MUSKEGON LAKE NATURE PRESERVE MERES FISH AND WILDLIFE HABITAT RESTORATION PROJECT

100% CONSTRUCTION DOCUMENTS

January 27, 2020

PREPARED FOR:

WEST MICHIGAN SHORELINE REGIONAL **DEVELOPMENT COMMISSION** 316 MORRIS AVENUE, SUITE 340 MUSKEGON, MICHIGAN 49440





CALL MISS DIG

CALL 3 FULL

WORKING DAYS:

811

1-800-482-7171

MICHIGAN STATE MAP

NOT TO SCALE

PREPARED BY:

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

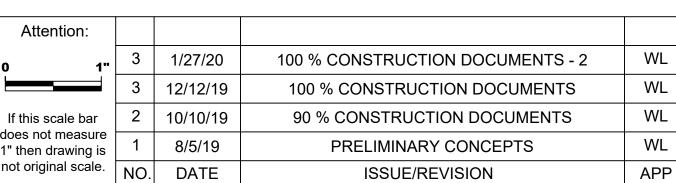


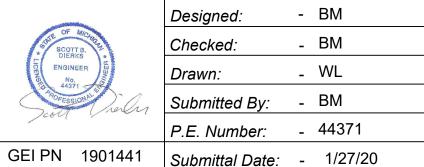
PROJECT PARTNERS:

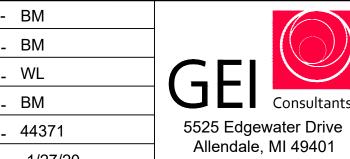




Sheet List Table				
Sheet Number	Sheet Title			
G1	COVER SHEET			
C1	EXISTING CONDITIONS			
C2	ACCESS & STAGING			
C3	INVASIVE SPECIES REMOVAL PLAN			
C4	PROPOSED CONDITIONS			
C5	DEBRIS REMOVAL PLAN			
C6	WORK AREAS 1, 2, & 3			
C7	RESTORATION AREAS 1, 2, & 3			
C8	WORK AREAS 4, 5, & 6			
C9	RESTORATION AREAS 4, 5, & 6			
C10	WORK AREAS 7 & 8			
C11	RESTORATION AREAS 7 & 8			
D1	DETAILS			
D2	PLANT LISTS			









Muskegon, MI 49440

Muskegon Lake Nature Preserve DWG. NO. MERES Fish and Wildlife Habitat G1 **Restoration Project** ISSUE **COVER SHEET**

MUSKEGON LAKE

LOCATION MAP

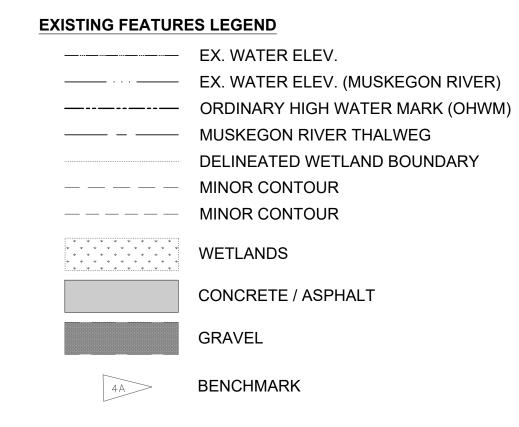
NOT TO SCALE



PROJECT AREA

NOT TO SCALE

Attention:				
0 1"	3	1/27/20	100 % CONSTRUCTION DOCUMENTS - 2	WL
	3	12/12/19	100 % CONSTRUCTION DOCUMENTS	WL
If this scale bar	2	10/10/19	90 % CONSTRUCTION DOCUMENTS	WL
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not original scale.	NO	DATE		4 DD

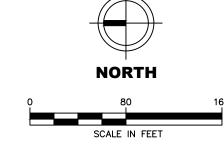


NOTES

- 1) Benchmark #4A elevation 592.97'. Location at southwest corner of 'Community Events' sign on Lake Ave, east of entrance to the nature preserve. NAVD88 Via VRS, OPUS & GPS OBSV.
- 2) Water elevation measured on 5/17/19 and 4/28/14. Water elevation varies depