	DETAILS (3 OF 3)

PREPARED FOR:

WEST MICHIGAN SHORELINE REGIONAL
DEVELOPMENT COMMISSION
316 MORRIS AVE, SUITE 340
MUSKEGON, MI 49940
(231)722-7878



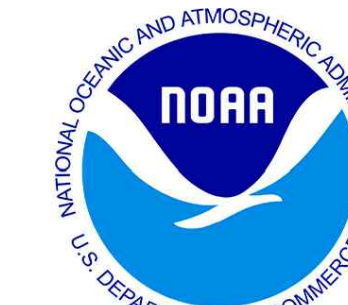
MUSKEGON COUNTY
990 TERRACE ST #105
MUSKEGON, MI 49442



GREAT LAKES COMMISSION
2805 S INDUSTRIAL HWY # 100
ANN ARBOR, MI 48104
(734)971-9135



NATIONAL OCEANIC AND
ATMOSPHERIC ADMINISTRATION
4840 S. STATE RD
ANN ARBOR, MI 48108



PREPARED BY:

GEI CONSULTANTS OF MICHIGAN P.C.
5225 EDGEWATER DRIVE
ALLENDALE, MI 49401
(616)384-2710

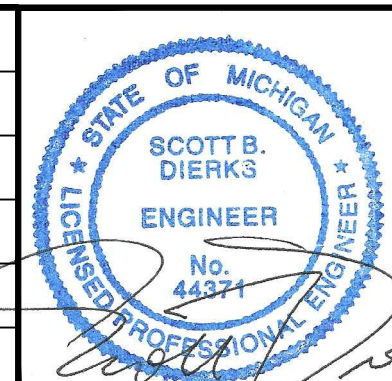


FOR CONSTRUCTION

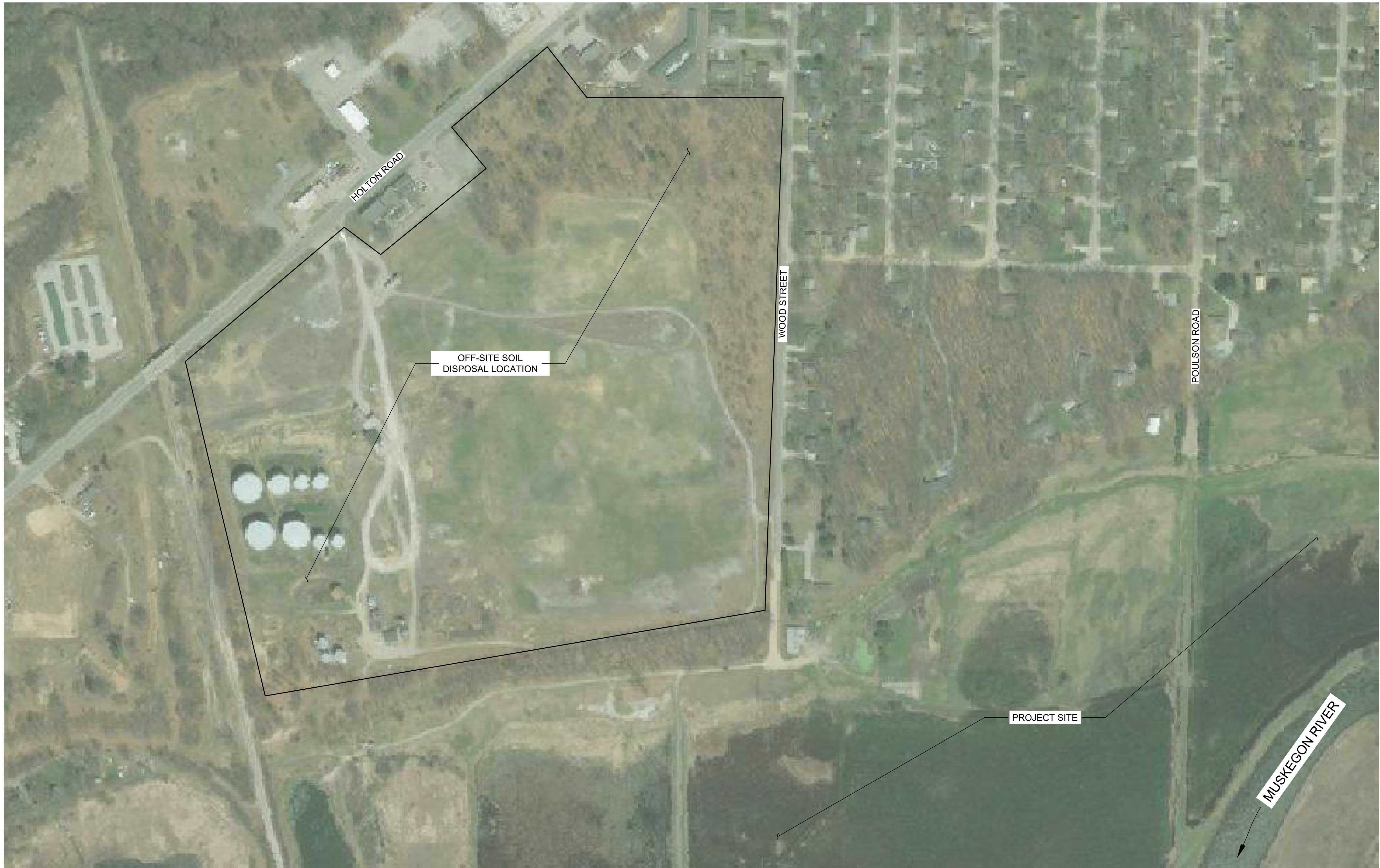
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12/06/2018
GEI PROJECT NO. 1602940

NO.	DATE	ISSUE/REVISION	APP
1	11/16/2018	JPA DRAWINGS	SD
0	6/1/2018	JPA DRAWINGS	SD
			APP



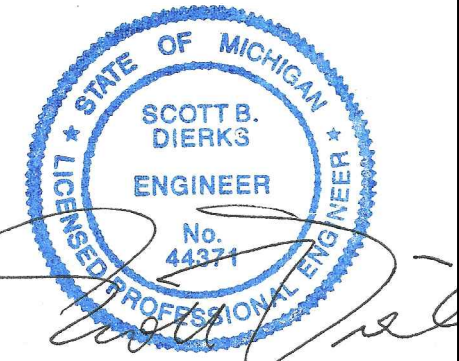
DWG. NO.
G-01
SHEET NO.
1 OF 20



LOWER MUSKEGON
 RIVER HYDROLOGIC
 RECONNECTION

Attention: 1"
 If this scale bar does not measure
 1" then drawing is not original scale.

NO.	DATE	ISSUE/REVISION	APP
2	12/6/2018	CONSTRUCTION DRAWINGS	SD
1	11/16/2018	JPA DRAWINGS	SD
0	6/1/2018	JPA DRAWINGS	SD



Designed: B. Majka
 Checked: S. Dierks
 Drawn: I. Roberts
 Submitted By: B. Majka
 P.E. No.: 44371

ALTERNATE A1:
 PROPOSED OFF
 SITE SOIL
 DISPOSAL
 LOCATION

GEI Project 1602940
 DWG. NO.
A-01
 SHEET NO.
2 OF 20

PROPOSED SOIL DISPOSAL LOCATION

NOTES:

1. SOIL SHALL BE PLACED AND SPREAD TO A UNIFORM THICKNESS.
2. EXACT LOCATION AND SOIL DEPTH WITHIN THE DESIGNATED DISPOSAL AREA WILL BE DETERMINED BY THE LANDOWNER AND THE ENGINEER.
3. SOIL SHALL CONTAIN A MINIMUM OF 5% ORGANIC MATTER BY WEIGHT.
4. SEEDING TO BE COMPLETED BY OTHERS.

For Construction
 SCALE: 1" = 150'

**LOWER MUSKEGON
 RIVER HYDROLOGIC
 RECONNECTION**

Attention: 1"
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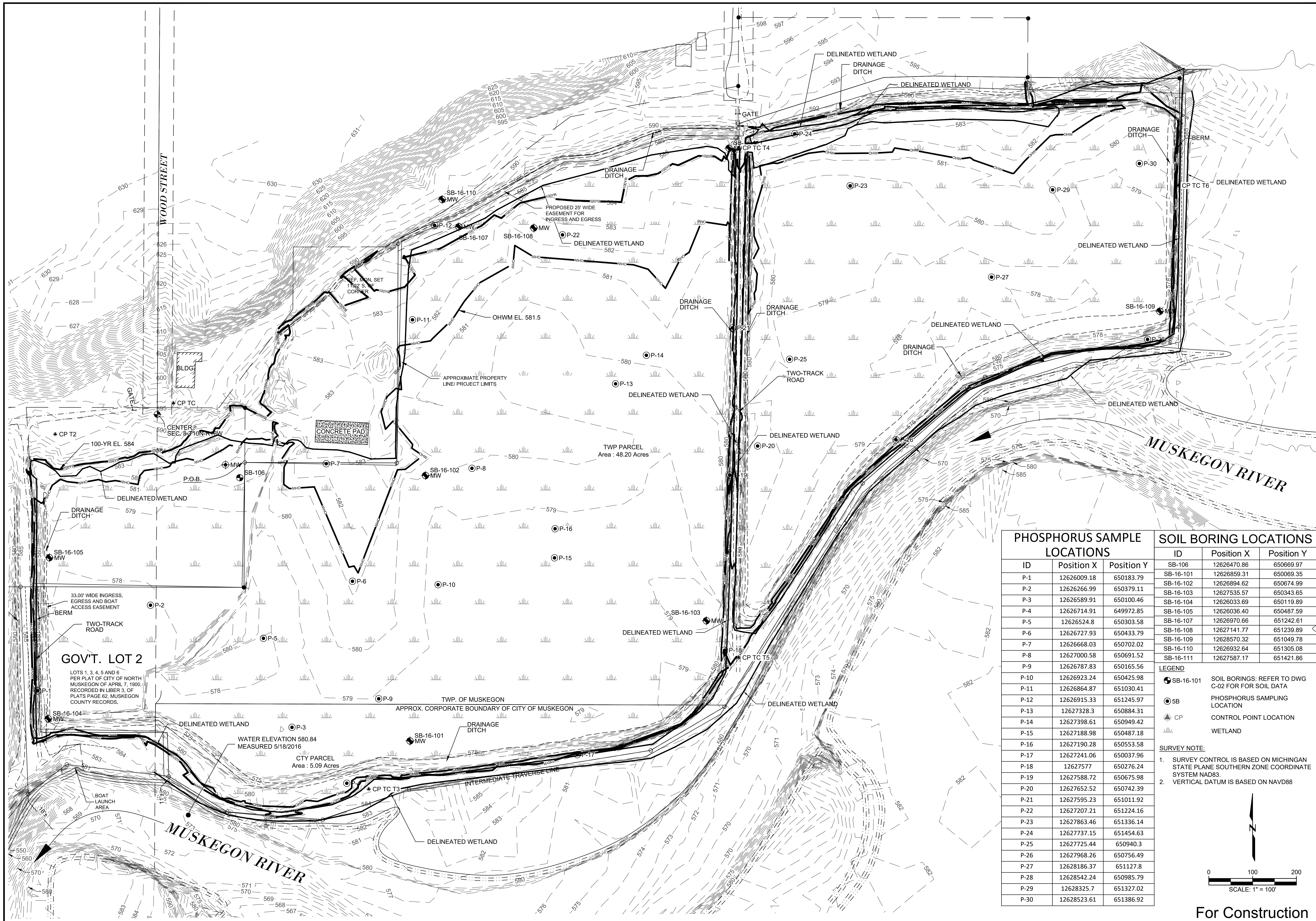
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**EXISTING
 CONDITIONS**

GEI Project 1602940
 DWG. NO.
C-01
 SHEET NO.
3 OF 20

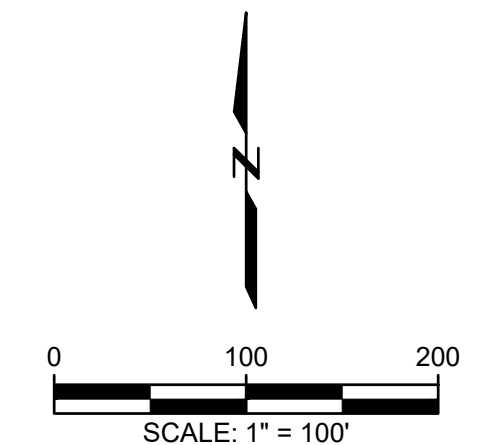


PHOSPHORUS SAMPLE LOCATIONS		
ID	Position X	Position Y
P-1	12626009.18	650183.79
P-2	12626266.99	650379.11
P-3	12626589.91	650100.46
P-4	12626714.91	649972.85
P-5	12626524.8	650303.58
P-6	12626727.93	650433.79
P-7	12626668.03	650702.02
P-8	12627000.58	650691.52
P-9	12626787.83	650165.56
P-10	12626923.24	650425.98
P-11	12626864.87	651030.41
P-12	12626915.33	651245.97
P-13	12627328.3	650884.31
P-14	12627398.61	650949.42
P-15	12627188.98	650487.18
P-16	12627190.28	650553.58
P-17	12627241.06	650037.96
P-18	12627577	650276.24
P-19	12627588.72	650675.98
P-20	12627652.52	650742.39
P-21	12627595.23	651011.92
P-22	12627207.21	651224.16
P-23	12627863.46	651336.14
P-24	12627737.15	651454.63
P-25	12627725.44	650940.3
P-26	12627968.26	650756.49
P-27	12628186.37	651127.8
P-28	12628542.24	650985.79
P-29	12628325.7	651327.02
P-30	12628523.61	651386.92

SOIL BORING LOCATIONS		
ID	Position X	Position Y
SB-106	12626470.86	650669.97
SB-16-101	12626859.31	650069.35
SB-16-102	12626894.62	650674.99
SB-16-103	12627535.57	650343.65
SB-16-104	12626033.69	650119.89
SB-16-105	12626036.40	650487.59
SB-16-107	12626970.66	651242.61
SB-16-108	12627141.77	651239.89
SB-16-109	12628570.32	651049.78
SB-16-110	12626932.64	651305.08
SB-16-111	12627587.17	651421.86

LEGEND
 ● SB-16-101 SOIL BORINGS: REFER TO DWG C-02 FOR FOR SOIL DATA
 ● SB PHOSPHORUS SAMPLING LOCATION
 ▲ CP CONTROL POINT LOCATION
 ▨ WETLAND

SURVEY NOTE:
 1. SURVEY CONTROL IS BASED ON MICHIGAN STATE PLANE SOUTHERN ZONE COORDINATE SYSTEM NAD83.
 2. VERTICAL DATUM IS BASED ON NAVD88



For Construction

SOIL CORE ID	DEPTH (INCHES)	COLOR	TEXTURE	COMMENTS	SAMPLE ID
P-1	0-18" BLACK 18"-48" TAN		ORGANIC/TOPSOIL/ROOTS FINE-MEDIUM SAND	1.2' STANDING WATER, SAMPLED BELOW BOTTOM OF WATER EOB4	1a 0-0.5' 1b 1' 1c 2' 1d 3'
P-2	0-8.4" BLACK 8.4-36" BLACK		TOPSOIL W/ ORGANICS PEAT	2' STANDING WATER EOB @ 3'	2a 0-0.5' 2b 1' 2c 2' 2d 3'
P-3	0-20.4" BLACK 20.4-36" N/A		SILTY ORGANIC TOPSOIL FINE SAND		3a 0-0.5' 3b 1' 3c 2' 3d 3'
P-4	0-20.4" BROWN 20.4-12" TAN BROWN 12-36" BROWN		TOPSOIL W/ MEDIUM SAND SILTY SAND AND GRAVEL SILTY MEDIUM SAND	ON DIKE EOB @ 3'	4a 0-0.5' 4b 1' 4c 2' 4d 3'
P-5	0-18" BLACK 18-36" TAN		TOPSOIL/ORGANIC FINE-MEDIUM SAND	2' STANDING WATER EOB @ 3'	5a 0-0.5' 5b 1' 5c 2' 5d 3'
P-6	0-24" BLACK 24-30" BLACK 30-36" TAN		SILTY TOPSOIL/ORGANICS PEAT FINE-MEDIUM SAND W/ PLANT FRAGS	EOB @ 3'	6a 0-0.5' 6b 1' 6c 2' 6d 3'
P-7	0-6" BLACK 6-12" BROWN 12-30" TAN-BROWN 30-36" TAN		ORGANIC SOIL W/ ROOTS FINE-MEDIUM SAND W/ ORG. MEDIUM-COARSE SAND COARSE SAND W/ WOOD FRAGS	3' STANDING WATER EOB @ 3'	7a 0-0.5' 7b 1' 7c 2' 7d 3'
P-8	0-36" TAN BLACK		FINE -MEDIUM SAND	NO STANDING WATER WATER 2' DOWN EOB @ 3'	8a 0-0.5' 8b 1' 8c 2' 8d 3'
P-9	0-18" BLACK 18-30" N/A 30-36" BROWN		SILTY TOPSOIL/ORGANICS SILTY FINE SAND SILTY PEAT	2' STANDING WATER EOB @ 3'	9a 0-0.5' 9b 1' 9c 2' 9d 3'
P-10	0-24" N/A 24-36" N/A		SILTY TOPSOIL + ORGANICS SILTY FINE SAND	2' STANDING WATER EOB @ 3'	10a 0-0.5' 10b 1' 10c 2' 10d 3'
P-11	0-8.4" BLACK 8.4-36" TAN		TOPSOIL + ORGANICS MEDIUM-COARSE SAND	EOB @ 3' WET @ 1'	11a 0-0.5' 11b 1' 11c 2' 11d 3'
P-12	0-8.4" BLACK 8.4-24" BLACK 24-30" TAN 30-36" TAN		TOPSOIL W/ MEDIUM SAND PEAT MEDIUM-COARSE SAND MEDIUM SAND	EOB @ 3'	12a 0-0.5' 12b 1' 12c 2' 12d 3'
P-17	0-12" TAN-BROWN 12-36" TAN-BROWN		SILTY SAND W/ GRAVEL SILTY FINE-MEDIUM SAND	EOB @ 3' ON BERM	17a 0-0.5' 17b 1' 17c 2' 17d 3'
P-18	0-6" BROWN 6-12" BROWN 12-24" BROWN 24-36" TAN-BROWN		TOPSOIL/ORGANICS SILTY FINE SAND, GRAVEL, GLASS FRAGS	WEST SIDE OF BERM EOB @ 3'	18a 0-0.5' 18b 1' 18c 2' 18d 3'
P-19	0-30" BROWN 30-36" TAN		SILT W/ ORGANICS FINE SAND	EOB @ 3' JUST OFF WEST SIDE BERM	19a 0-0.5' 19b 1' 19c 2' 19d 3'
P-20	0-30" BROWN 30-36" TAN		SILT W/ ORGANICS FINE SAND	PHOTO @ 2' EOB @ 3' 1.5' ON STANDING WATER	20a 0-0.5' 20b 1' 20c 2' 20d 3'

SOIL CORE ID	DEPTH (INCHES)	COLOR	TEXTURE	COMMENTS	SAMPLE ID
P-21	0-6" BLACK 6-36" BROWN-BLACK		TOPSOIL/ORGANIC ROOT MASS MEDIUM COARSE SAND W/ ORGS, WOOD FRAGS	WEST SIDE OF DIKE @ STAFF GAGE WET AT 2' EOB @ 3'	21a 0-0.5' 21b 1' 21c 2' 21d 3'
P-23	0-6" N/A 6-30" TAN 30-36" TAN-BROWN		TOPSOIL/ORGANIC W/ MEDIUM COARSE SAND MEDIUM COARSE SAND MEDIUM COARSE SAND W/ ORGANIC AND SHELL FRAGS	EOB @ 3' SAT @ 0.5'	23a 0-0.5' 23b 1' 23c 2' 23d 3'
P-24	0-12" BLACK 12-24" TAN-BROWN 24-36" TAN		ORGANIC TOPSOIL FINE SAND SILT W/ FINE SAND	MOIST TO WET, SAT @ 2' EOB @ 3'	24a 0-0.5' 24b 1' 24c 2' 24d 3'
P-25	0-6" BLACK 6-12" GRAY-BLACK 12-24" BLACK 24-36" TAN		ORGANIC/ROOT SILT MEDIUM-COARSE SAND + PEAT FINE SAND	EOB @ 3' 2' STANDING WATER	17a 0-0.5' 17b 1' 17c 2' 17d 3'
P-26	0-24" BROWN 24-36" TAN-BROWN		SILT W/ FINE SAND, ORGANIC FINE-MEDIUM SAND	EOB @ 3' INSIDE EDGE OF DIKE 0.5' STANDING WATER	26a 0-0.5' 26b 1' 26c 2' 26d 3'
P-27	0-12" BLACK 12-36" TAN		TOPSOIL/ORGANIC ROOT MAT W/ MEDIUM COARSE SAND MEDIUM-COARSE SAND	EOB @ 3' 1.25' STANDING WATER	27a 0-0.5' 27b 1' 27c 2' 27d 3'
P-28	0-30" BROWN 30-36" TAN-BROWN		SILTY ORGANICS FINE SAND	EOB @ 3' MOVED TO INSIDE EDGE OF BERM DUE TO ACCESS 1.5' STANDING WATER	28a 0-0.5' 28b 1' 28c 2' 28d 3'
P-29	0-12" BLACK 12-18" BLACK 18-36" TAN		TOPSOIL/ORGANIC ROOT MASS TOPSOIL/ORGANIC ROOT MASS W/ MEDIUM COARSE SAND MEDIUM-COARSE SAND	EOB @ 3' 1.5' STANDING WATER	29a 0-0.5' 29b 1' 29c 2' 29d 3'
P-30	0-24" BLACK 24-36" TAN		MUCKY TOPSOIL MEDIUM-COARSE SAND	EOB @ 3' 1.5' STANDING WATER, SAMPLED BELOW WATER	30a 0-0.5' 30b 1' 30c 2' 30d 3'
SB-16-101	0-6" BLACK-GRAY 6-12" BLACK-GRAY 12-18" BLACK-GRAY 18-24" TAN		SILTY TOPSOIL/ORGANIC SILTY TOPSOIL/ORGANIC SILTY TOPSOIL/ORGANIC FINE-MEDIUM SAND	2' STANDING WATER EOB @ 2'	SB-16-101a 1' SB-16-101b 2'
SB-16-102	0-6" BLACK 6-12" BLACK 12-18" TAN 18-24" TAN		SILTY TOPSOIL/ORGANICS FINE-MEDIUM SAND FINE-MEDIUM SAND FINE-MEDIUM SAND	EOB @ 2'	SB-16-102a 1' SB-16-102b 2'
SB-16-103	0-6" GRAY-BLACK 6-12" GRAY-BLACK 12-18" GRAY-BLACK 18-24" GRAY 24-30" GRAY		SILT/ORGANICS SILT/ORGANICS SILT/ORGANICS FINE SAND FINE SAND	1' STANDING WATER EOB @ 2.5'	SB-16-103a 1' SB-16-103b 2.5'
SB-16-104	0-6" BROWN 6-12" BROWN 12-18" BROWN 18-24" TAN-GRAY 24-30" DARK GRAY		FINE SAND W/ SILT/COAL/BRICK FINE SAND W/ SILT/COAL/BRICK FINE SAND W/ SILT/COAL/BRICK MEDIUM SAND SILT	NO WATER AT SURFACE EOB @ 3' WET @ 2'	SB-16-104a 1' SB-16-104b 3'
SB-16-105	0-6" N/A 6-12" DARK 12-18" GRAY/BLACK 18-24" BLACK 24-30" TAN 30-36" TAN		N/A N/A SILT W/ FINE SAND PEAT PEAT FINE SAND SAND	2' STANDING WATER EOB @ 3'	SB-16-105a 1.5' SB-16-105b 3'

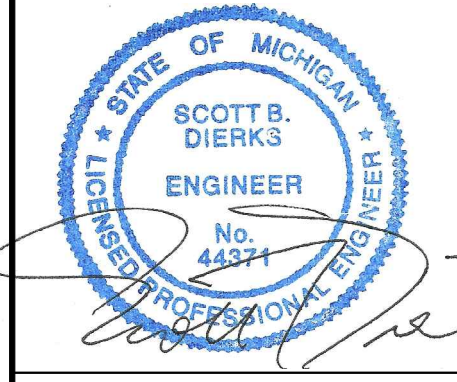
SOIL CORE ID	DEPTH (INCHES)	COLOR	TEXTURE	COMMENTS	SAMPLE ID
SB-16-106	0-6" BROWN-BLACK 6-12" BROWN-BLACK 12-18" BROWN-BLACK 18-24" BROWN-BLACK 24-30" BROWN-BLACK 30-36" BLACK 36-42" TAN 42-48" TAN		TOPSOIL/ORGANIC TOPSOIL/ORGANIC TOPSOIL/ORGANIC TOPSOIL/ORGANIC SILTY W/ PEAT SILTY SAND FINE-MEDIUM SAND FINE-MEDIUM SAND	AT OIL WELL PIPE 100 YDS S OF BARN, WATER @ SURFACE BOSMA SAYS PIPE MARKS AN OIL WELL PETRO ODOR PETRO ODOR STRONG ODOR STRONG ODOR, OILY SHEEN EOB @ 4'	SB-16-106a 1' SB-16-106b 2' SB-16-106c 2.5' SB-16-106d 3'
SB-16-107	0-6" BLACK 6-12" BLACK 12-18" BLACK 18-24" BLACK 24-30" N/A 30-36" TAN		TOPSOIL W/ MEDIUM SAND TOPSOIL W/ MEDIUM SAND TOPSOIL W/ MEDIUM SAND TOPSOIL W/ PEAT TOPSOIL W/ PEAT MEDIUM SAND	WOOD @ 2.2'	SB-16-107a 1' SB-16-107b 3'
SB-16-108	0-6" BLACK 6-12" BLACK 12-18" BLACK 18-24" BLACK 24-30" TAN		TOPSOIL/ORGANIC W/ MEDIUM SAND TOPSOIL/ORGANIC W/ MEDIUM SAND, WOOD/PEAT N/A N/A FINE-MEDIUM SAND	2' STANDING WATER EOB @ 2' WOOD	SB-16-108a 1.5' SB-16-108b 2'
SB-16-109	0-6" BLACK-GRAY 6-12" BLACK-GRAY 12"-18" GRAY 18"-24" GRAY		SILTY ORGANIC SILTY ORGANIC GRAY SAND GRAY SAND	12" STANDING WATER	SB-16-109A 1' SB-16-109B 2'
SB-16-110	0-6" BLACK-GRAY 6-12" BLACK-GRAY 12-18" TAN 18-24" TAN		SILT LOAM SILT LOAM COARSE SAND COARSE SAND		SB-16-110A 1' SB-16-110B 2'
SB-16-111	0-6" BLACK-GRAY 6-12" BLACK-GRAY 12-18" TAN 18-24" TAN		SILT LOAM SILT LOAM FINE-MEDIUM SAND FINE-MEDIUM SAND		SB-16-111A 1' SB-16-111B 2'
SB-106-1E	0-60" N/A 36" TAN-GRAY 60-120" TAN 72" N/A 90" TAN		ORGANICS/PEAT FINE-MEDIUM SAND FINE-MEDIUM SAND N/A MEDIUM-COARSE SAND, GRAVEL	6' EAST OF STANDPIPE ODOR AND SHEEN SOME ODOR AND SHEEN SHEEN STOPS EOB @ 10'	SB-106-1E 4-5' SB-106-1E 7.5-8'
SB-106-1N	0-60" N/A 24" TAN-GRAY 36" TAN-GRAY 54" TAN 60-120" TAN 90" TAN		PEAT/ORGANICS FINE SAND AND SILT FINE SAND FINE SAND FINE-MEDIUM SAND MEDIUM-COARSE SAND, GRAVEL	6' NORTH OF STANDPIPE SLIGHT ODOR CLEAN, NO ODOR, SHEEN EOB @ 10'	SB-106-1N 4-5' SB-106-1N 7.5-8'
SB-106-1S	0-60" N/A 24" TAN-GRAY 60-120" TAN 90" TAN		PEAT/ORGANICS FINE SAND, GRAVEL FINE SAND MEDIUM-COARSE SAND	7.5' SOUTH OF STANDPIPE, SATURATED ODOR AND STAINING (PETRO) ODOR NO ODOR OR SHEEN, EOB @ 10'	SB-106-1S 4.5-5' SB-106-1S 7.5-8'
SB-106-1W	0-60" N/A 30" TAN-GRAY 60-120" TAN 90" N/A		PEAT/ORGANICS FINE-MEDIUM SAND MEDIUM-FINE SAND MEDIUM-COARSE SAND, GRAVEL	6' WEST OF STANDPIPE, SATURATED SLIGHT SHEEN AND ODOR NO ODOR, EOB @ 10', 6FT NO ODOR REMAINING	SB-106-1W 4.5-5' SB-106-1W 7.5-8'



LOWER MUSKEGON RIVER HYDROLOGIC RECONNECTION

Attention: 1" scale bar does not measure 1" then drawing is not original scale.

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2	12/6/2018	CONSTRUCTION DRAWINGS	SD
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SOIL BORING DATA

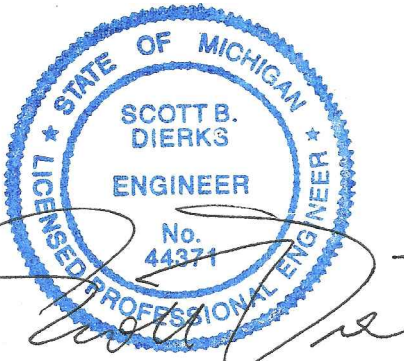
GEI Project 1602940
DWG. NO.
C-02
SHEET NO.
5 OF 20

For Construction

LOWER MUSKEGON RIVER HYDROLOGIC RECONNECTION

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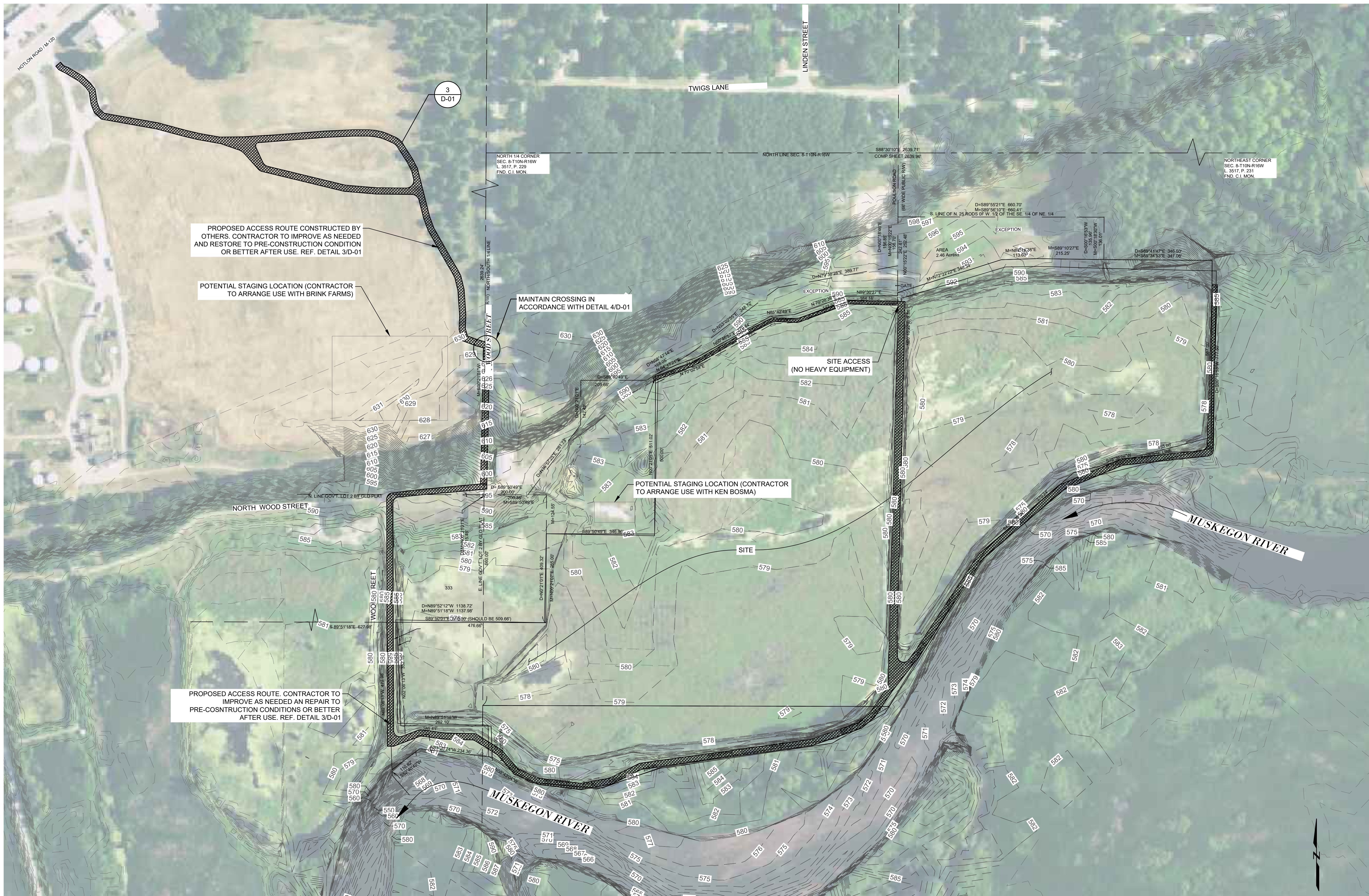
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PROPOSED ACCESS PLAN

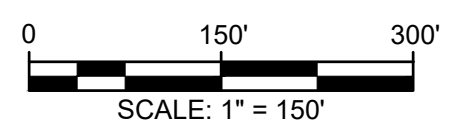
GEI Project 1602940
 DWG. NO.
C-03
 SHEET NO.
5 OF 20



PROPOSED ACCESS ROUTE

LEGEND
 ACCESS ROAD

- NOTES:**
- CONTRACTOR MAY CONSTRUCT ACCESS ROADS THROUGHOUT THE SITE AS NEEDED. ALL ACCESS ROADS SHALL BE REMOVED PRIOR TO HYDRAULIC RECONNECTION.
 - CONTRACTOR TO MAINTAIN ACCESS ROADS IN ADEQUATE CONDITION THROUGHOUT THE SITE AND THROUGH THE DURATION OF THE PROJECT.



For Construction

DEWATERING NOTES:

INSTALLATION

- The CONTRACTOR shall be responsible for providing all materials, equipment, labor, and services necessary for management of surface and groundwater, including seepage and precipitation.
- Install a dewatering system to lower and control ground surface water in order to permit excavation and placement of backfill materials to be performed under dry conditions. Make the dewatering system adequate to pre-drain the water-bearing strata above and below the bottom of utilities and other excavations.
- CONTRACTOR shall use a dewatering system that extracts groundwater through vacuum wells or other similar mechanism. All extracted water must come from locations outside the horizontal and vertical extents of earth excavation.
- In addition, reduce hydrostatic pressure head in water-bearing strata below utilities and other excavations, to extent that water levels in the construction area are a minimum of 1 foot below prevailing excavation surface at all times.

WATER DISPOSAL

- Dispose of water removed from the excavations in such a manner that will not endanger portions of work under construction or completed, and will not cause inconvenience to the OWNER, adjacent landowners, or to others working near the site.
- All surface water pumped prior to the start of construction activities may be discharged into the Muskegon River.
- Once construction activities have begun, maintenance pumping must come through the extraction of groundwater that is not directly impacted by earth excavation or construction activities. Clean groundwater may be pumped directly into the Muskegon River.
- All maintenance dewatering must be disposed of in the manner described above until excavation, fill, and placement of structures is complete.
- The CONTRACTOR shall be responsible for control of runoff in all work areas including, but not limited to, excavations, access roads, parking area, and staging areas. The CONTRACTOR shall provide, operate, and maintain all ditches, basins, sumps, culverts, site grading, and pumping facilities to divert, collect, and remove all water from the work areas.

OPERATION

- Prior to any excavation below the ground water table, place system into operation to lower water table as required to facilitate construction.
- The CONTRACTOR shall be responsible for providing all facilities required to divert, collect, control, and remove water from all construction work areas and excavations. Surface water shall drain away from active excavations.
- Dewatering equipment shall be provided to remove and dispose of

all surface and ground water entering excavations, trenches, or other parts of the work during construction. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the excavation work is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result. Water levels in the construction area shall be a minimum of 1 foot below the prevailing excavation surface.

4. In order to maintain embankment stability during pond dewatering a perimeter dike dewatering system shall be of sufficient size and capacity necessary to lower and maintain ground water table to an elevation at least 1 foot below lowest subgrade or bottom of pipe trench along the entire length of the perimeter dike and to allow material within the ponds to be excavated and/or placed in a reasonably dry condition. A dewatering system is not required along the center dike that separates the two ponds as long as the water levels in each pond is lowered at the same rate and maintained at the same elevation. Materials to be removed shall be sufficiently dry to permit excavation to grades shown and to stabilize excavation slopes where sheeting is not required. Operate dewatering system continuously until backfill work has been completed. Drainage features shall have sufficient capacity to avoid flooding of work areas.

5. Prevent loss of fines, seepage, boils, quick conditions or softening of foundation strata.

6. Maintain stability of sides and bottom of excavation. Control of surface and subsurface water is part of dewatering requirements. Maintain adequate control so that the stability of excavated and constructed slopes are not adversely affected by saturated soil, including water entering prepared subbase and subgrades where underlying materials are not free draining or are subject to swelling or freeze-thaw action.

7. Drainage features shall be so arranged and altered as required to avoid degradation of the final excavated surface(s). The CONTRACTOR shall utilize all necessary erosion and sediment control measures as described herein to avoid construction related degradation of the natural water quality.

STANDBY EQUIPMENT

- Provide complete standby equipment, installed and available for immediate operation, as may be required to adequately maintain de-watering on a continuous basis and in the event that all or any part of the system may become inadequate or fail.

CORRECTIVE ACTION

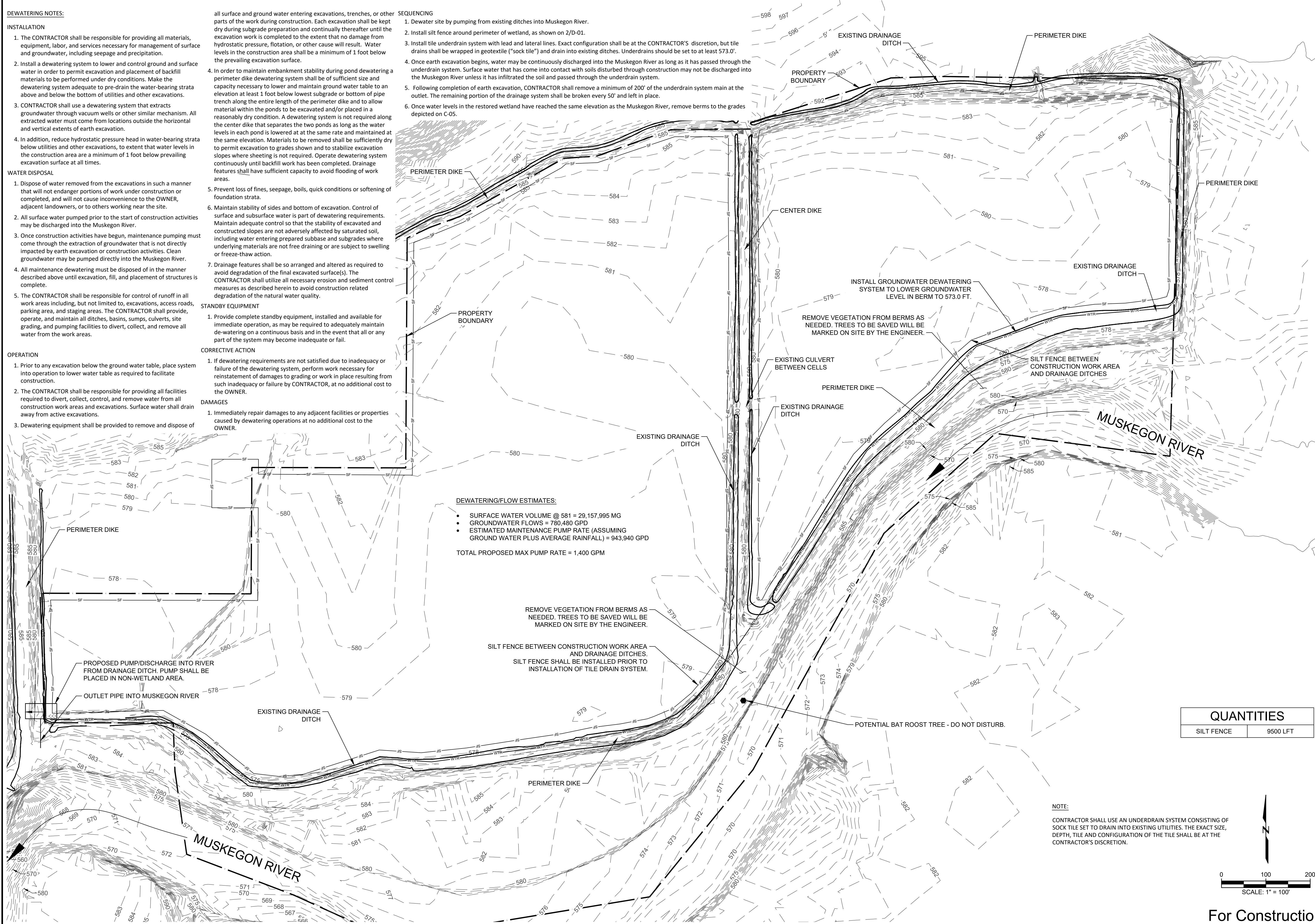
- If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system, perform work necessary for reinstatement of damages to grading or work in place resulting from such inadequacy or failure by CONTRACTOR, at no additional cost to the OWNER.

DAMAGES

- Immediately repair damages to any adjacent facilities or properties caused by dewatering operations at no additional cost to the OWNER.

SEQUENCING

- Dewater site by pumping from existing ditches into Muskegon River.
- Install silt fence around perimeter of wetland, as shown on 2/D-01.
- Install tile underdrain system with lead and lateral lines. Exact configuration shall be at the CONTRACTOR'S discretion, but tile drains shall be wrapped in geotextile ("sock tile") and drain into existing ditches. Underdrains should be set to at least 573.0'.
- Once earth excavation begins, water may be continuously discharged into the Muskegon River as long as it has passed through the underdrain system. Surface water that has come into contact with soils disturbed through construction may not be discharged into the Muskegon River unless it has infiltrated the soil and passed through the underdrain system.
- Following completion of earth excavation, CONTRACTOR shall remove a minimum of 200' of the underdrain system main at the outlet. The remaining portion of the drainage system shall be broken every 50' and left in place.
- Once water levels in the restored wetland have reached the same elevation as the Muskegon River, remove berms to the grades depicted on C-05.



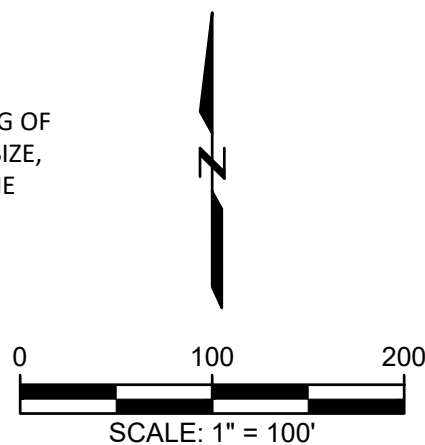
DEWATERING/FLOW ESTIMATES:

- SURFACE WATER VOLUME @ 581 = 29,157,995 MG
- GROUNDWATER FLOWS = 780,480 GPD
- ESTIMATED MAINTENANCE PUMP RATE (ASSUMING GROUND WATER PLUS AVERAGE RAINFALL) = 943,940 GPD

TOTAL PROPOSED MAX PUMP RATE = 1,400 GPM

QUANTITIES	
SILT FENCE	9500 LFT

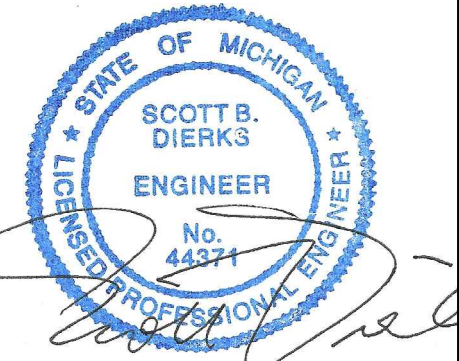
NOTE:
CONTRACTOR SHALL USE AN UNDERDRAIN SYSTEM CONSISTING OF SOCK TILE SET TO DRAIN INTO EXISTING UTILITIES. THE EXACT SIZE, DEPTH, TILE AND CONFIGURATION OF THE TILE SHALL BE AT THE CONTRACTOR'S DISCRETION.



LOWER MUSKEGON RIVER HYDROLOGIC RECONNECTION

Attention: 1"
If this scale bar does not measure 1" then drawing is not original scale.

NO.	DATE	ISSUE/REVISION	APP
2	12/6/2018	CONSTRUCTION DRAWINGS	SD
1	11/16/2018	JPA DRAWINGS	SD
0	6/1/2018	JPA DRAWINGS	SD

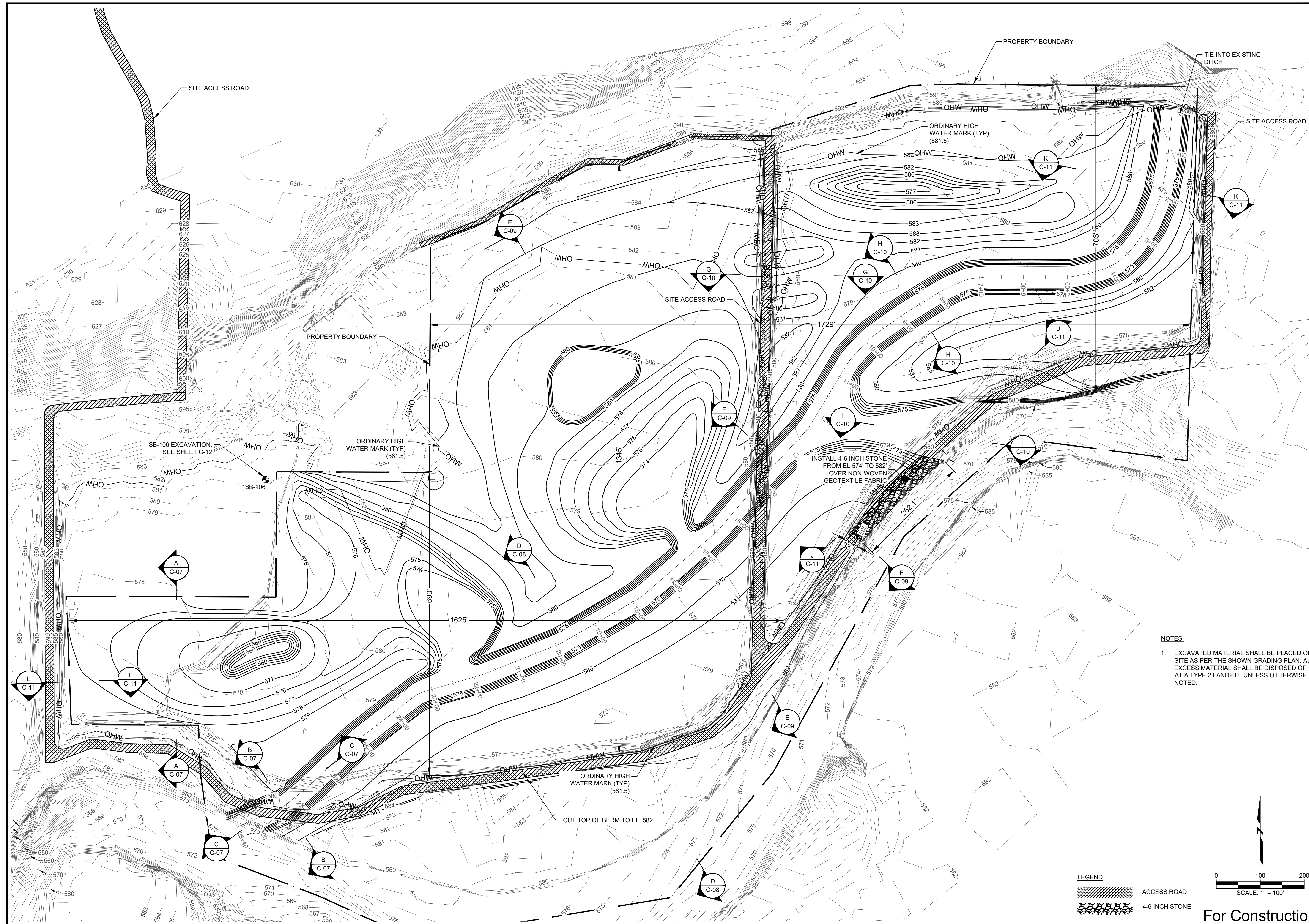


Designed: B. Majka
Checked: S. Dierks
Drawn: I. Roberts
Submitted By: B. Majka
P.E. No.: 44371

DEMOLITION, SEQUENCING AND DEWATERING PLAN

GEI Project 1602940
DWG. NO. **C-04**
SHEET NO. **6 OF 20**

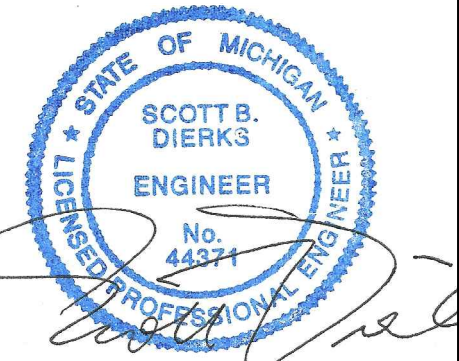
For Construction



**LOWER MUSKEGON
 RIVER HYDROLOGIC
 RECONNECTION**

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Designed: B. Majka
 Checked: S. Dierks
 Drawn: I. Roberts
 Submitted By: B. Majka
 P.E. No.: 44371

**PROPOSED
 GRADING PLAN**

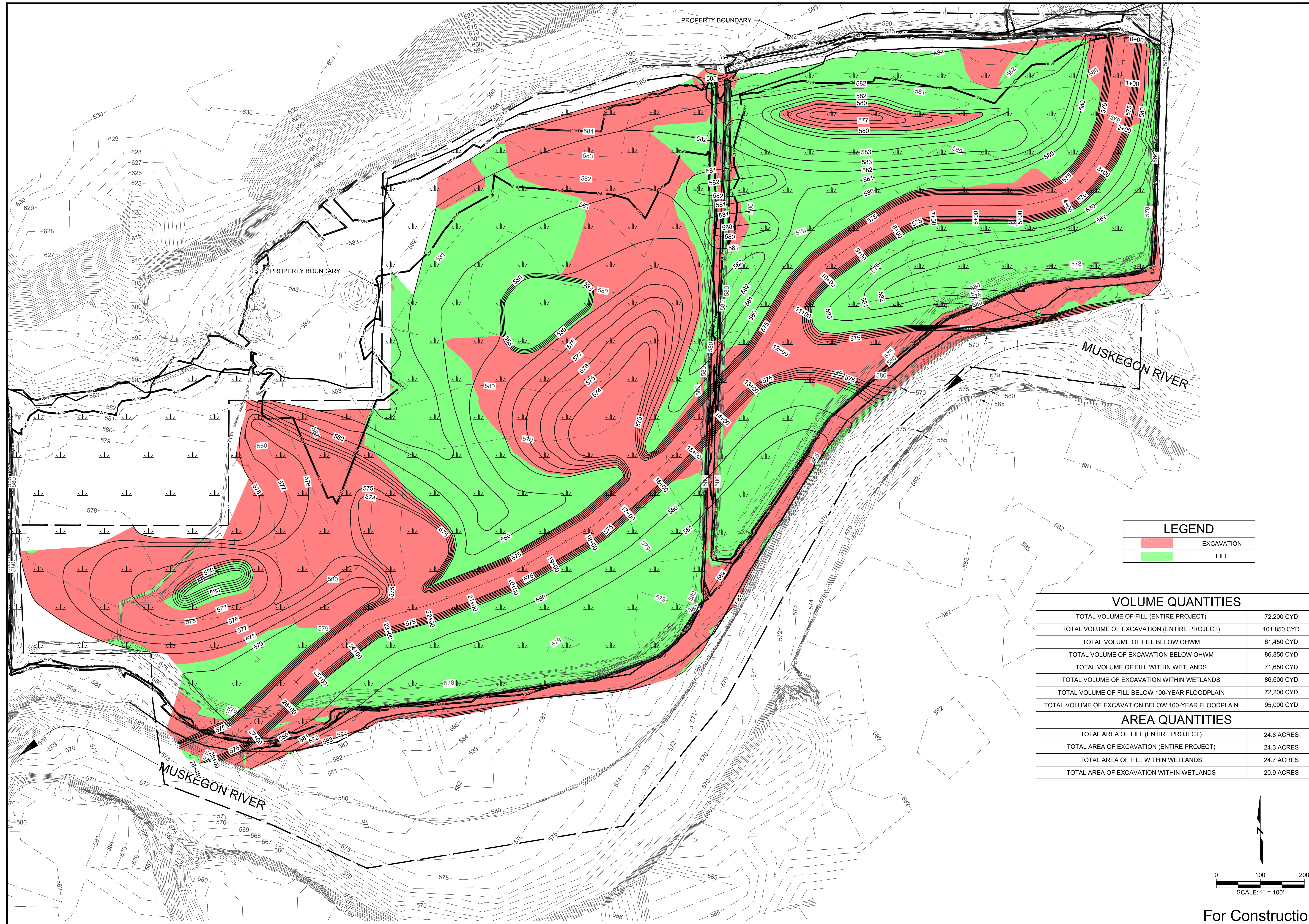
GEI Project 1602940
 DWG. NO.
C-05
 SHEET NO.
7 OF 20

NOTES:
 1. EXCAVATED MATERIAL SHALL BE PLACED ON SITE AS PER THE SHOWN GRADING PLAN. ALL EXCESS MATERIAL SHALL BE DISPOSED OF AT A TYPE 2 LANDFILL UNLESS OTHERWISE NOTED.

LEGEND
 ACCESS ROAD
 4-6 INCH STONE

0 100 200
 SCALE: 1" = 100'

For Construction



LEGEND

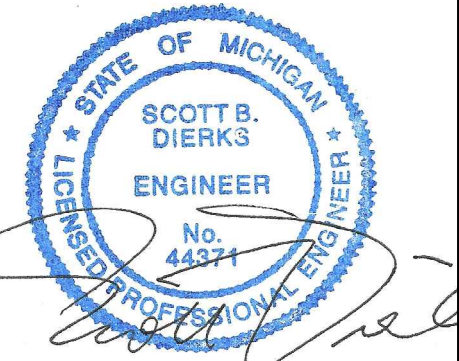
	EXCAVATION
	FILL

VOLUME QUANTITIES	
TOTAL VOLUME OF FILL (ENTIRE PROJECT)	72,200 CYD
TOTAL VOLUME OF EXCAVATION (ENTIRE PROJECT)	101,850 CYD
TOTAL VOLUME OF FILL BELOW OHWM	61,450 CYD
TOTAL VOLUME OF EXCAVATION BELOW OHWM	86,850 CYD
TOTAL VOLUME OF FILL WITHIN WETLANDS	71,650 CYD
TOTAL VOLUME OF EXCAVATION WITHIN WETLANDS	86,600 CYD
TOTAL VOLUME OF FILL BELOW 100-YEAR FLOODPLAIN	72,200 CYD
TOTAL VOLUME OF EXCAVATION BELOW 100-YEAR FLOODPLAIN	95,000 CYD
AREA QUANTITIES	
TOTAL AREA OF FILL (ENTIRE PROJECT)	24.8 ACRES
TOTAL AREA OF EXCAVATION (ENTIRE PROJECT)	24.3 ACRES
TOTAL AREA OF FILL WITHIN WETLANDS	24.7 ACRES
TOTAL AREA OF EXCAVATION WITHIN WETLANDS	20.9 ACRES

**LOWER MUSKEGON
 RIVER HYDROLOGIC
 RECONNECTION**

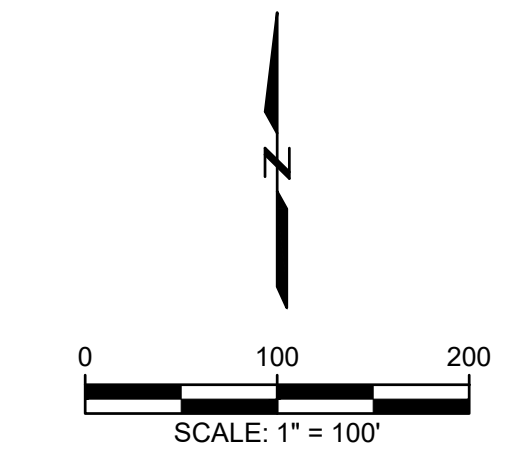
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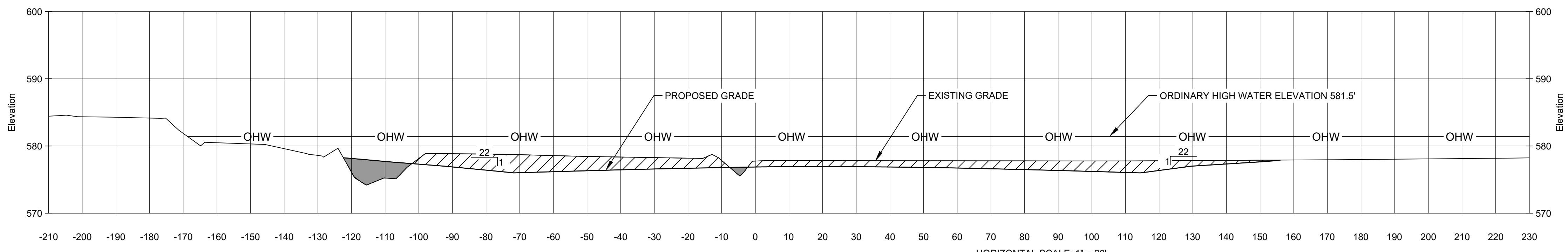
Designed: B. Majka
 Checked: S. Dierks
 Drawn: I. Roberts
 Submitted By: B. Majka
 P.E. No.: 44371

**VISUAL DISPLAY OF
 PROPOSED
 EXCAVATION AND
 FILL**

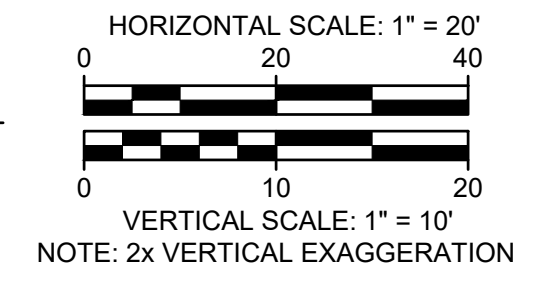


For Construction

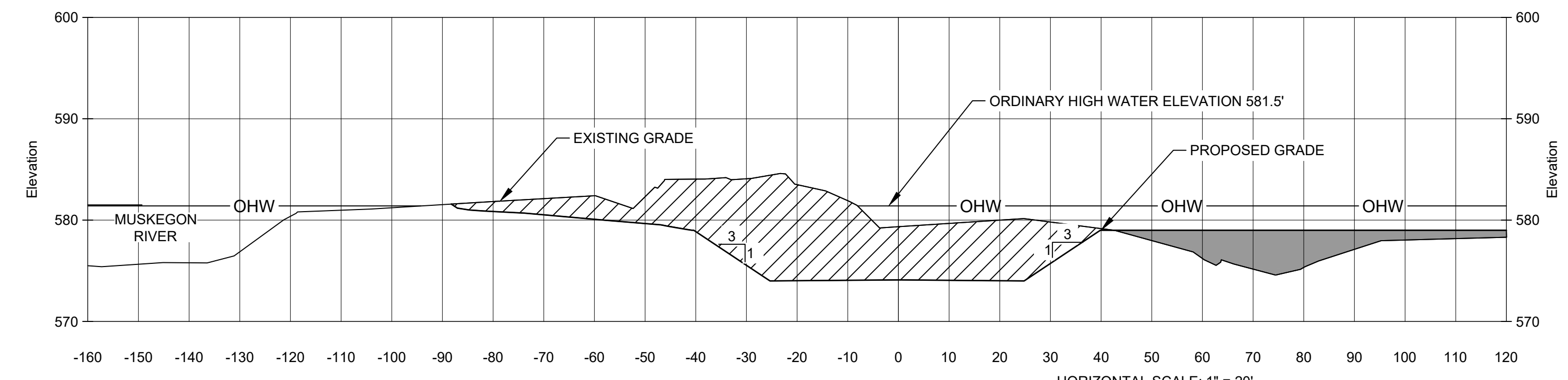
I:\geiconsulta B:\Working\WMSRDC\1602940 Lower Muskegon River\00_CAD\Design\Production\PLTS_Visual_Grading.dwg - 12/6/2018



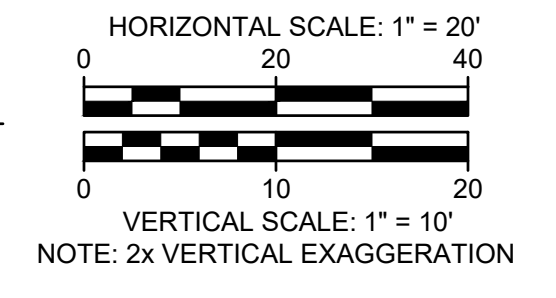
(A-A) SECTION STA 28+20
(C-05) FLOODPLAIN



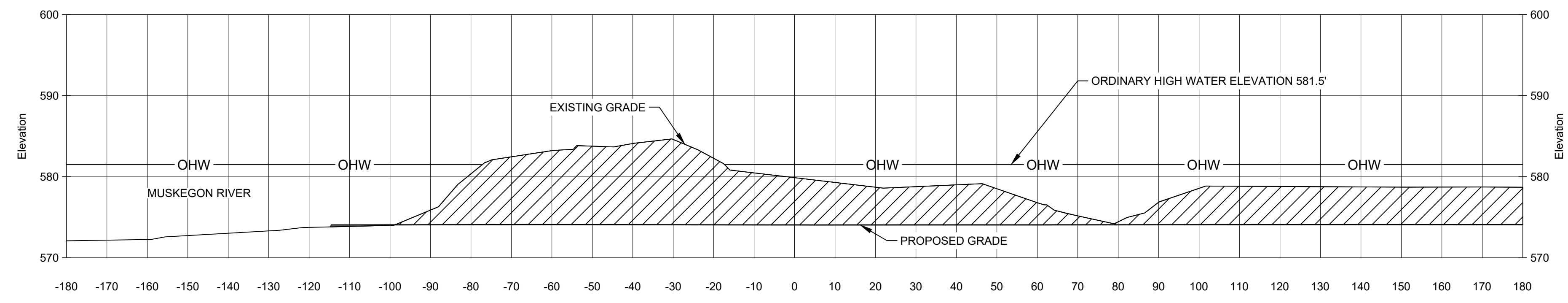
SECTION STA 28+20 EARTH EXCAVATION AREAS	
CUT	700 SFT
FILL	100 SFT



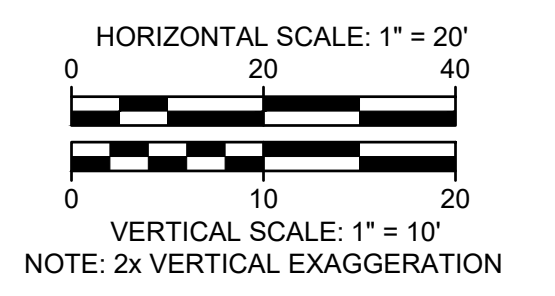
(B-B) SECTION STA 27+30
(C-05) MAIN CHANNEL ENTRANCE



SECTION STA 27+30 EARTH EXCAVATION AREAS	
CUT	1215 SFT
FILL	305 SFT



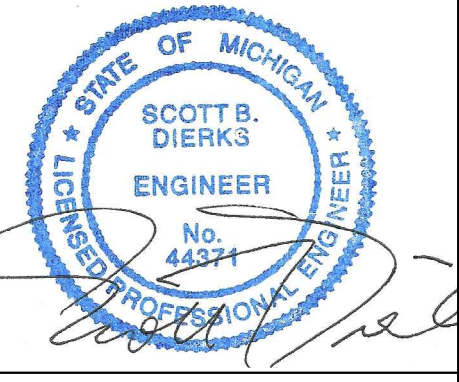
(C-C) PROFILE STA 25+50 TO 29+00
(C-05) MAIN CHANNEL BOTTOM



SECTION STA 25+50 TO 29+00 EARTH EXCAVATION AREAS	
CUT	2930 SFT
FILL	5 SFT

Attention: 1"
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0	6/1/2018	JPA DRAWINGS	SD




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LEGEND	
	CUT
	FILL

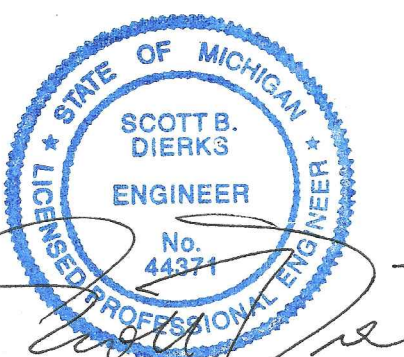
PROPOSED
 CROSS
 SECTIONS
 (1 OF 5)

GEI Project 1602940
 DWG. NO.
C-07
 SHEET NO.
 9 OF 20

For Construction

Attention:

 If this scale bar does not measure
 1" then drawing is not original scale.

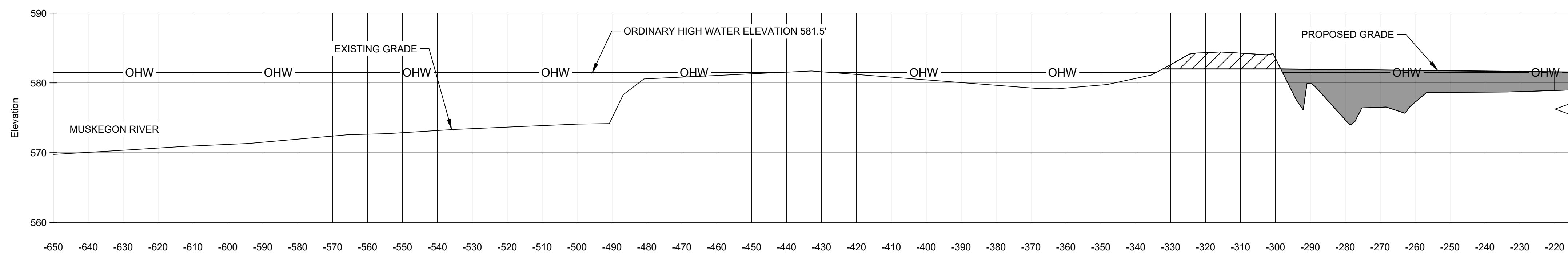
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0	6/1/2018	JPA DRAWINGS	SD



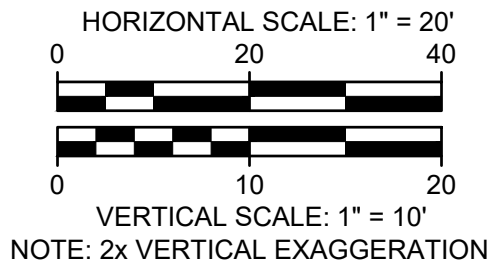
Designed: B. Majka
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Drawn: I. Roberts
Submitted By: B. Majka
P.E. No.: 44371

**PROPOSED
 CROSS
 SECTIONS
 (2 OF 5)**

GEI Project 1602940
 DWG. NO.
C-08
 SHEET NO.
10 OF 20

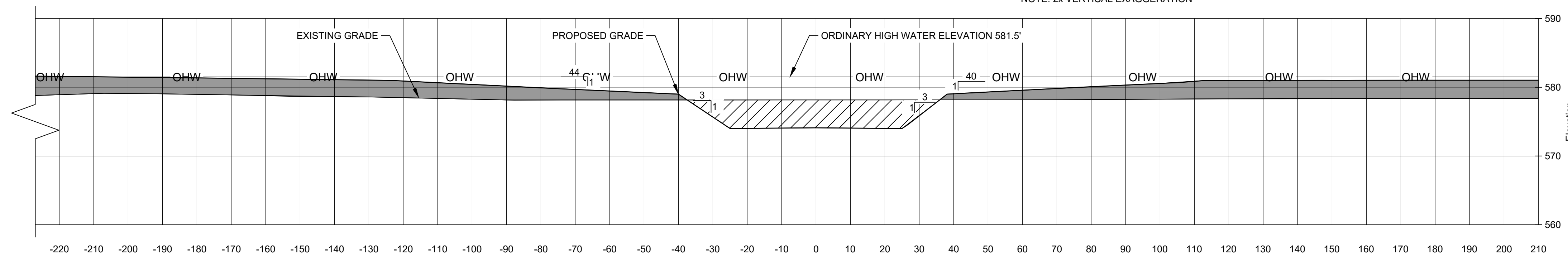


(D-D)
(C-05) SECTION STA 19+50 650' to 220' LEFT OF CL
 MAIN CHANNEL BOTTOM

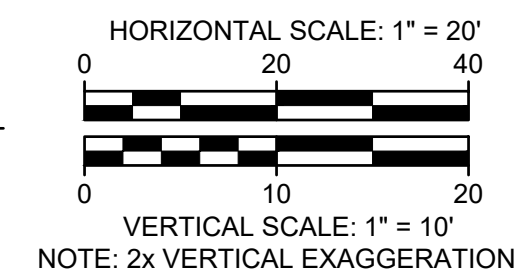


**SECTION STA 19+50
 EARTH EXCAVATION AREAS**

CUT	640 SFT
FILL	2170 SFT



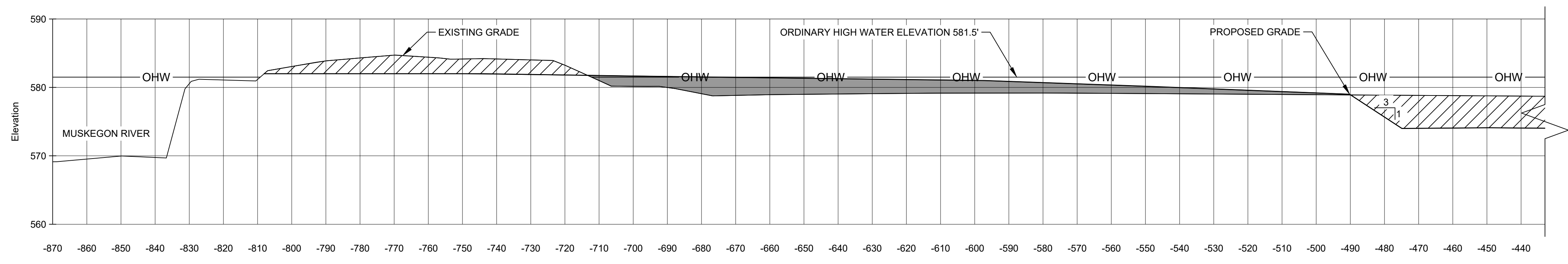
(D-D)
(C-05) SECTION STA 19+50 220' LEFT OF CL TO 210' RIGHT OF CL
 MAIN CHANNEL BOTTOM



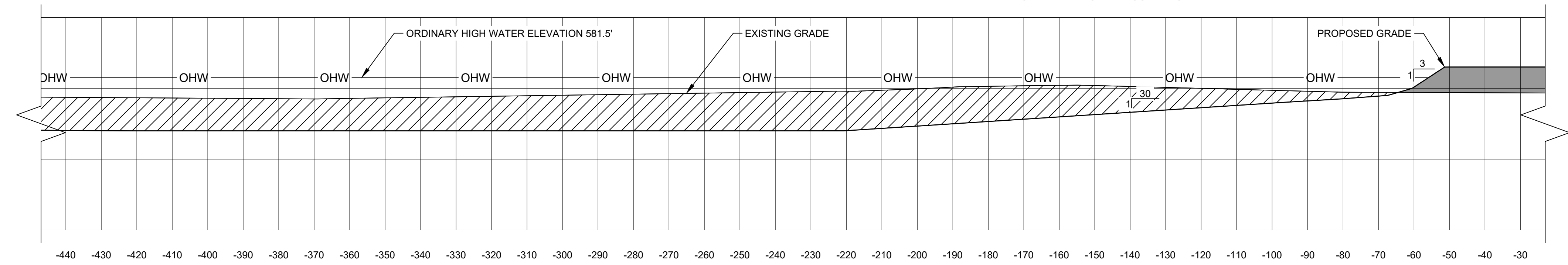
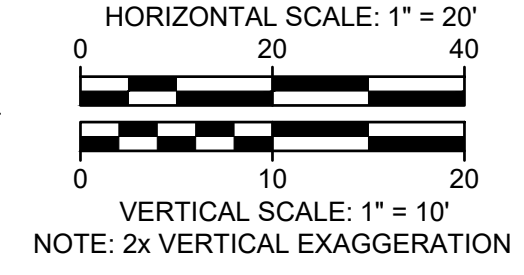
LEGEND

	CUT
	FILL

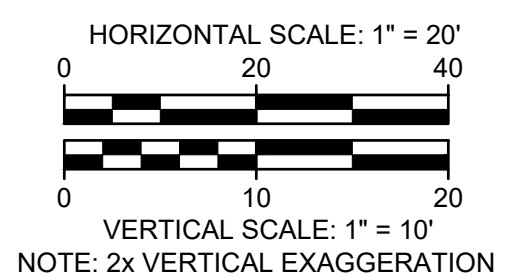
For Construction



E-E
C-05 SECTION STA 16+20 870' TO 440' LEFT OF CL
 FLOODPLAIN

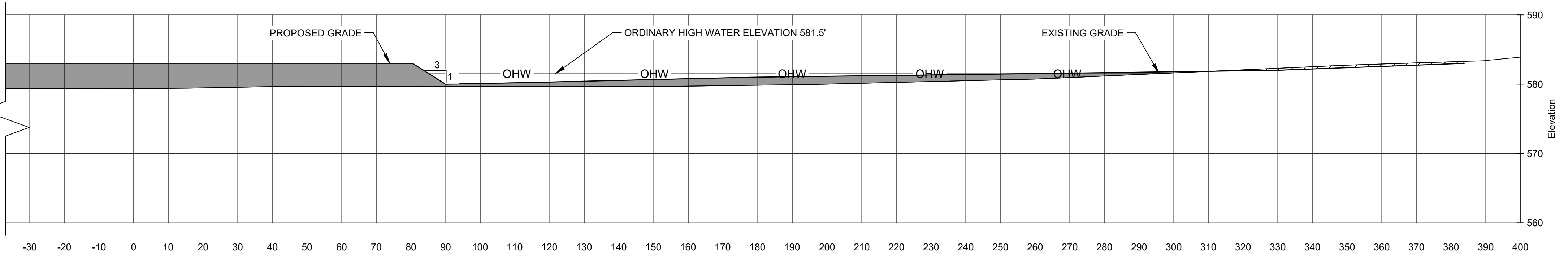


E-E
C-05 SECTION STA 16+20 440' TO 30' LEFT OF CL
 FLOODPLAIN

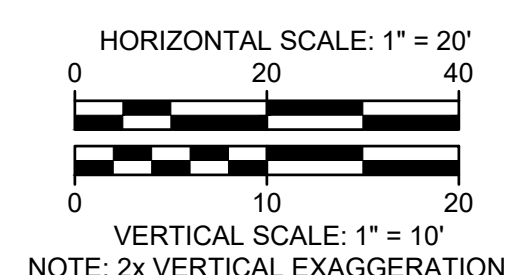


**SECTION STA 16+20
 EARTH EXCAVATION AREAS**

CUT	4000 SFT
FILL	2020 SFT

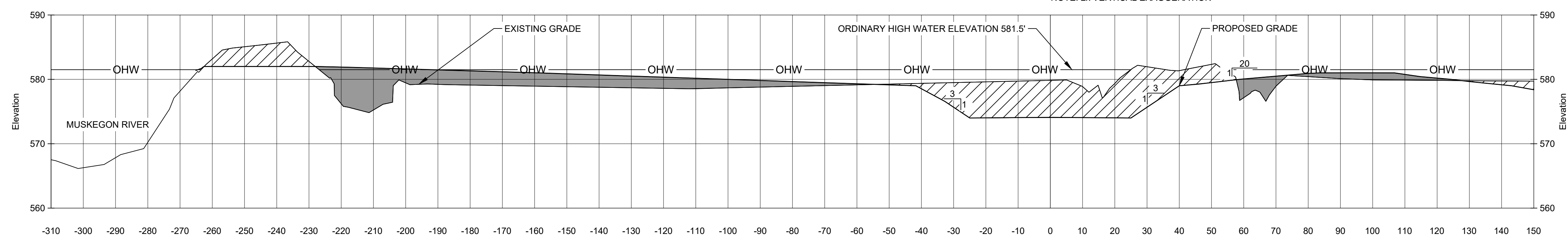


E-E
C-05 SECTION STA 16+20 30' LEFT OF CL TO 400' RIGHT OF CL
 FLOODPLAIN

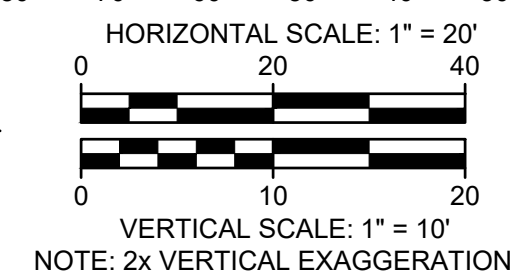


LEGEND

	CUT
	FILL



F-F
C-05 SECTION 13+50
 MAIN CHANNEL BOTTOM

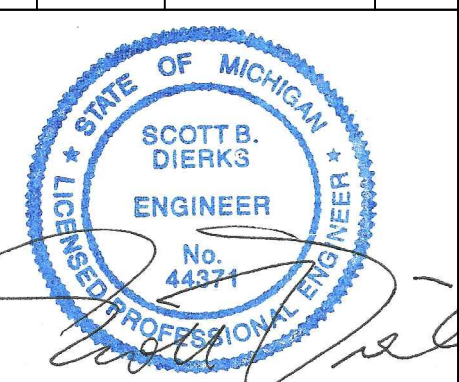


**SECTION STA 13+50
 EARTH EXCAVATION AREAS**

CUT	1085 SFT
FILL	845 SFT

Attention: 1"
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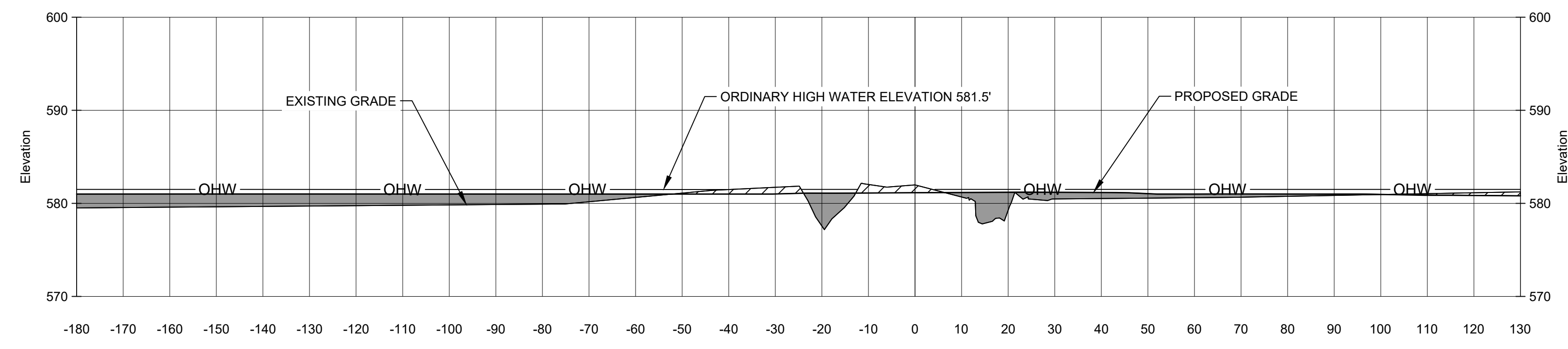


Designed: B. Majka
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 P.E. No.: 44371

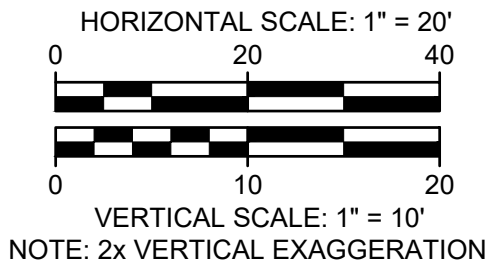
**PROPOSED
 CROSS
 SECTIONS
 (3 OF 5)**

GEI Project 1602940
 DWG. NO.
C-09
 SHEET NO.
11 OF 20

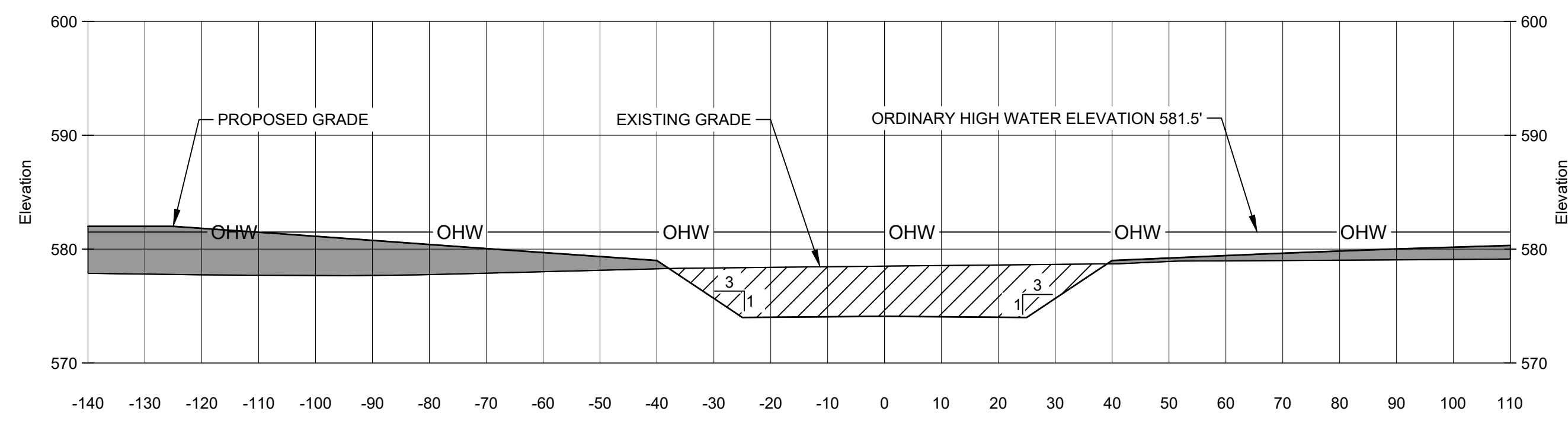
For Construction



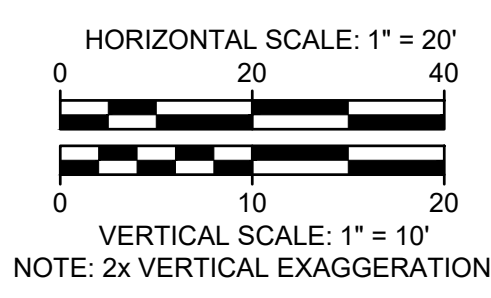
G-G
C-05 SECTION 12+70
 FLOODPLAIN



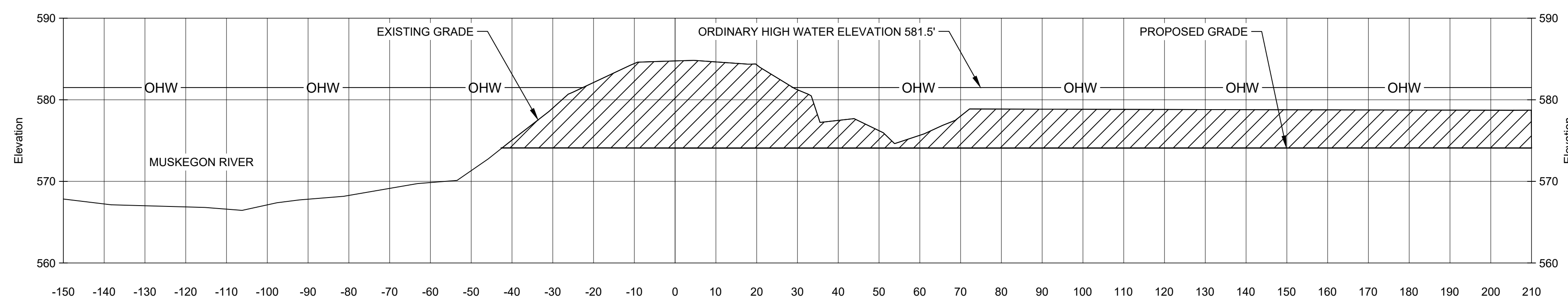
SECTION STA 12+70 EARTH EXCAVATION AREAS	
CUT	65 SFT
FILL	455 SFT



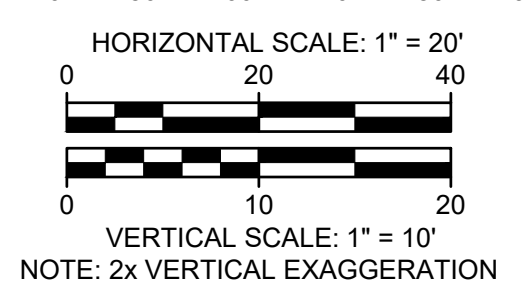
H-H
C-05 SECTION 8+60
 MAIN CHANNEL BOTTOM



SECTION STA 8+60 EARTH EXCAVATION AREAS	
CUT	570 SFT
FILL	680 SFT



I-I
C-05 SECTION 12+00
 MAIN CHANNEL ENTRANCE

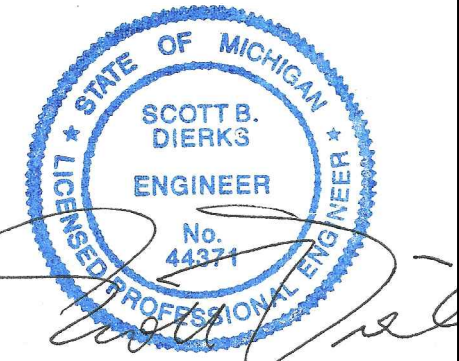


SECTION STA 12+00 EARTH EXCAVATION AREAS	
CUT	2730 SFT
FILL	0 SFT

LEGEND	
	CUT
	FILL

Attention: 1"
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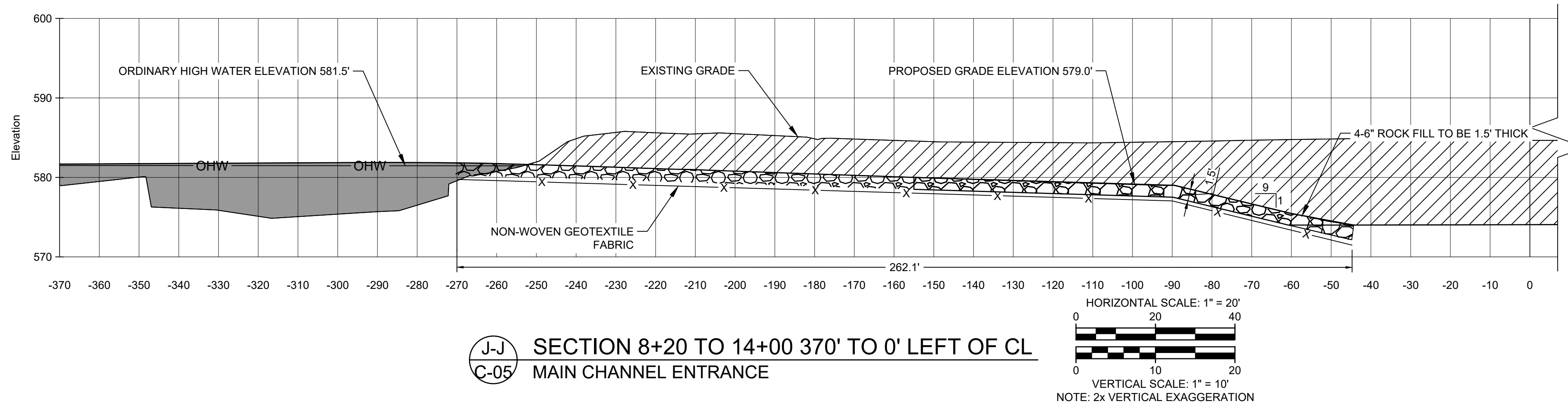


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 Drawn: I. Roberts
 Submitted By: B. Majka
 P.E. No.: 44371

PROPOSED
 CROSS
 SECTIONS
 (4 OF 5)

GEI Project 1602940
 DWG. NO.
C-10
 SHEET NO.
 12 OF 20

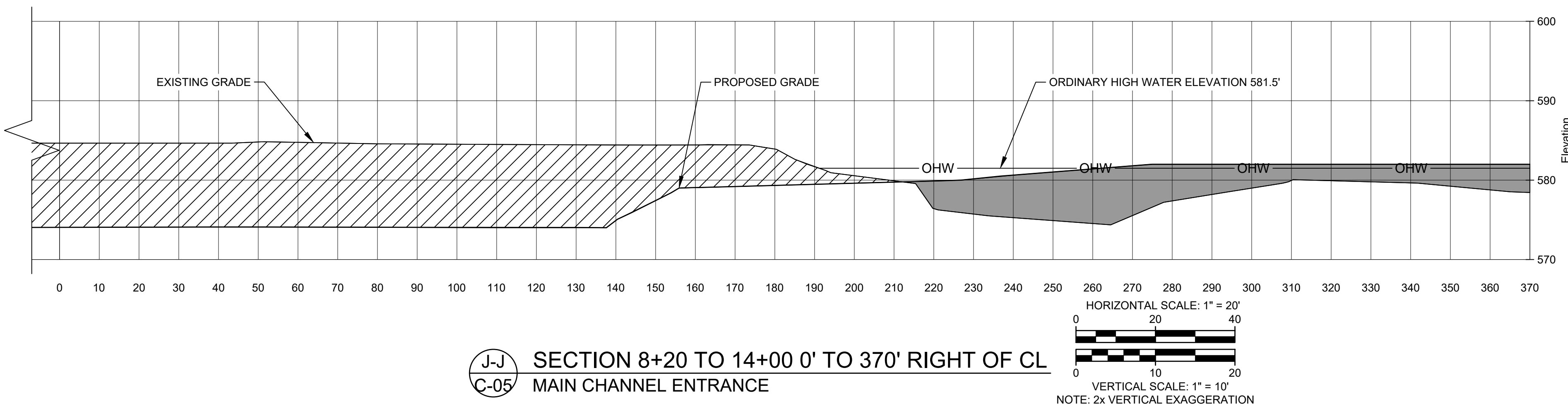
For Construction



J-J SECTION 8+20 TO 14+00 370' TO 0' LEFT OF CL
C-05 MAIN CHANNEL ENTRANCE

LEGEND

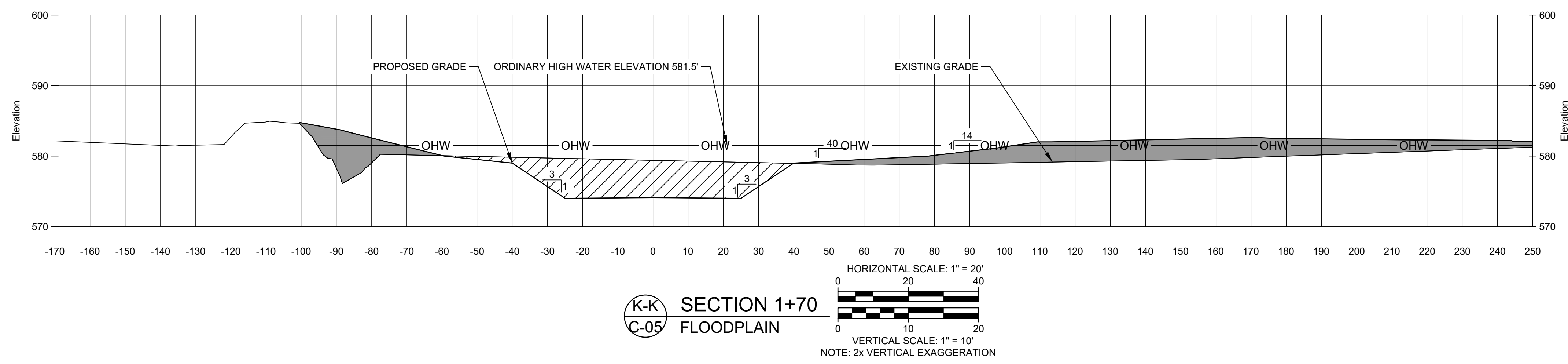
	CUT
	FILL



J-J SECTION 8+20 TO 14+00 0' TO 370' RIGHT OF CL
C-05 MAIN CHANNEL ENTRANCE

**SECTION STA 8+20 TO 14+00
 EARTH EXCAVATION AREAS**

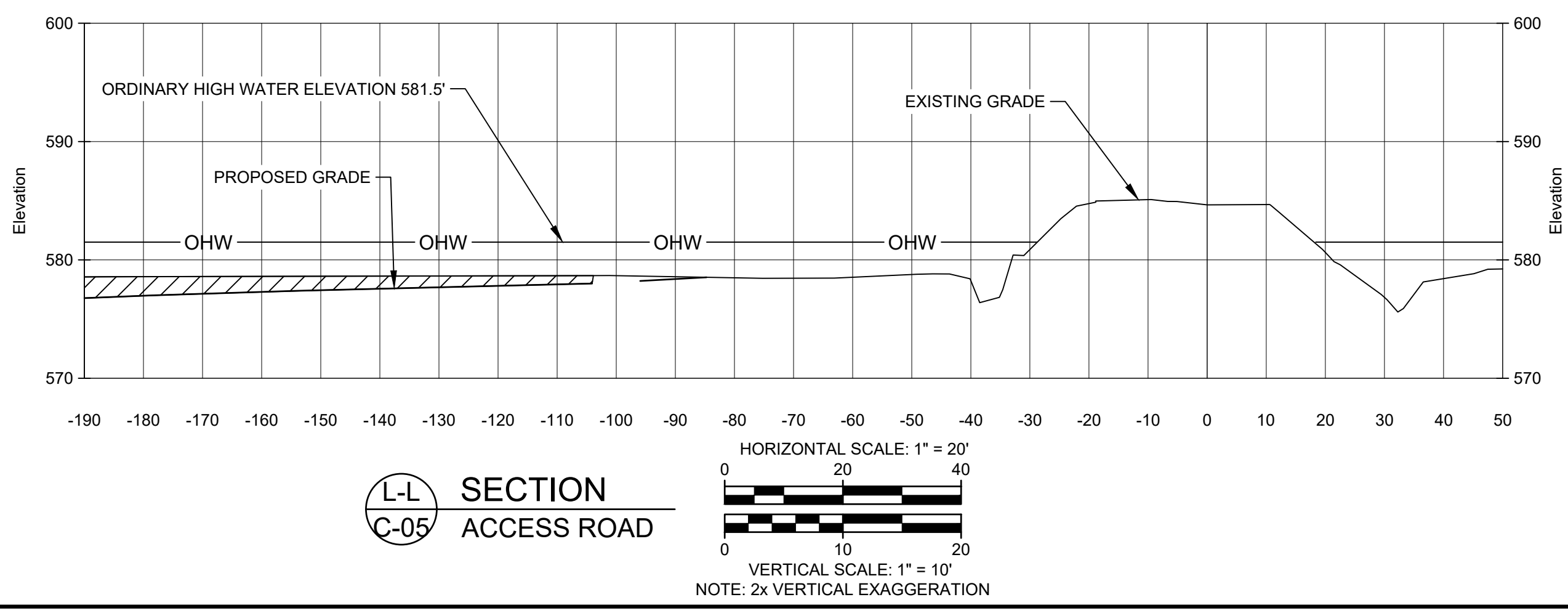
CUT	6715 SFT
FILL	2260 SFT



K-K SECTION 1+70
C-05 FLOODPLAIN

**SECTION STA 1+70
 EARTH EXCAVATION AREAS**

CUT	725 SFT
FILL	1045 SFT



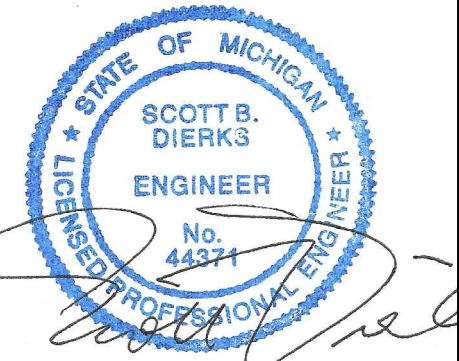
L-L SECTION
C-05 ACCESS ROAD

**SECTION
 EARTH EXCAVATION AREAS**

CUT	205 SFT
FILL	0 SFT

Attention: 1"
 If this scale bar does not measure 1" then drawing is not original scale.

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0	6/1/2018	JPA DRAWINGS	SD



Designed: B. Majka
 Checked: S. Dierks
 Drawn: I. Roberts
 Submitted By: B. Majka
 P.E. No.: 44371

**PROPOSED
 CROSS
 SECTIONS
 (5 OF 5)**

GEI Project 1602940
 DWG. NO.
C-11
 SHEET NO.
13 OF 20

For Construction

**LOWER MUSKEGON
 RIVER HYDROLOGIC
 RECONNECTION**

Attention: 1"
 If this scale bar does not measure
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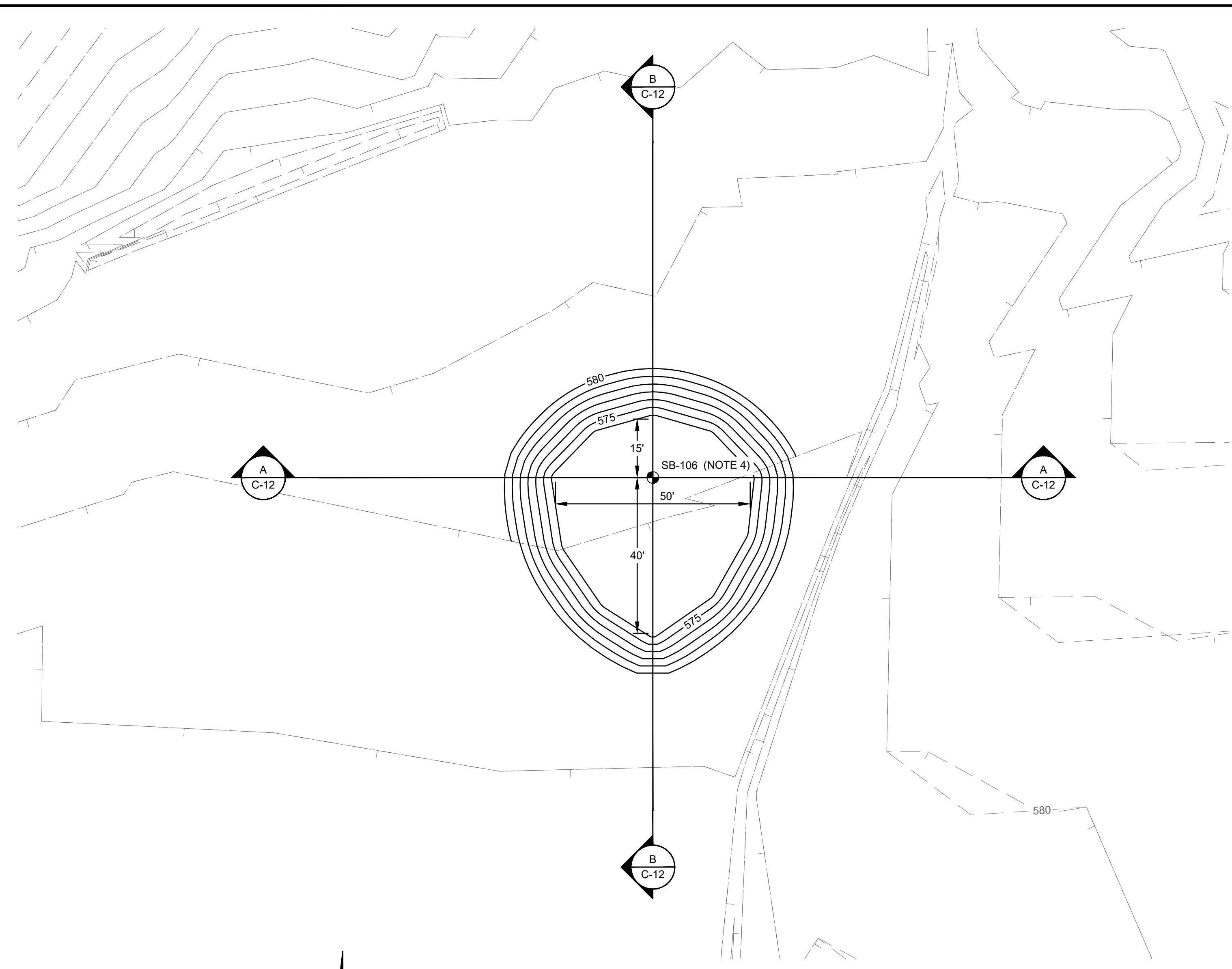
NO.	DATE	ISSUE/REVISION	APP
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0	6/1/2018	JPA DRAWINGS	SD



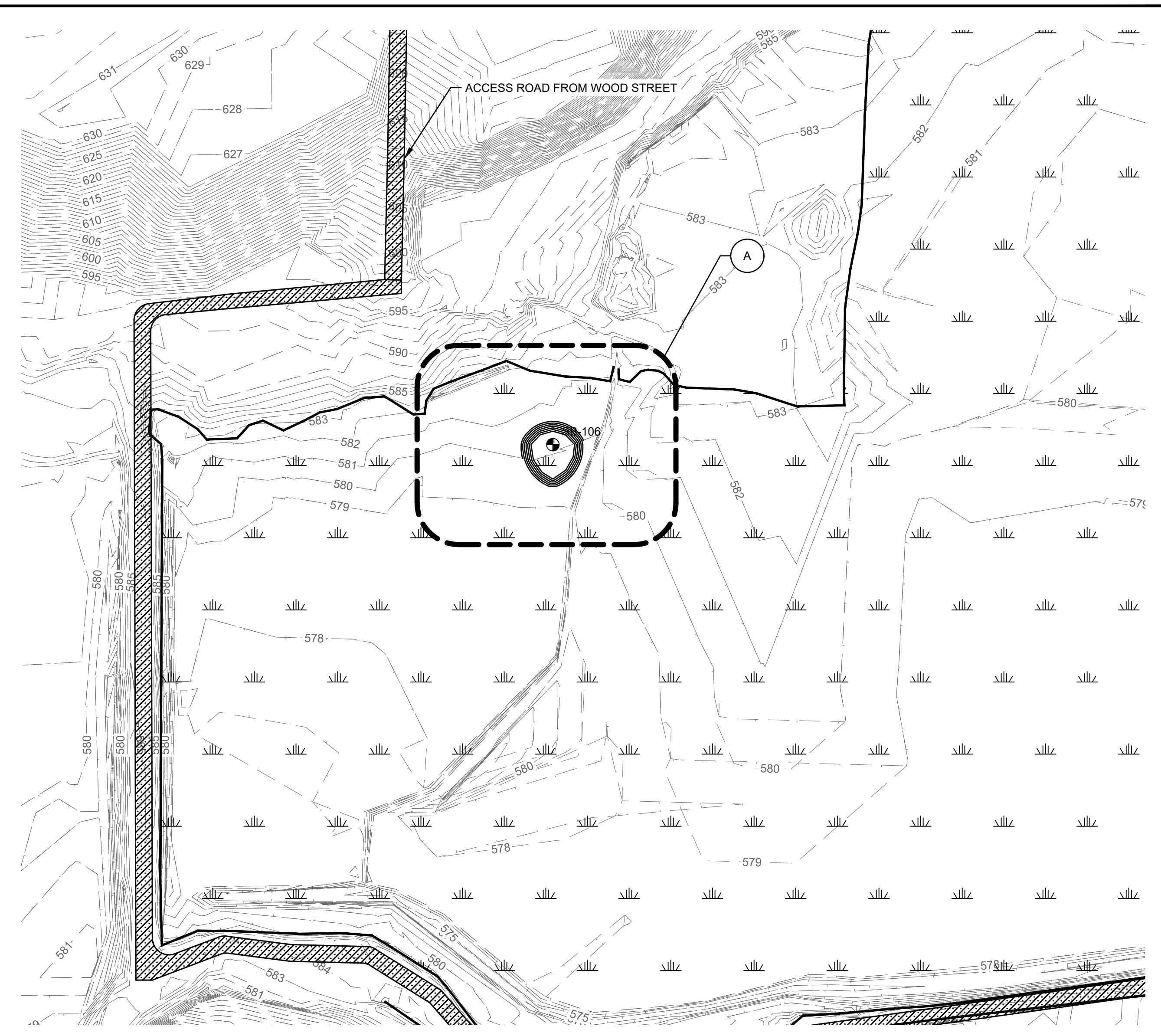
Designed: B. Majka
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 Submitted By: B. Majka
 P.E. No.: 44371

**SB-106 SOIL
 REMOVAL
 DIAGRAM**

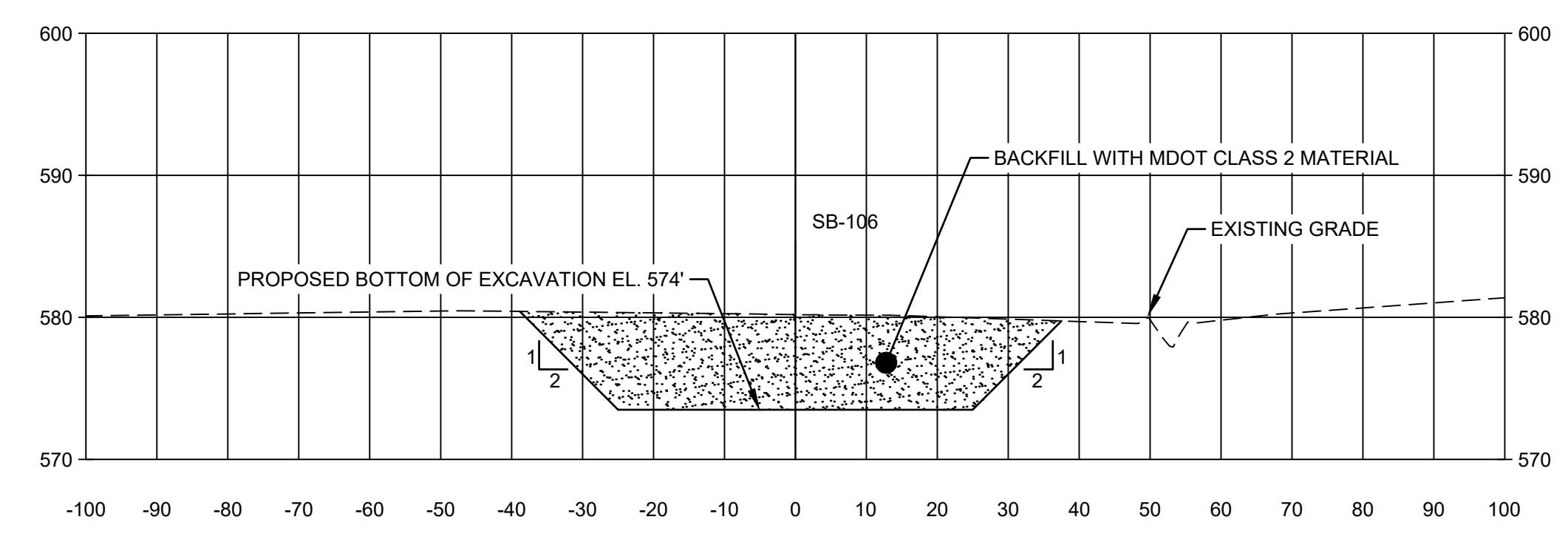
GEI Project 1602940
 DWG. NO.
C-12
 SHEET NO.
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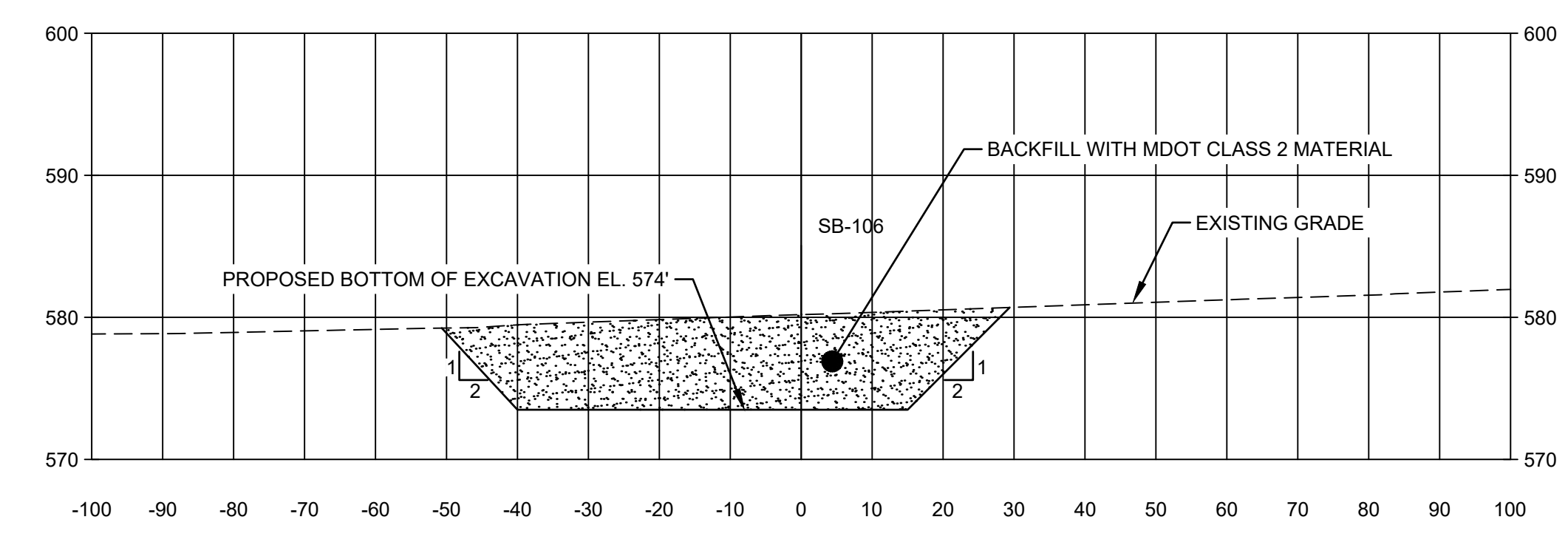
(A) DETAIL
 - SB-106 EXCAVATION
 SCALE: 1" = 20'



**SB-106 SITE LOCATION
 PLAN**
 SCALE: 1" = 100'



(A-A) SECTION
 C-12 SB-106 EXCAVATION
 SCALE: 1" = 20'



(B-B) SECTION
 C-12 SB-106 EXCAVATION
 SCALE: 1" = 20'

QUANTITIES	
EXCAVATION	775 CYD
FILL	775 CYD

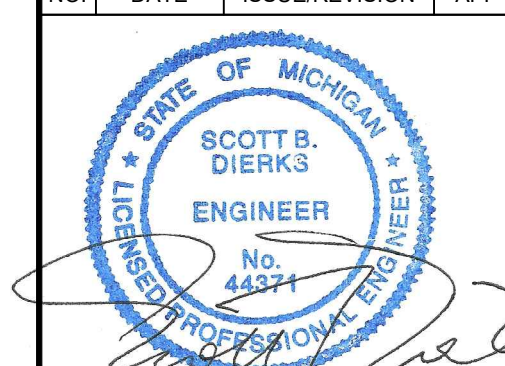
- NOTES:**
- SOIL AT THIS LOCATION CONTAINS SEVERAL CONTAMINANTS THAT EXCEED MDEQ PART 201 CLEANUP CRITERIA. SOIL RESULTS ARE INCLUDED IN THE SPECIFICATIONS.
 - SOIL EXCAVATED AT THE LOCATION SHOWN ON THIS SHEET SHALL BE DISPOSED OF AS HAZARDOUS WASTE AT A TYPE 2 LANDFILL.
 - CONTRACTOR SHALL TAKE ALL NECESSARY SAFETY PRECAUTIONS, INCLUDING BUT NOT LIMITED TO THOSE DESCRIBED IN THE SPECIFICATIONS.
 - BORING SB-106 IS LOCATED AT 650,669.97 N, 12,626,470.86 E

For Construction

LOWER MUSKEGON RIVER HYDROLOGIC RECONNECTION

Attention: 1"
 If this scale bar does not measure 1" then drawing is not original scale.

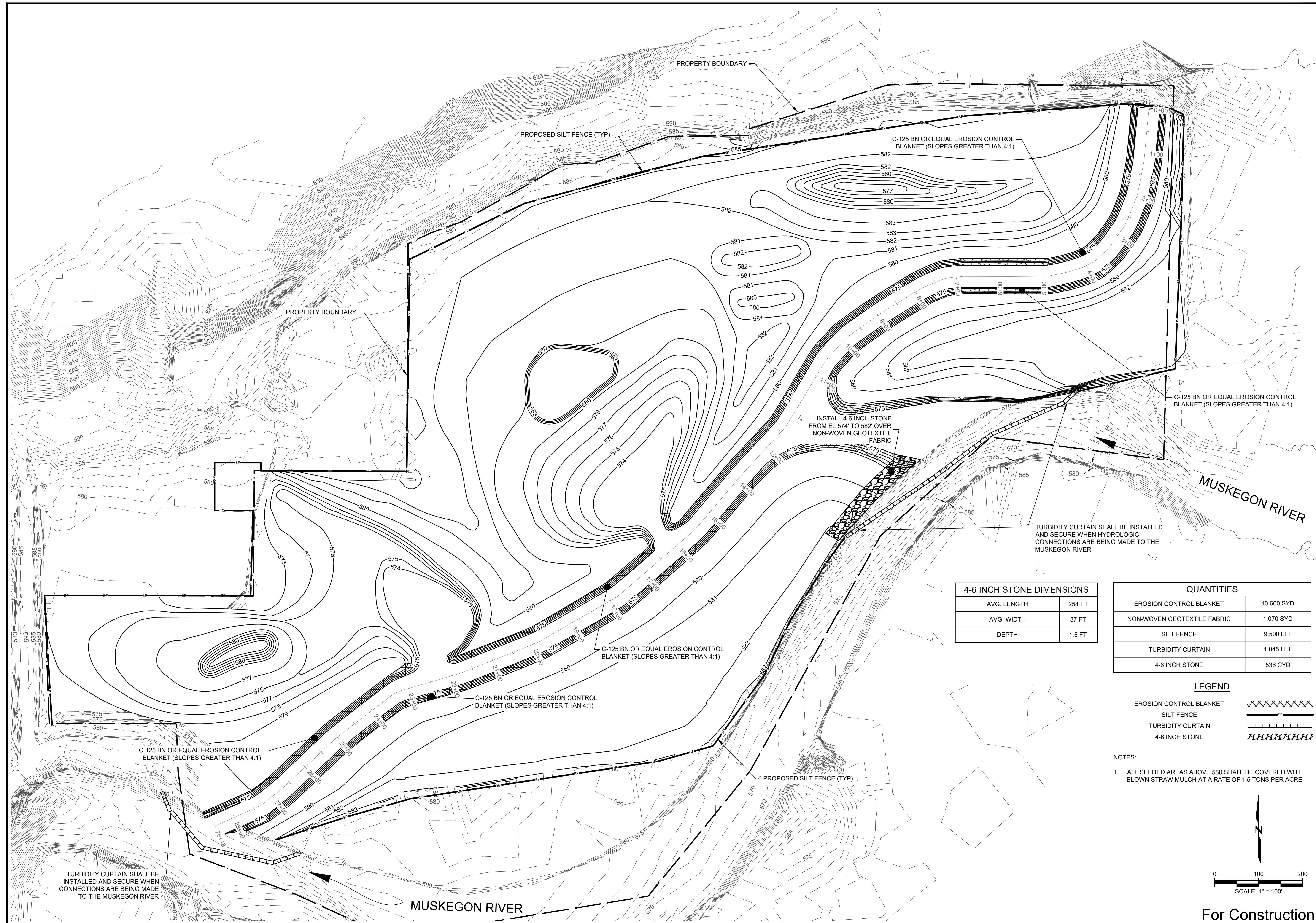
NO.	DATE	ISSUE/REVISION	APP
2	12/6/2018	CONSTRUCTION DRAWINGS	SD
1	11/16/2018	JPA DRAWINGS	SD
0	6/1/2018	JPA DRAWINGS	SD



Designed: B. Majka
 Checked: S. Dierks
 Drawn: I. Roberts
 Submitted By: B. Majka
 P.E. No.: 44371

SOIL EROSION AND SEDIMENTATION CONTROL PLAN

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 DWG. NO.
L-01
 SHEET NO.
15 OF 20



LOWER MUSKEGON RIVER HYDROLOGIC RECONNECTION

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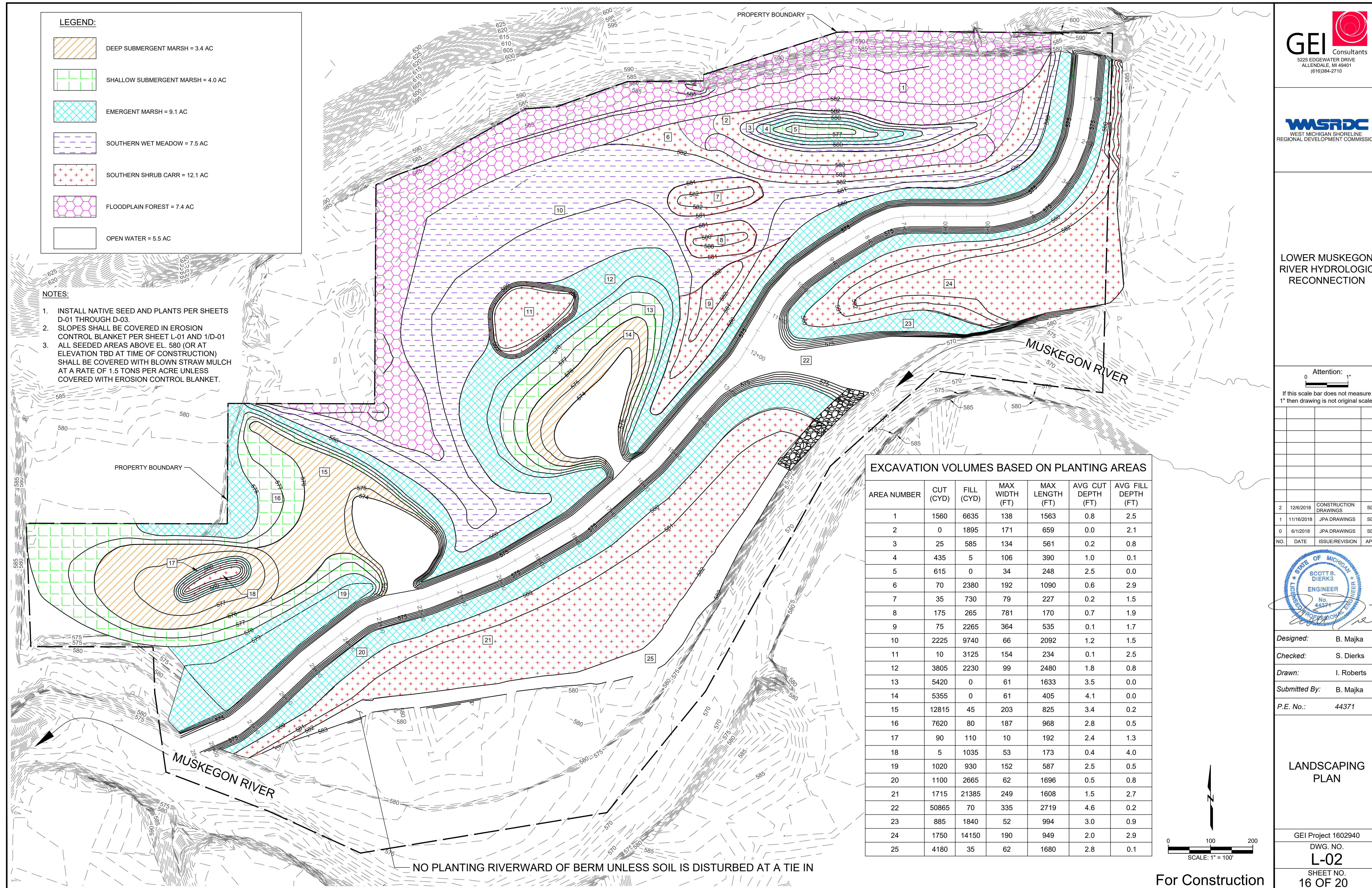
LANDSCAPING PLAN

GEI Project 1602940
 DWG. NO.
L-02
 SHEET NO.
16 OF 20

LEGEND:

- DEEP SUBMERGENT MARSH = 3.4 AC
- SHALLOW SUBMERGENT MARSH = 4.0 AC
- EMERGENT MARSH = 9.1 AC
- SOUTHERN WET MEADOW = 7.5 AC
- SOUTHERN SHRUB CARR = 12.1 AC
- FLOODPLAIN FOREST = 7.4 AC
- OPEN WATER = 5.5 AC

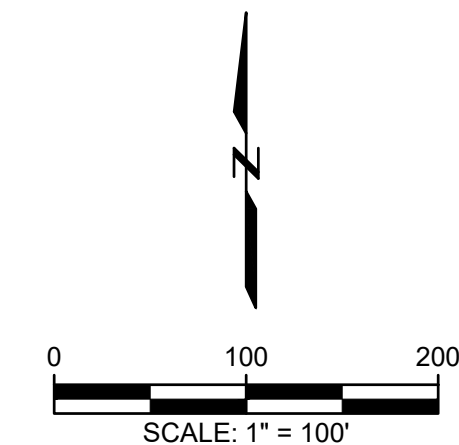
- NOTES:**
- INSTALL NATIVE SEED AND PLANTS PER SHEETS D-01 THROUGH D-03.
 - SLOPES SHALL BE COVERED IN EROSION CONTROL BLANKET PER SHEET L-01 AND 1/D-01
 - ALL SEEDED AREAS ABOVE EL. 580 (OR AT ELEVATION TBD AT TIME OF CONSTRUCTION) SHALL BE COVERED WITH BLOWN STRAW MULCH AT A RATE OF 1.5 TONS PER ACRE UNLESS COVERED WITH EROSION CONTROL BLANKET.



EXCAVATION VOLUMES BASED ON PLANTING AREAS














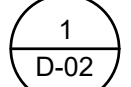
AREA NUMBER	CUT (CYD)	FILL (CYD)	MAX WIDTH (FT)	MAX LENGTH (FT)	AVG CUT DEPTH (FT)	AVG FILL DEPTH (FT)
1	1560	6635	138	1563	0.8	2.5
2	0	1895	171	659	0.0	2.1
3	25	585	134	561	0.2	0.8
4	435	5	106	390	1.0	0.1
5	615	0	34	248	2.5	0.0
6	70	2380	192	1090	0.6	2.9
7	35	730	79	227	0.2	1.5
8	175	265	781	170	0.7	1.9
9	75	2265	364	535	0.1	1.7
10	2225	9740	66	2092	1.2	1.5
11	10	3125	154	234	0.1	2.5
12	3805	2230	99	2480	1.8	0.8
13	5420	0	61	1633	3.5	0.0
14	5355	0	61	405	4.1	0.0
15	12815	45	203	825	3.4	0.2
16	7620	80	187	968	2.8	0.5
17	90	110	10	192	2.4	1.3
18	5	1035	53	173	0.4	4.0
19	1020	930	152	587	2.5	0.5
20	1100	2665	62	1696	0.5	0.8
21	1715	21385	249	1608	1.5	2.7
22	50865	70	335	2719	4.6	0.2
23	885	1840	52	994	3.0	0.9
24	1750	14150	190	949	2.0	2.9
25	4180	35	62	1680	2.8	0.1

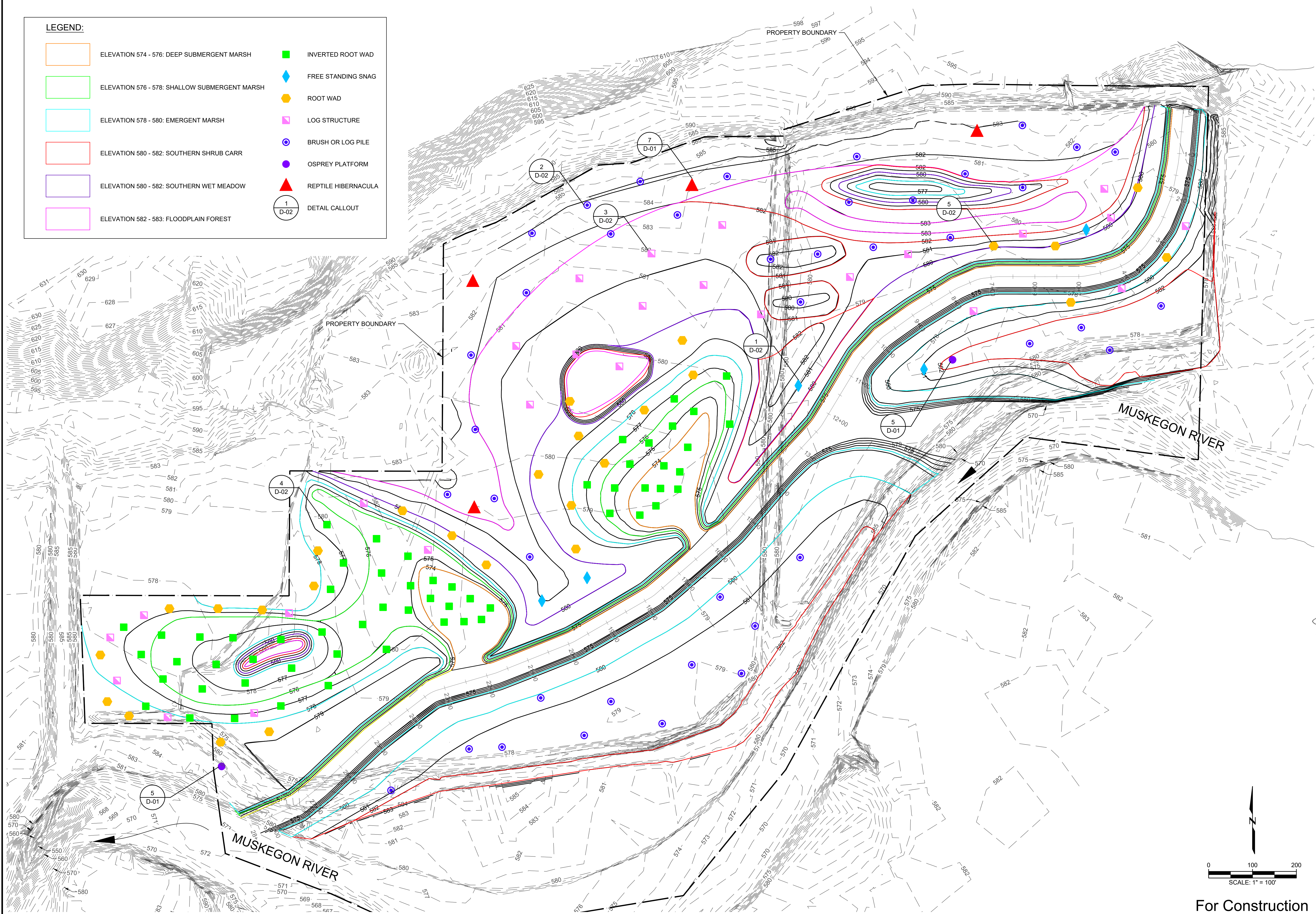
NO PLANTING RIVERWARD OF BERM UNLESS SOIL IS DISTURBED AT A TIE IN



For Construction

LEGEND:

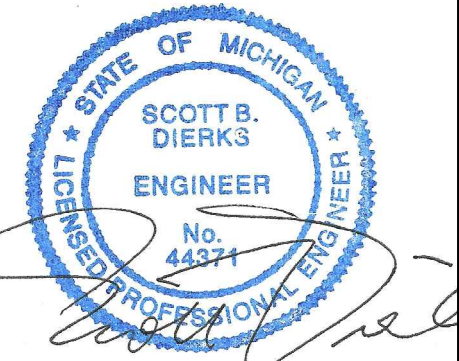
- | | | | |
|---|---|---|---------------------|
|  | ELEVATION 574 - 576: DEEP SUBMERGENT MARSH |  | INVERTED ROOT WAD |
|  | ELEVATION 576 - 578: SHALLOW SUBMERGENT MARSH |  | FREE STANDING SNAG |
|  | ELEVATION 578 - 580: EMERGENT MARSH |  | ROOT WAD |
|  | ELEVATION 580 - 582: SOUTHERN SHRUB CARR |  | LOG STRUCTURE |
|  | ELEVATION 580 - 582: SOUTHERN WET MEADOW |  | BRUSH OR LOG PILE |
|  | ELEVATION 582 - 583: FLOODPLAIN FOREST |  | OSPREY PLATFORM |
| | |  | REPTILE HIBERNACULA |
| | |  | DETAIL CALLOUT |



LOWER MUSKEGON RIVER HYDROLOGIC RECONNECTION

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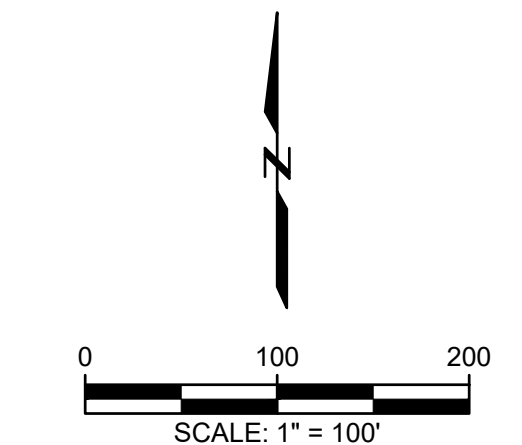
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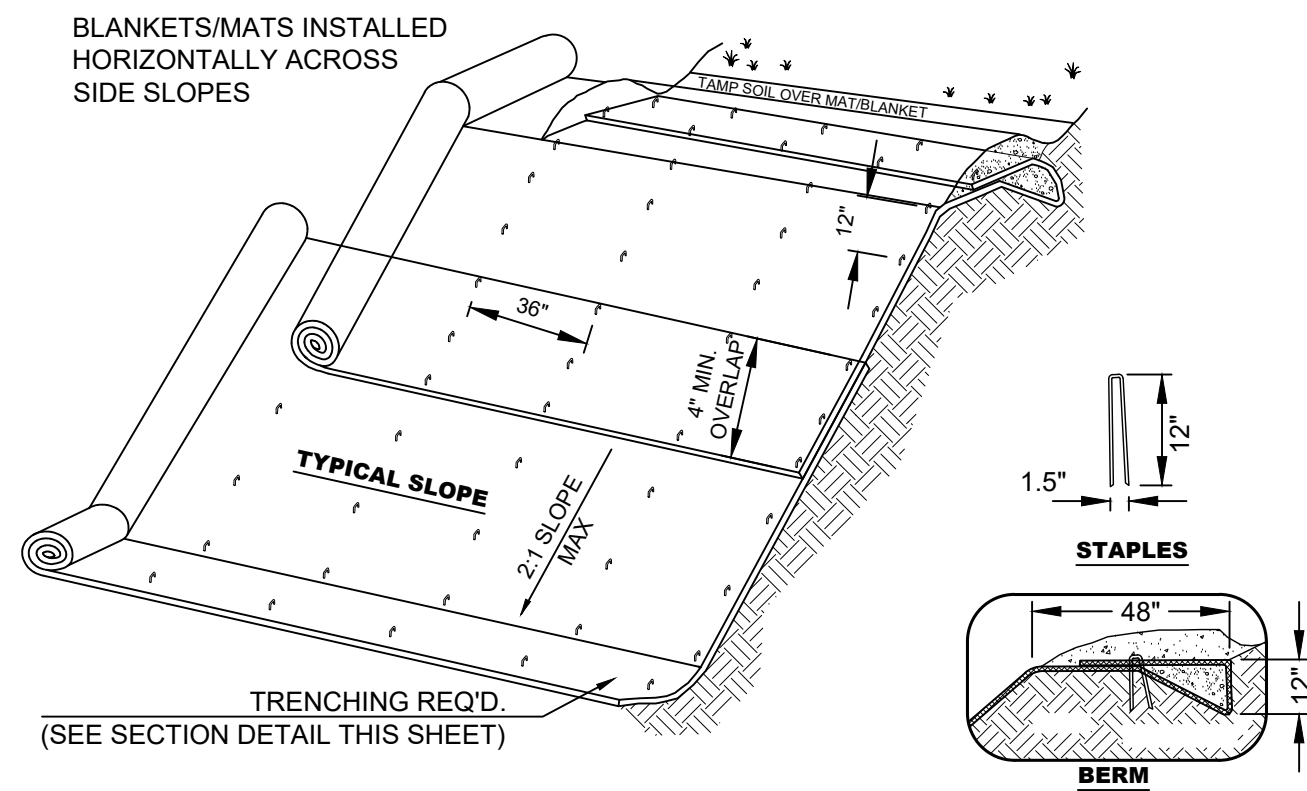
Designed: B. Majka
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WILDLIFE HABITAT STRUCTURES

GEI Project 1602940
 DWG. NO.
L-03
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17 OF 20

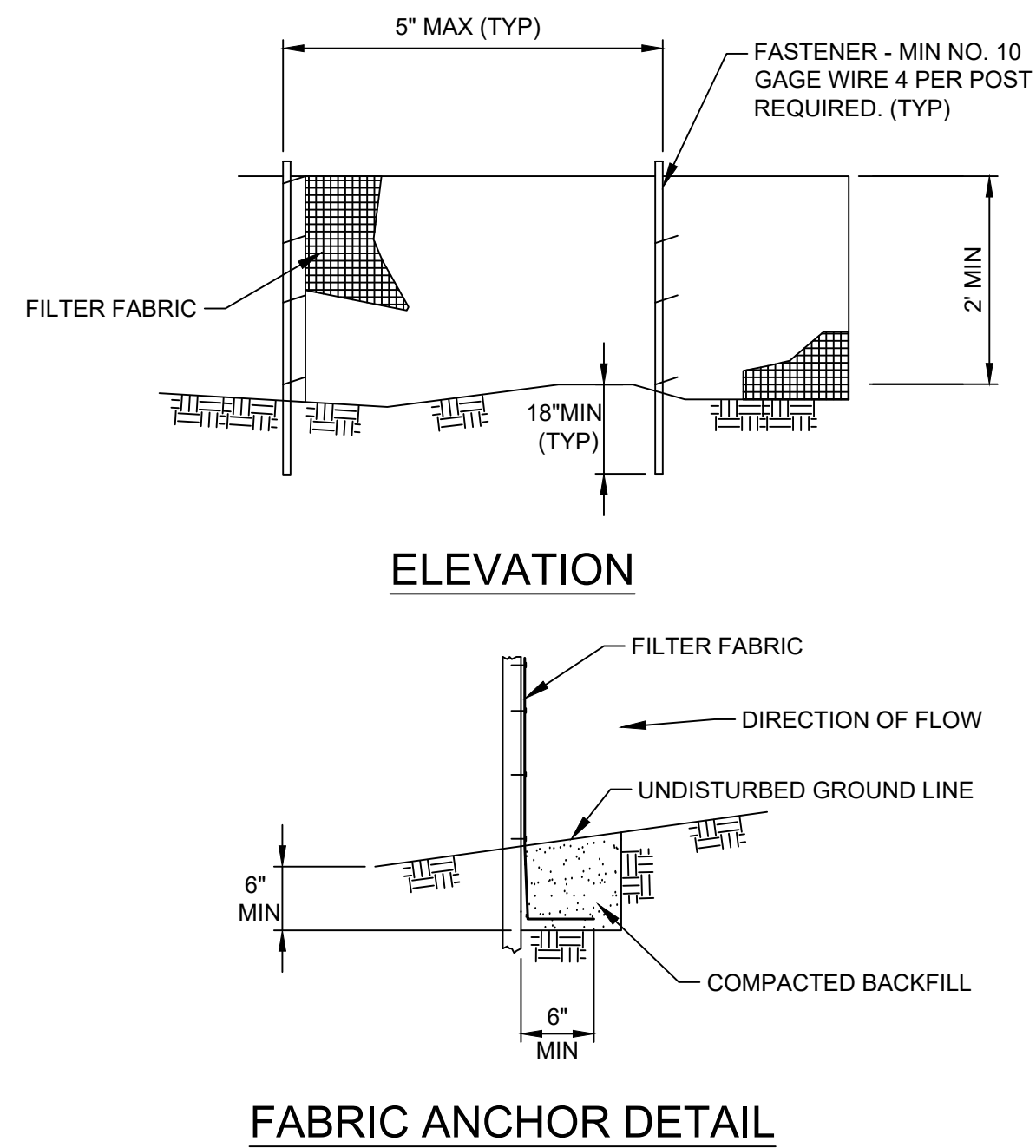


For Construction



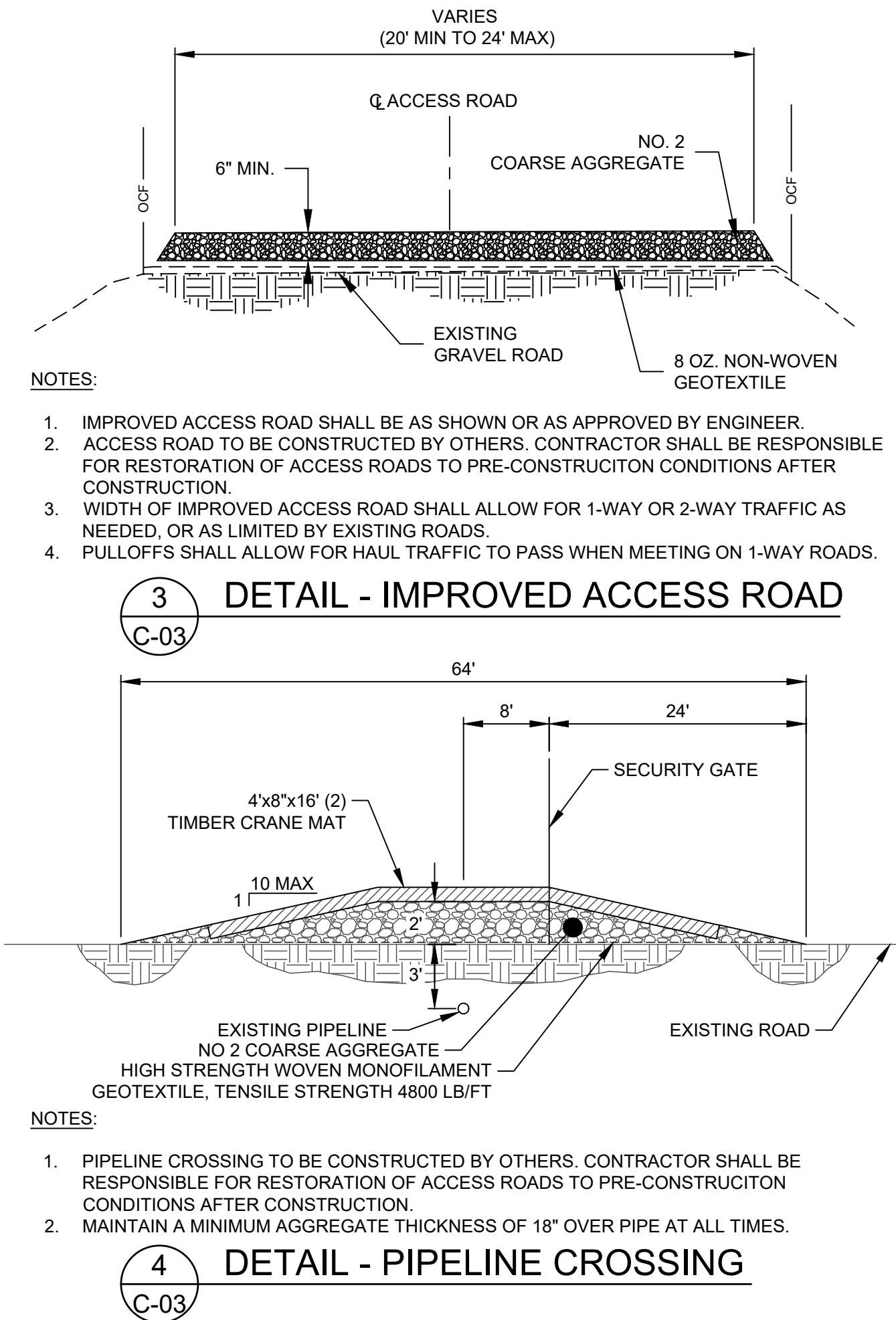
- NOTES:**
- SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS AND GRASS. MATS/BLANKETS SHALL HAVE GOOD SOIL CONTACT.
 - APPLY PERMANENT SEEDING BEFORE PLACING BLANKETS
 - LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.

1 **DETAIL - EROSION CONTROL BLANKET**
L-01 NAG C-125BN OR EQUAL



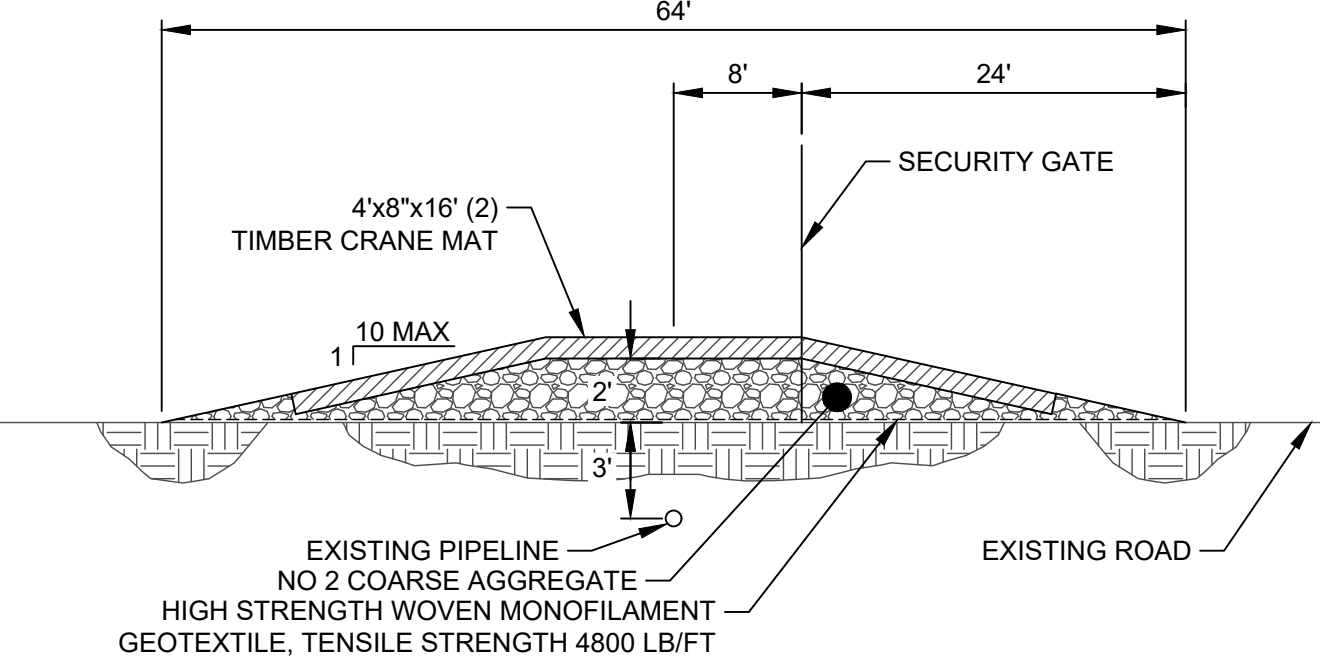
- NOTES:**
- TEMPORARY SEDIMENT FENCE SHALL BE INSTALLED PRIOR TO ANY GRADING WORK IN THE AREA TO BE PROTECTED. IT SHALL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD AND REMOVED IN CONJUNCTION WITH THE FINAL GRADING AND SITE STABILIZATION.
 - FILTER FABRIC SHALL MEET THE REQUIREMENTS OF MATERIAL SPECIFICATION 592 GEOTEXTILE TABLE 1 OR 2, CLASS L WITH EQUIVALENT OPENING SIZE OF AT LEAST 30 FOR NONWOVEN AND 50 FOR WOVEN.
 - FENCE POSTS SHALL BE EITHER WOOD POST WITH A MINIMUM CROSS-SECTIONAL AREA OF 3.0 SQ. IN. OR A STANDARD STEEL POST.

2 **DETAIL - SILT FENCE**
-



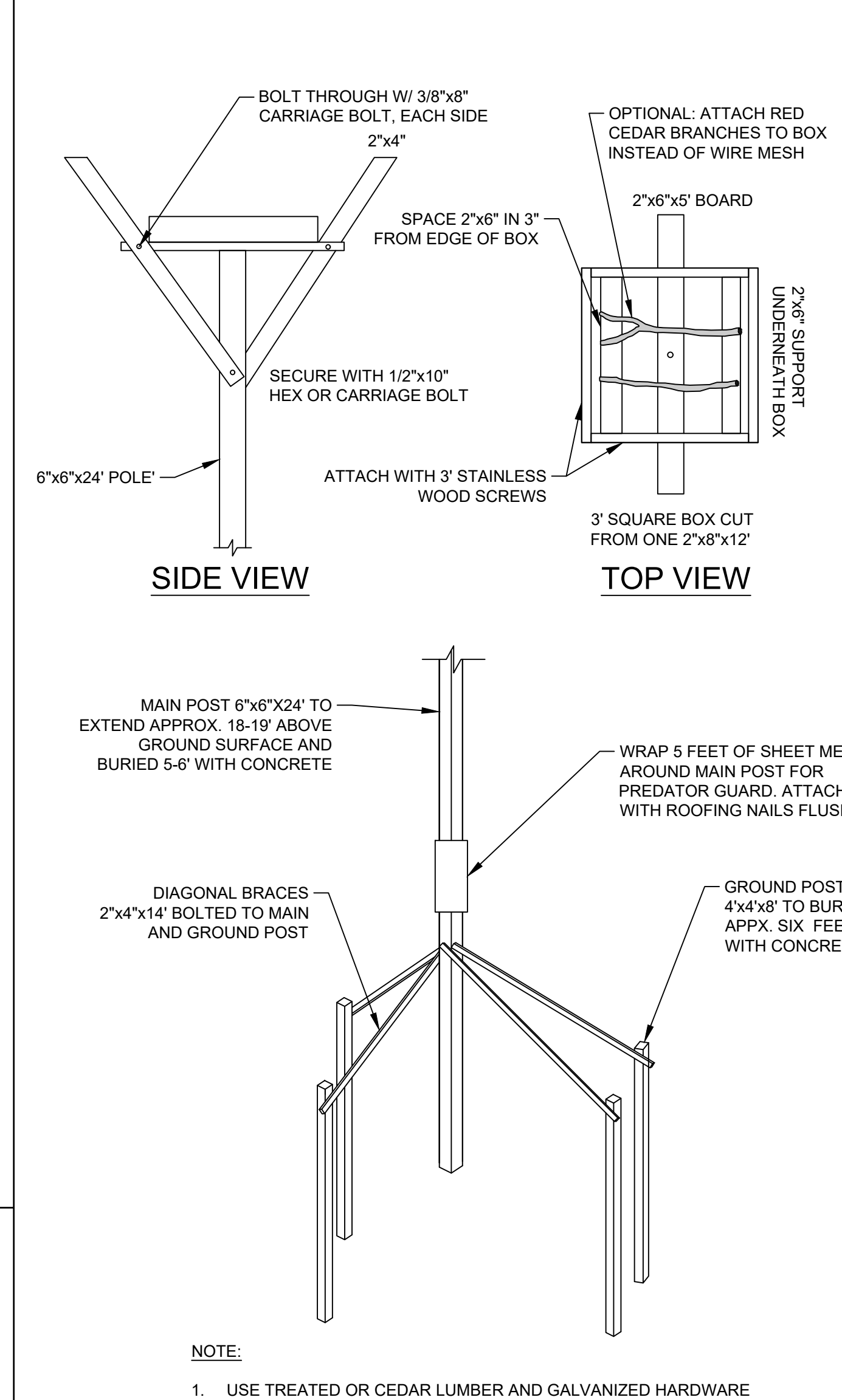
- NOTES:**
- IMPROVED ACCESS ROAD SHALL BE AS SHOWN OR AS APPROVED BY ENGINEER.
 - ACCESS ROAD TO BE CONSTRUCTED BY OTHERS. CONTRACTOR SHALL BE RESPONSIBLE FOR RESTORATION OF ACCESS ROADS TO PRE-CONSTRUCTION CONDITIONS AFTER CONSTRUCTION.
 - WIDTH OF IMPROVED ACCESS ROAD SHALL ALLOW FOR 1-WAY OR 2-WAY TRAFFIC AS NEEDED, OR AS LIMITED BY EXISTING ROADS.
 - PULLOFFS SHALL ALLOW FOR HAUL TRAFFIC TO PASS WHEN MEETING ON 1-WAY ROADS.

3 **DETAIL - IMPROVED ACCESS ROAD**
C-03



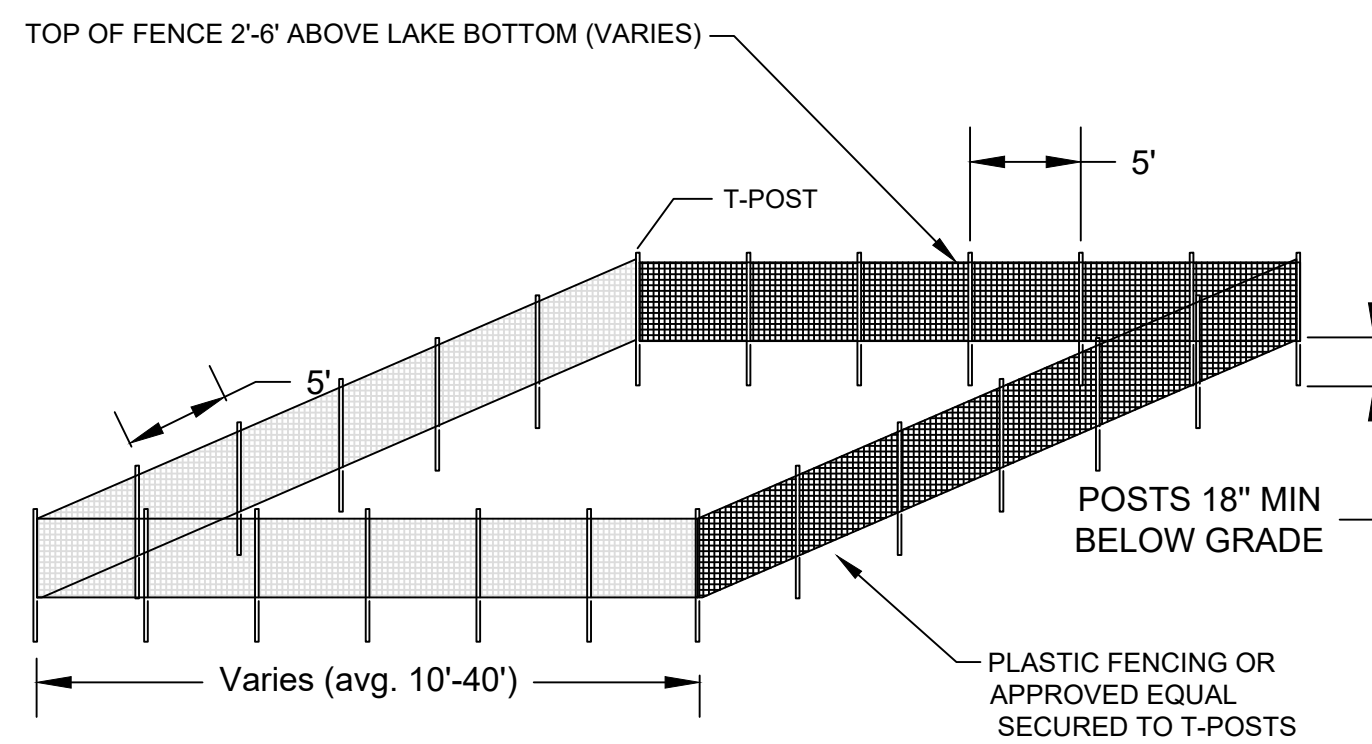
- NOTES:**
- PIPELINE CROSSING TO BE CONSTRUCTED BY OTHERS. CONTRACTOR SHALL BE RESPONSIBLE FOR RESTORATION OF ACCESS ROADS TO PRE-CONSTRUCTION CONDITIONS AFTER CONSTRUCTION.
 - MAINTAIN A MINIMUM AGGREGATE THICKNESS OF 18" OVER PIPE AT ALL TIMES.

4 **DETAIL - PIPELINE CROSSING**
C-03



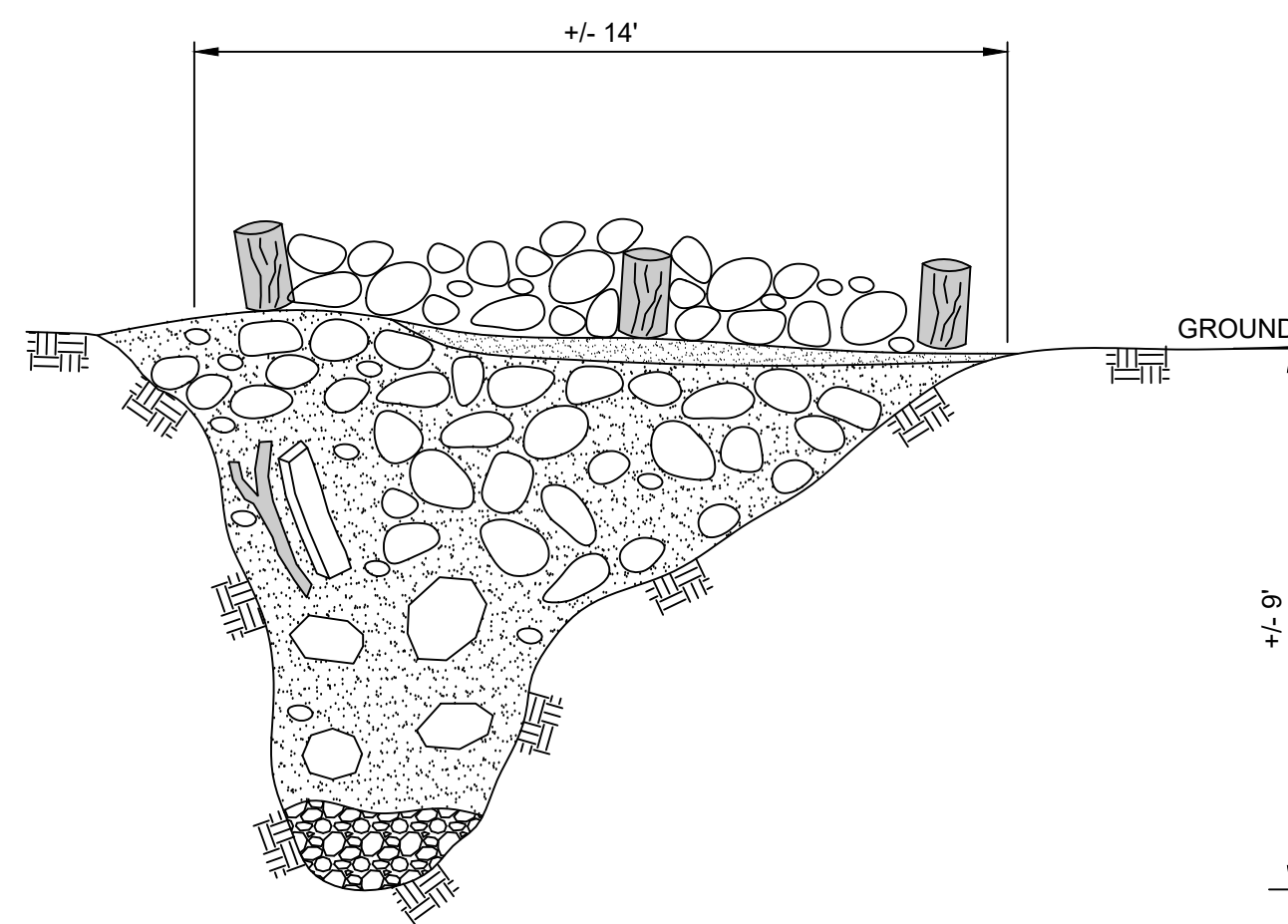
- NOTE:**
- USE TREATED OR CEDAR LUMBER AND GALVANIZED HARDWARE

5 **DETAIL - OSPREY PLATFORM**
L-03



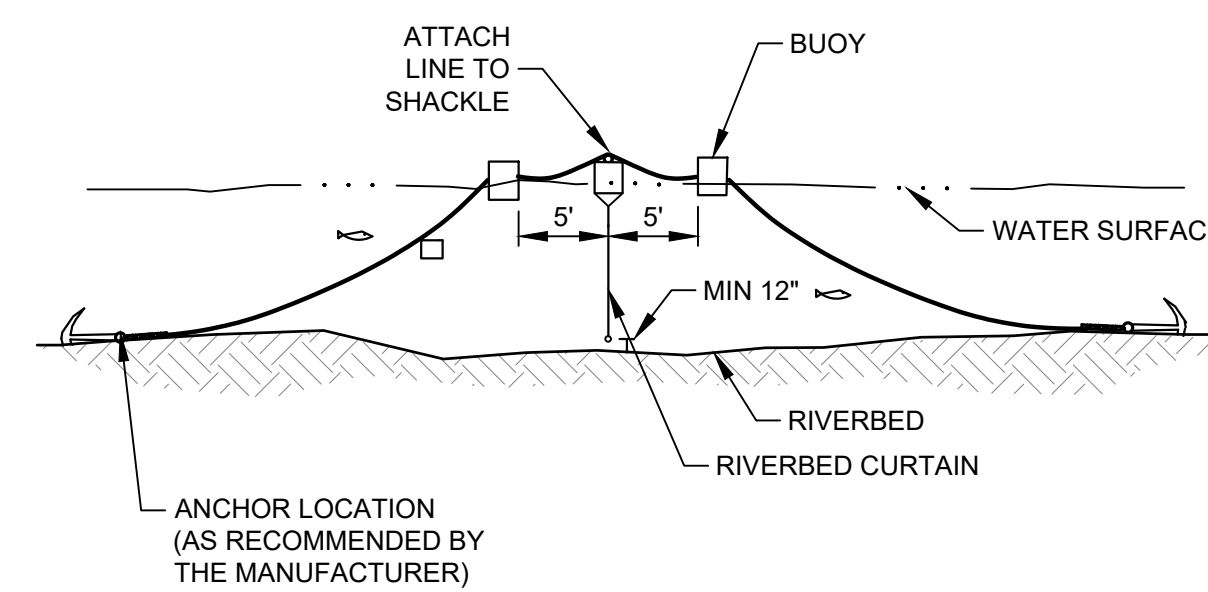
- NOTES:**
- EXCLUSIONARY MEASURES SHALL CONSIST OF PLASTIC FENCING OR APPROVED EQUAL SECURED WITH 6" T-POSTS ON 6 FOOT INTERVALS. NETTING SHALL SURROUND INDIVIDUAL PLANT PODS. SET FENCE BOTTOM AT WETLAND BOTTOM. TOP OF FENCE MUST BE ABOVE SURFACE WATER ELEVATION THROUGHOUT THE DURATION OF THE GROWING SEASON. PODS NEED NOT BE PRECISELY SQUARE SHAPED-EXACT SIZE AND SHAPE MAY VARY. EXCLUSIONARY MEASURES SHALL REMAIN FOR 1 GROWING SEASON FOLLOWING PLANT INSTALLATION AND SHALL BE REMOVED DURING THE SEPTEMBER/OCTOBER FOLLOWING INSTALLATION. ALL EMERGENT PLANTINGS SHALL BE ENCLOSED IN PODS, AS SHOWN ON PLANS. EXACT SIZE AND QUANTITY OF PODS MAY VARY TO ACCOMMODATE ACTUAL SITE CONDITIONS.

6 **DETAIL - ANIMAL EXCLUSION FENCING**
-



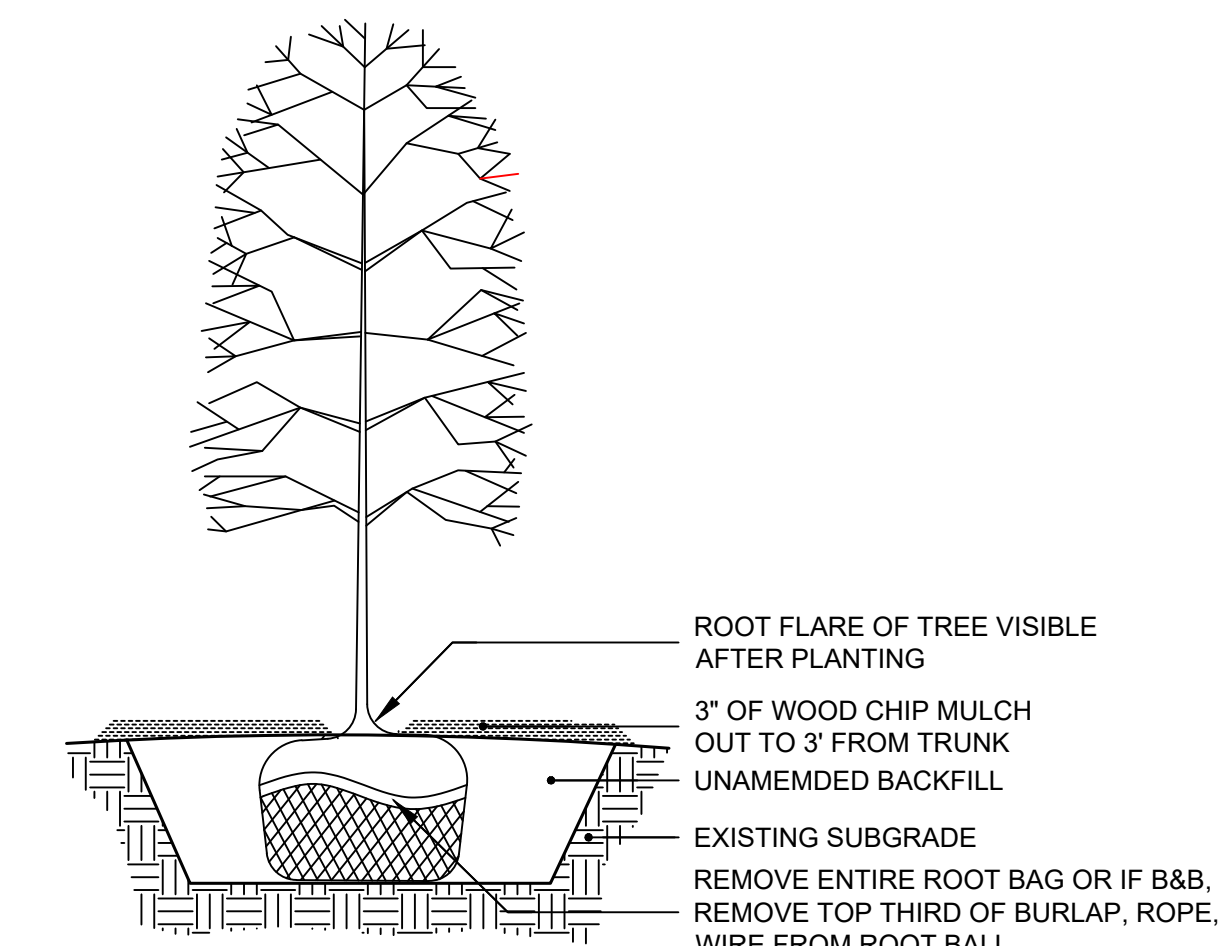
- NOTES:**
- THE HIBERNACULUM CAN BE SIZED TO FIT THE AVAILABLE SPACE WITH ENGINEER APPROVAL BUT MUST BE DEEPER THAN THE FROST LINE, APPROXIMATELY 8-9' DEEP.
 - SIDE SLOPE OF EXCAVATION SHOULD VARY BUT SHOULD BE MINIMUM OF 1H:1V. STEEP SIDE SLOPES CAN ALLOW COLD AIR TO SINK AND SETTLE, CREATING UNFAVORABLE TEMPERATURES WITHIN THE HIBERNACULUM.
 - PLACE LAYER OF 2-4" GRAVEL OF VARYING DEPTH (6"-1.5") AT THE BOTTOM OF THE HOLE.
 - ON TOP OF THE GRAVEL, PLACE CLEAN RUBBLE (OLD CINDER BLOCKS WITH OPENINGS, CONCRETE SLABS, 12-18" ANGULAR STONE), STUMPS, AND LARGE BRANCHES AT VARIOUS ANGLES UP TO THE APPROXIMATE FROST LINE OF 3' FROM THE SURFACE. PLACE MATERIAL TO CREATE OPENINGS AND CHAMBERS THROUGHOUT. IF NECESSARY, HAND PLACE THE MATERIALS TO ENSURE THAT A SPACE OR TUNNEL EXTENDS DOWN INTO THE BOTTOM OF THE PIT AT EACH OF THE CORNERS. CONTINUE TO FILL THE PIT WHILE MAINTAINING AS MANY OPENINGS AND CHAMBERS AS POSSIBLE.
 - PLACE AN INSULATING LAYER OF SMALLER ROCK (2"-12") AND BRANCHES/LOGS (2"-12" DIAMETER) FROM APPROXIMATELY 3' BELOW THE SURFACE TO THE GROUND SURFACE. BE SURE TO LEAVE THE ENTRANCES OPEN AND KEEP THE TOP CLEAR OF SHRUBS THAT MAY GROW AS THE SITE MATURES.
 - CAP THE HIBERNACULUM WITH BRANCH AND LOG (2"-12" DIAMETER) DEBRIS CREATING A 2'-3' TALL "BRUSH PILE".
 - THE ENGINEER MUST BE ON SITE DURING CONSTRUCTION.

7 **DETAIL - REPTILE HIBERNACULA**
L-03



- NOTES:**
- FLOATING TURBIDITY BARRIER CONSTRUCTION SHALL CONFORM WITH RELEVANT LOCAL AND STATE STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL.
 - FLOATING TURBIDITY BARRIER WILL BE INSPECTED AND MAINTAINED DAILY.

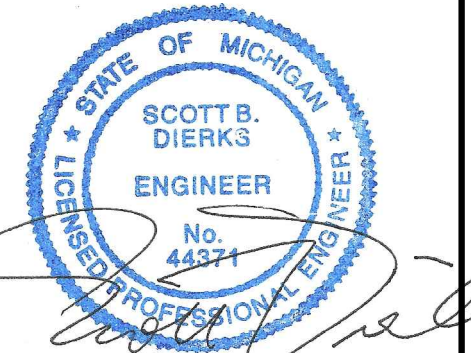
8 **DETAIL - FLOATING TURBIDITY CURTAIN**
L-01



- NOTE:**
- WOOD CHIP MULCH WILL ONLY BE PLACED AROUND 2" DBH TREES.

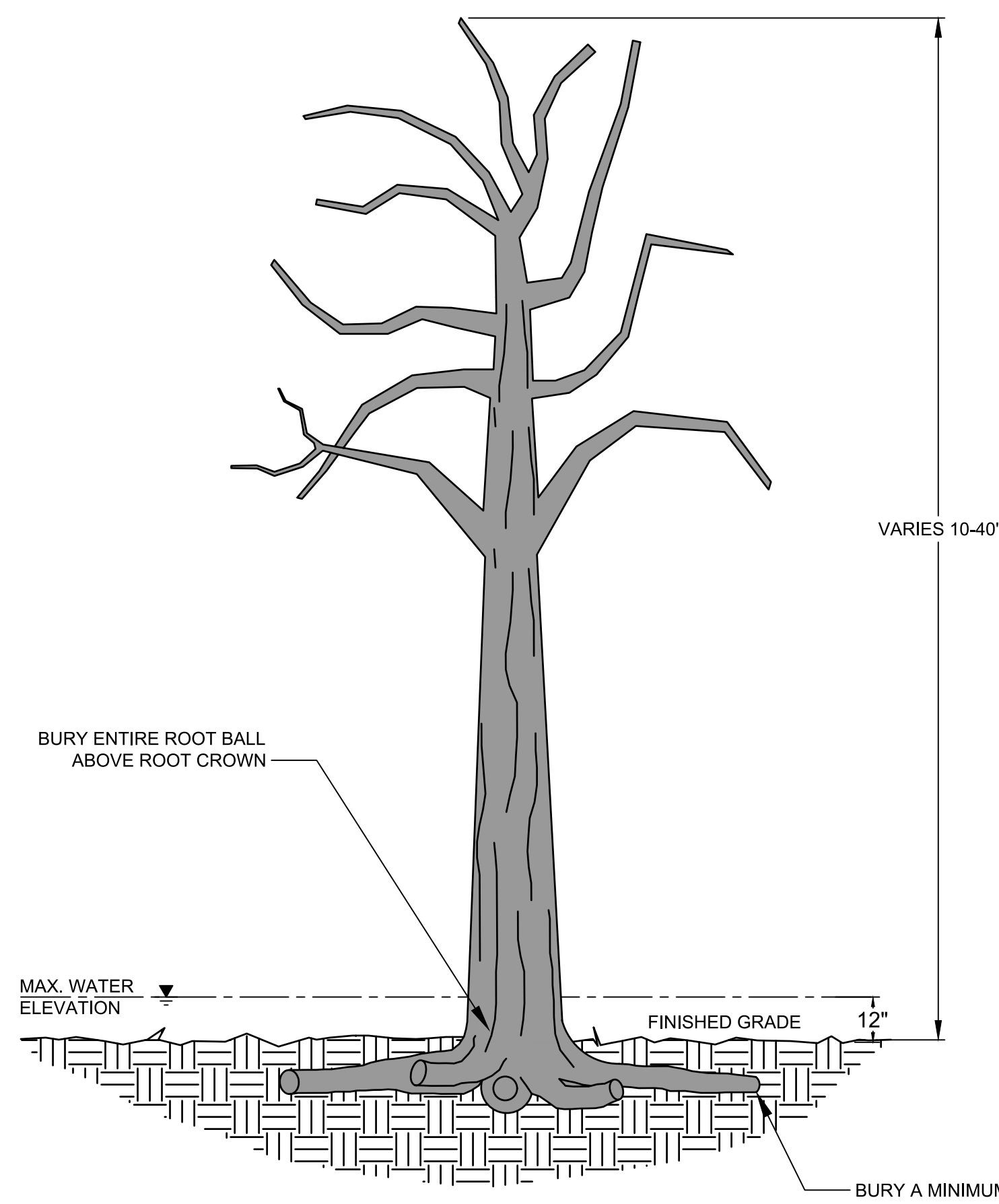
9 **DETAIL - TREE/SHRUB INSTALLATION**
-

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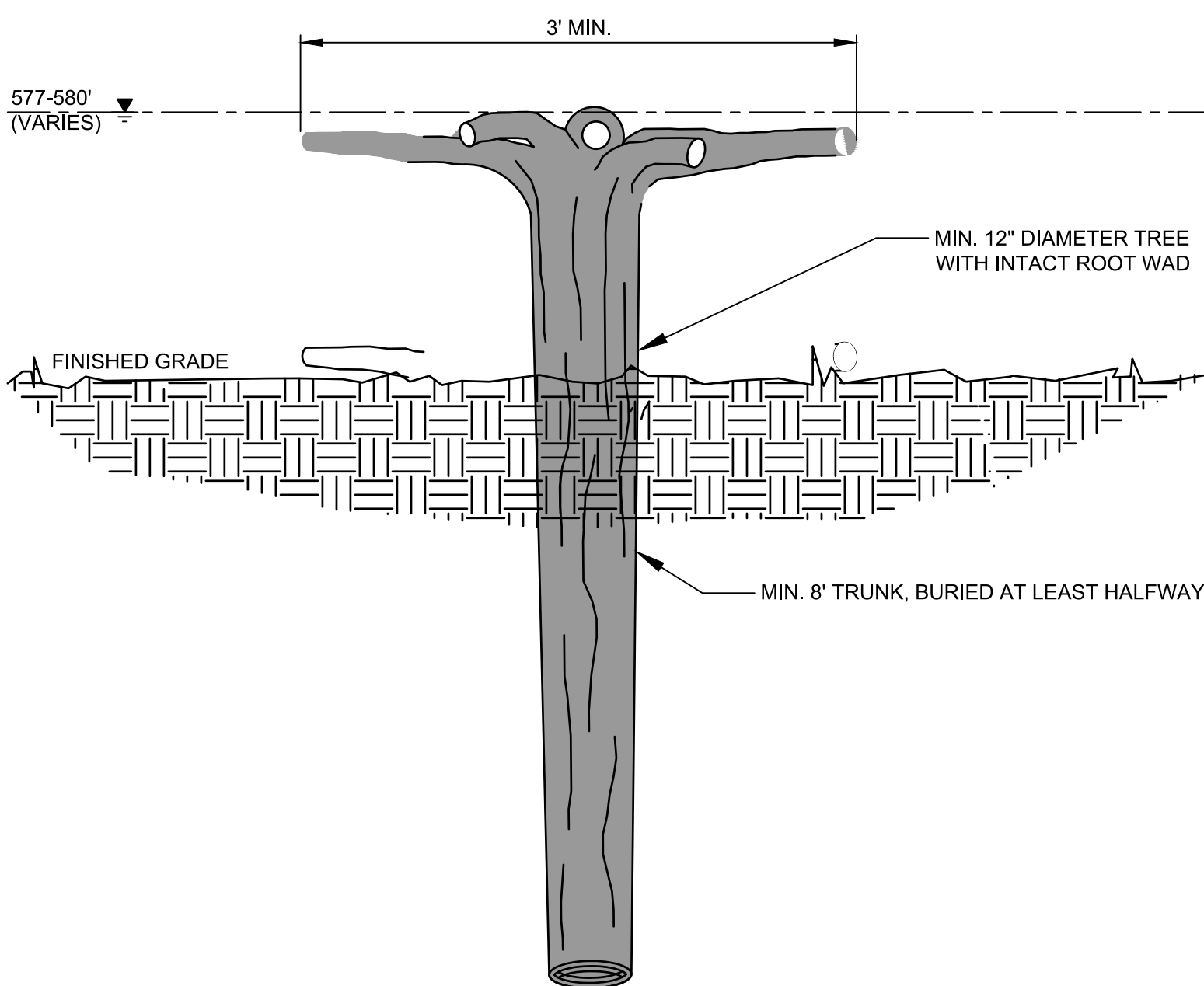


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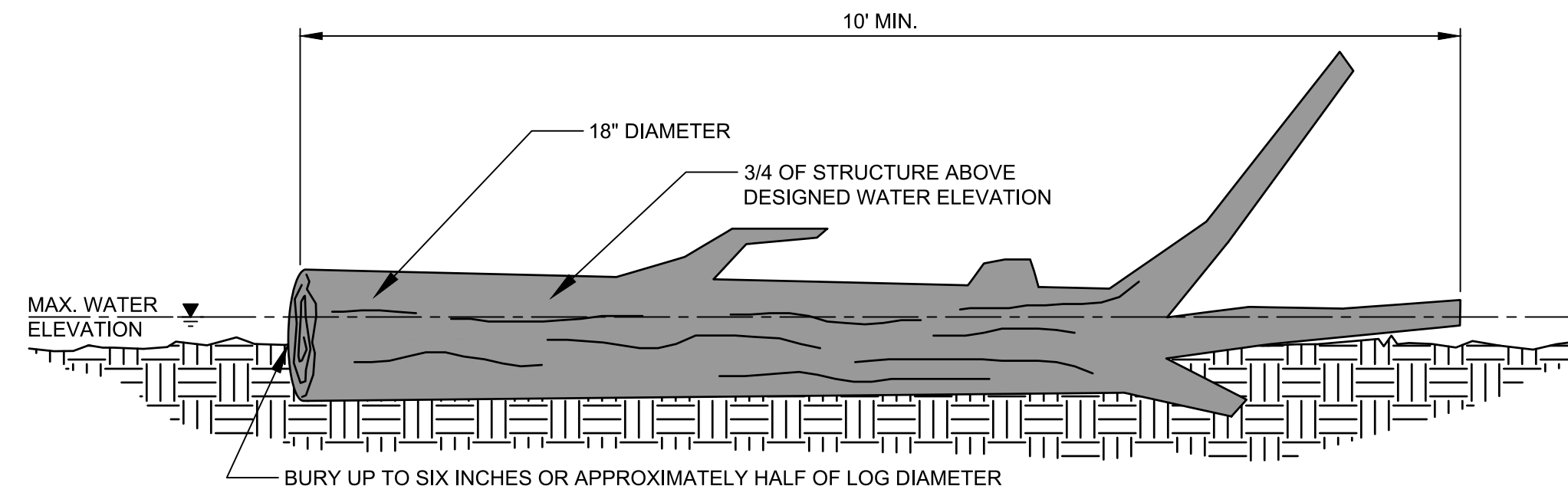
**DETAILS
(1 OF 2)**



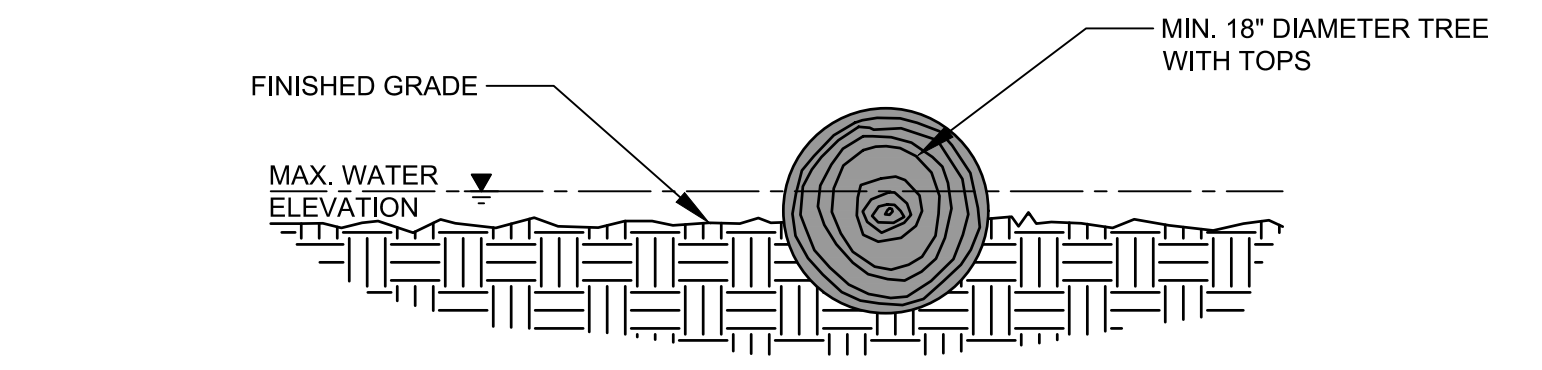
1
L-03
DETAIL - FREE STANDING SNAG
NOT TO SCALE



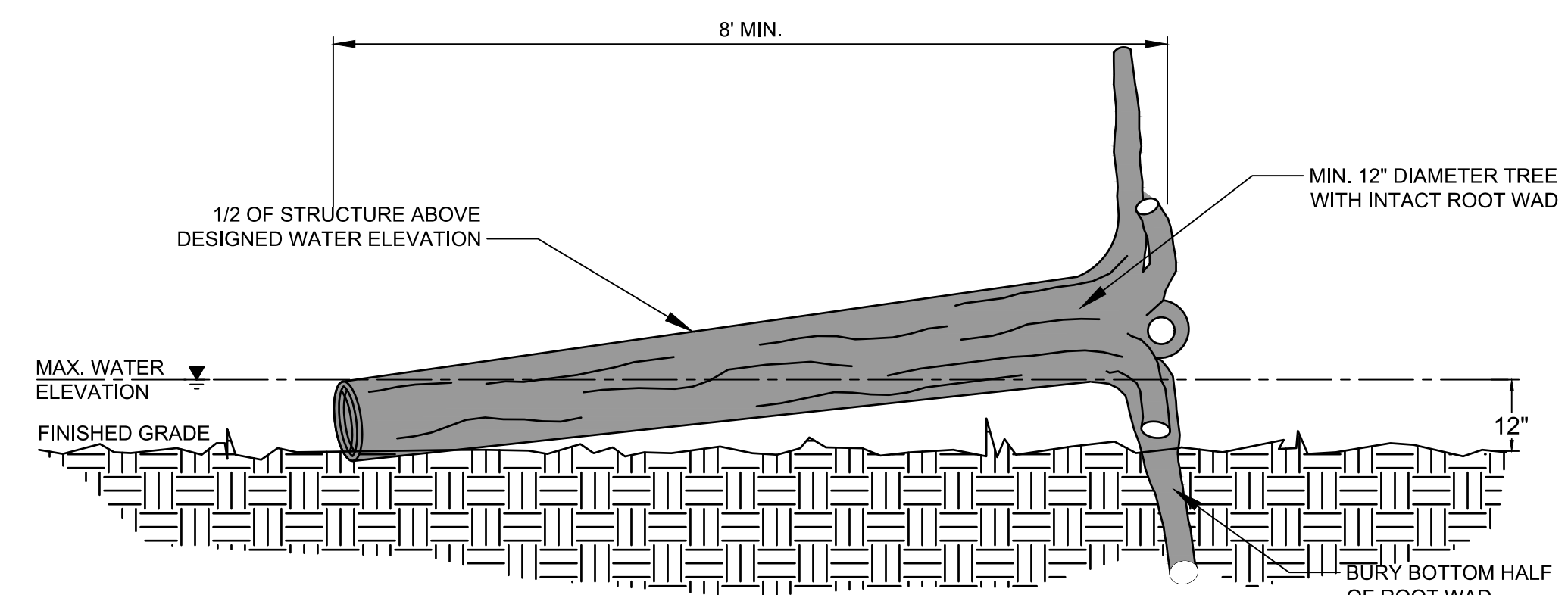
4
L-03
DETAIL - INVERTED ROOT WAD
NOT TO SCALE



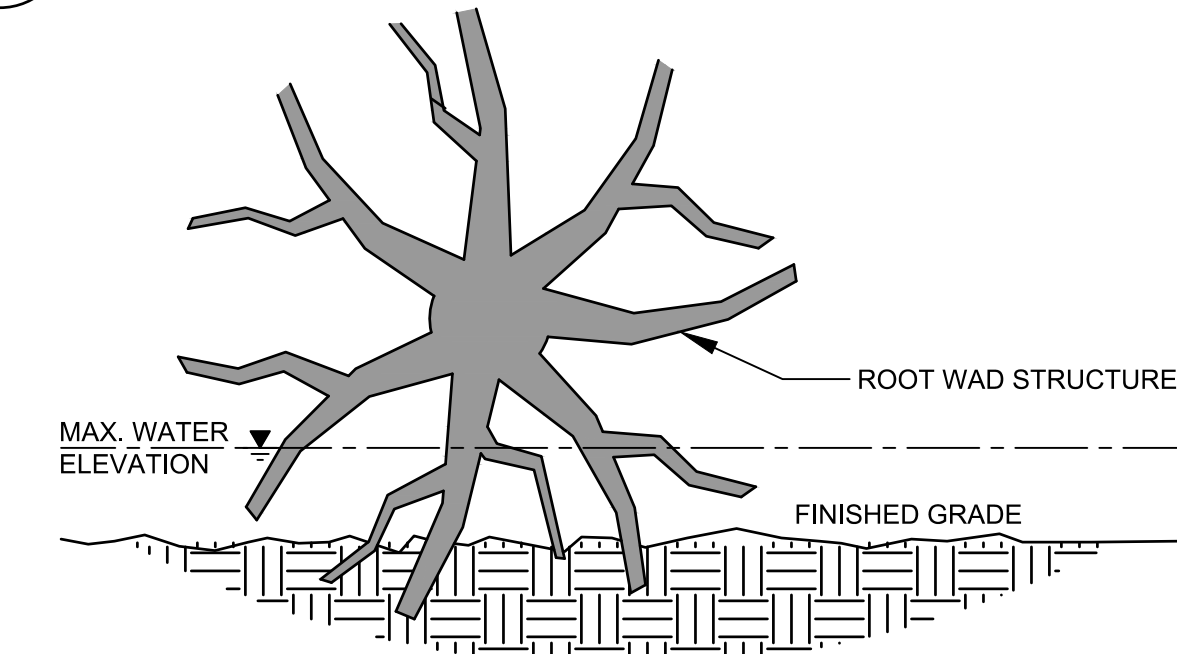
3
L-03
DETAIL - LOG STRUCTURE SIDE VIEW
NOT TO SCALE



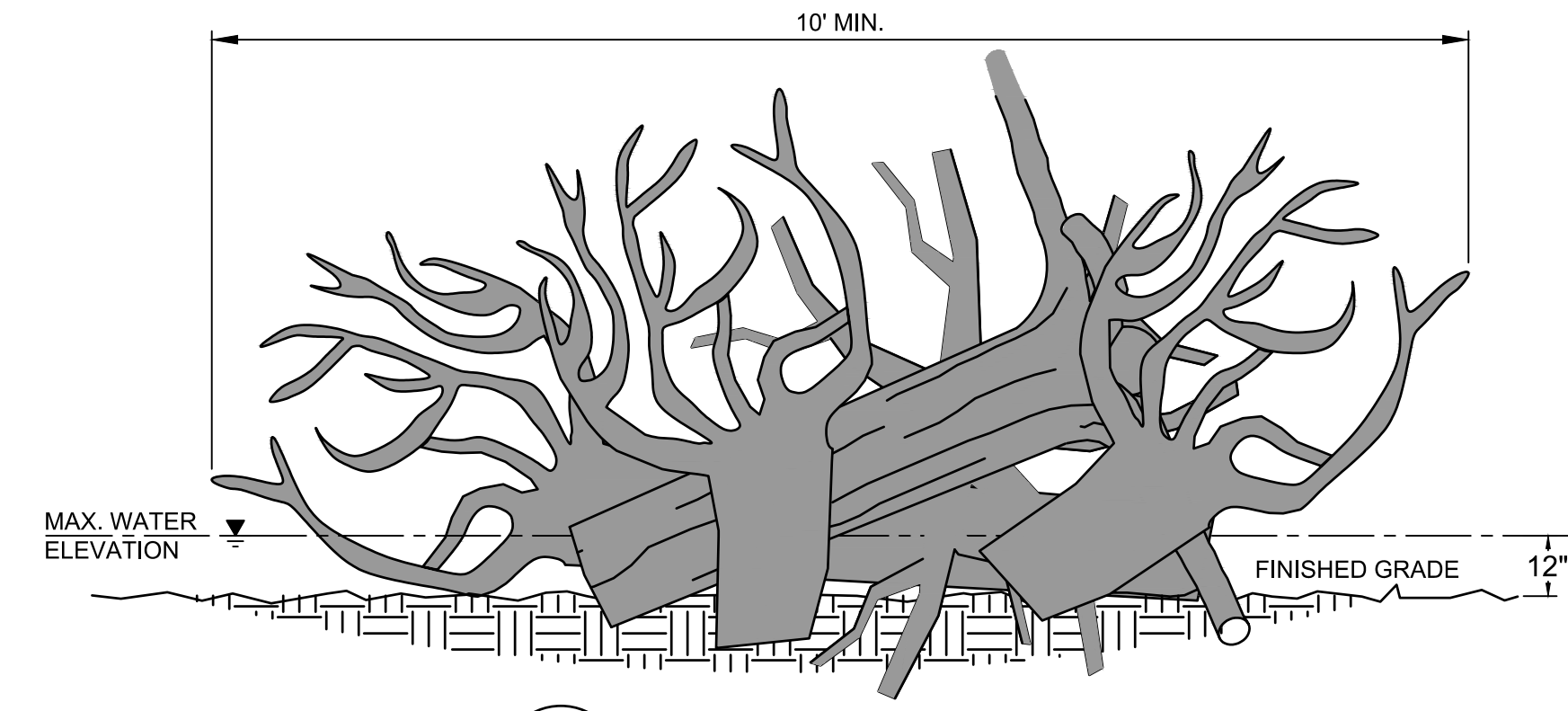
3
L-03
DETAIL - LOG STRUCTURE-LOOKING DOWN TRUNK
NOT TO SCALE



5
L-03
DETAIL - ROOT WAD - SIDE VIEW
NOT TO SCALE



5
L-02
DETAIL - ROOT WAD - LOOKING AT ROOTS
NOT TO SCALE

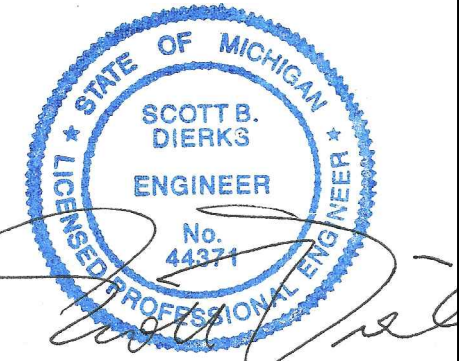


2
L-03
DETAIL - BRUSH OR LOG PILE

- SHEET NOTES:
1. WATER ELEVATIONS IN WETLANDS WILL VARY SEASONALLY.
 2. ALL LARGE WOODY DEBRIS WILL BE PINNED WITH NATIVE MATERIAL AND/OR BURIED IN THE GROUND SUFFICIENTLY SO THEY WILL NOT FLOAT AWAY.

Attention: 1"
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P.E. No.: 44371

DETAILS
(2 OF 3)

GEI Project 1602940
DWG. NO.
D-02
SHEET NO.
19 OF 20

For Construction

EMERGENT MARSH SEED MIX		
Scientific Name	Common Name	PLS Oz Per Acre
<i>Acorus calamus</i>	Sweet flag	4
<i>Asclepias incarnata</i>	Swamp milkweed	4
<i>Avena sativa</i>	Seed oats	512
<i>Bidens cernua</i>	Nodding bur marigold	2
<i>Calamagrostis canadensis</i>	Blue joint grass	2
<i>Carex vulpinoidea</i>	Brown fox sedge	4
<i>Decodon verticillatus</i>	Swamp loosestrife	0.25
<i>Eleocharis acicularis</i>	Needle spike rush	0.5
<i>Eleocharis palustris</i>	Great spike rush	1
<i>Glyceria striata</i>	Fowl manna grass	1
<i>Hibiscus moscheutos</i>	Swamp rose mallow	4
<i>Iris virginica shrevei</i>	Blue flag iris	6
<i>Juncus canadensis</i>	Canadian rush	1
<i>Juncus effusus</i>	Common rush	3
<i>Juncus torreyi</i>	Torrey's rush	0.25
<i>Leersia oryzoides</i>	Rice cut grass	2
<i>Lolium multiflorum</i>	Annual rye	160
<i>Mimulus ringens</i>	Monkey flower	1
<i>Peltandra virginica</i>	Arrow arum	6
<i>Pontederia cordata</i>	Pickereel weed	4
<i>Rumex orbiculatus</i>	Great water dock	1
<i>Sagittaria latifolia</i>	Common arrowhead	2
<i>Saururus cernuus</i>	Lizard's tail	0.5
<i>Scirpus acutus</i>	Hard-stemmed bulrush	2
<i>Scirpus atrovirens</i>	Dark green rush	2
<i>Scirpus cyperinus</i>	Wool grass	1
<i>Scirpus fluviatilis</i>	River bulrush	2
<i>Scirpus pungens</i>	Chairmaker's rush	3
<i>Scirpus validus creber</i>	Great bulrush	4
<i>Sparganium eurycarpum</i>	Common bur reed	2
<i>Zizania aquatica</i>	Wild rice	32
	Total PLS Ounces Per Acre	769.50
	Total PLS Pounds Per Acre	48.09

FLOODPLAIN FOREST SEED MIX		
Scientific Name	Common Name	PLS Oz Per Acre
<i>Angelica atropurpurea</i>	Great angelica	2
<i>Asclepias incarnata</i>	Swamp milkweed	1
<i>Aster novae-angliae</i>	New England aster	2
<i>Avena sativa</i>	Seed oats	512
<i>Bidens cernua</i>	Nodding bur marigold	2
<i>Bidens frondosa</i>	Common beggars tick	2
<i>Bromus pubescens</i>	Woodland brome	3
<i>Calamagrostis canadensis</i>	Blue joint grass	4
<i>Carex crinita</i>	Fringed sedge	2
<i>Carex grayi</i>	Common bur sedge	2
<i>Carex lupulina</i>	Common hop sedge	2
<i>Carex muskingumensis</i>	Swamp oval sedge	2
<i>Carex vulpinoidea</i>	Brown fox sedge	3
<i>Cinna arundinacea</i>	Common wood reed	2
<i>Coreopsis tripteris</i>	Tall coreopsis	1
<i>Elymus riparius</i>	Riverbank wild rye	12
<i>Elymus virginicus</i>	Virginia wild rye	32
<i>Eupatorium maculatum</i>	Spotted joe-pye weed	1
<i>Glyceria striata</i>	Fowl manna grass	2
<i>Iris virginica shrevei</i>	Blue flag iris	4
<i>Leersia oryzoides</i>	Rice cut grass	3
<i>Lobelia cardinalis</i>	Cardinal flower	0.5
<i>Lobelia siphilitica</i>	Great blue lobelia	1
<i>Lolium multiflorum</i>	Annual rye	160
<i>Rudbeckia laciniata</i>	Wild golden glow	3
<i>Saururus cernuus</i>	Lizard's tail	0.5
<i>Thalictrum dasycarpum</i>	Purple meadow rue	1
	Total PLS Ounces	762.00
	Total PLS Pounds	47.63

SOUTHERN WET MEADOW / SOUTHERN SHRUB CARR SEED MIX		
Scientific Name	Common Name	PLS Oz Per Acre
<i>Acorus calamus</i>	Sweet flag	2
<i>Angelica atropurpurea</i>	Great angelica	2
<i>Asclepias incarnata</i>	Swamp milkweed	4
<i>Aster novae-angliae</i>	New England aster	1
<i>Avena sativa</i>	Seed oats	512
<i>Bidens cernua</i>	Nodding bur marigold	2
<i>Bromus ciliatus</i>	Fringed brome	2
<i>Calamagrostis canadensis</i>	Blue joint grass	2
<i>Carex comosa</i>	Bristly sedge	2
<i>Carex crinita</i>	Fringed sedge	2
<i>Carex hystericina</i>	Porcupine sedge	2
<i>Carex lupulina</i>	Common hop sedge	2
<i>Carex muskingumensis</i>	Swamp oval sedge	2
<i>Carex stricta</i>	Common tussock sedge	0.5
<i>Carex vulpinoidea</i>	Brown fox sedge	2
<i>Coreopsis tripteris</i>	Tall coreopsis	1
<i>Elymus virginicus</i>	Virginia wild rye	16
<i>Eupatorium maculatum</i>	Spotted joe-pye weed	2
<i>Eupatorium perfoliatum</i>	Common boneset	2
<i>Glyceria striata</i>	Fowl manna grass	2
<i>Hibiscus moscheutos</i>	Swamp rose mallow	2
<i>Iris virginica shrevei</i>	Blue flag iris	5
<i>Juncus effusus</i>	Common rush	2
<i>Leersia oryzoides</i>	Rice cut grass	2
<i>Liatris spicata</i>	Marsh blazing star	1
<i>Lobelia cardinalis</i>	Cardinal flower	0.5
<i>Lobelia siphilitica</i>	Great blue lobelia	1
<i>Lolium multiflorum</i>	Annual rye	160
<i>Mimulus ringens</i>	Monkey flower	2
<i>Monarda fistulosa</i>	Wild bergamot	2
<i>Pycnanthemum virginianum</i>	Common mountain mint	1
<i>Rosa palustris</i>	Swamp rose	1
<i>Sagittaria latifolia</i>	Common arrowhead	1
<i>Scirpus atrovirens</i>	Dark green rush	1
<i>Scirpus cyperinus</i>	Wool grass	1
<i>Solidago ohioensis</i>	Ohio goldenrod	1
<i>Spartina pectinata</i>	Prairie cord grass	6
<i>Thalictrum dasycarpum</i>	Purple meadow rue	0.5
<i>Verbena hastata</i>	Blue vervain	2
<i>Zizia aurea</i>	Golden Alexanders	2
	Total PLS Ounces Per Acre	756.50
	Total PLS Pounds Per Acre	47.28

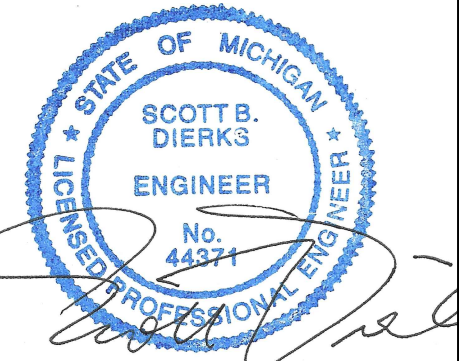
Scientific Name	Common Name	Wetland Indicator Status	Deep Submergent Marsh (3.4 ac)	Shallow Submergent Marsh (4.0 ac)	Emergent Marsh (9.1 ac)	Southern Shrub Carr (12.1 ac)	Southern Wet Meadow (7.5 ac)	Floodplain Forest (7.4 ac)
<i>Asclepia incarnata</i>	Swamp milkweed	OBL			125		100	
<i>Eupatorium maculatum</i>	Joe-Pye weed	OBL					100	
<i>Iris virginica shrevei</i>	Blue flag iris	OBL			125		100	
<i>Liatris spicata</i>	Marsh blazing star	FAC					100	
<i>Lobelia cardinalis</i>	Cardinal flower	OBL					100	
<i>Lobelia siphilitica</i>	Blue lobelia	FACW					100	
<i>Mimulus ringens</i>	Monkeyflower	OBL					100	
<i>Nuphar advena</i>	Spatterdock	OBL		500				
<i>Nymphaea tuberosa</i>	White water lily	OBL		500				
<i>Peltandra virginica</i>	Arrow arum	OBL			100			
<i>Pontederia cordata</i>	Pickereelweed	OBL		250	100			
<i>Sagittaria latifolia</i>	Arrowhead	OBL			100			
<i>Saururus cernuus</i>	Lizard's tail	OBL			50			
<i>Solidago patula</i>	Swamp goldenrod	OBL					100	
<i>Vallisneria americana</i>	Wild celery	OBL	1,000	300				
<i>Calamagrostis canadensis</i>	Blue joint grass	OBL					75	
<i>Carex comosa</i>	Bristly sedge	OBL					100	
<i>Carex lacustris</i>	Lake sedge	OBL			100			
<i>Carex muskingumensis</i>	Sand bracted sedge	OBL					150	
<i>Carex vulpinoidea</i>	Brown fox sedge	OBL						
<i>Juncus effusus</i>	Soft rush	OBL			50			
<i>Schoenoplectus acutus</i>	Hardstem bulrush	OBL			300			
<i>Schoenoplectus pungens</i>	Common threesquare	OBL					300	
<i>Schoenoplectus tabernaemontani</i>	Softstem bulrush	OBL			300			
<i>Scirpus cyperinus</i>	Wool Grass	OBL					100	
<i>Sparganium eurycarpum</i>	Common burreed	OBL			100			
	<i>Per-acreTotal</i>		1,000	1,550	1,750		1,225	
	<i>Total Qty</i>			3,400	6,200	15,926	9,188	
Shrubs								
<i>Cephalanthus occidentalis</i>	Buttonbush	OBL				50		
<i>Cornus amomum</i>	Silky dogwood	FACW				50		75
<i>Cornus sericea</i>	Red-osier dogwood	FACW				50		75
<i>Rosa palustris</i>	Swamp rose	OBL				50		
<i>Sambucus canadensis</i>	Elderberry	FACW				50		75
<i>Spiraea alba</i>	Meadowsweet	FACW				50		
<i>Viburnum opulus v. americanum</i>	American highbush cranberry	FACW				50		75
	<i>Per-acreTotal</i>					350		300
	<i>Total Qty</i>					4235		2220
Trees (24-36" bare-root)								
<i>Acer rubrum</i>	Red maple	FAC						10
<i>Nyssa sylvatica</i>	Black gum	FACW						10
<i>Platanus occidentalis</i>	Sycamore	FACW						10
<i>Quercus bicolor</i>	Swamp white oak	FACW						10
<i>Quercus palustris</i>	Pin oak	FACW						10
<i>Salix nigra</i>	Black willow	OBL						10
	<i>Per-acreTotal</i>							60
	<i>Total Qty</i>							444
Trees (2" caliper)								
<i>Acer rubrum</i>	Red maple	FAC						2
<i>Acer saccharinum</i>	Silver maple	FACW						2
<i>Celtis occidentalis</i>	Hackberry	FAC						2
<i>Platanus occidentalis</i>	Sycamore	FACW						2
	<i>Quercus bicolor</i>	Swamp white oak	FACW					2
	<i>Quercus palustris</i>	Pin oak	FACW					2
	<i>Per-acreTotal</i>							12
	<i>Total Qty</i>							89



LOWER MUSKEGON RIVER HYDROLOGIC RECONNECTION

Attention: 1" scale bar does not measure 1" then drawing is not original scale.

NO.	DATE	ISSUE/REVISION	APP
2	12/6/2018	CONSTRUCTION DRAWINGS	SD
1	11/16/2018	JPA DRAWINGS	SD
0	6/1/2018	JPA DRAWINGS	SD



Designed: B. Majka
Checked: S. Dierks
Drawn: I. Roberts
Submitted By: B. Majka
P.E. No.: 44371

DETAILS (3 OF 3)

GEI Project 1602940
DWG. NO. **D-03**
SHEET NO. **20 OF 20**

For Construction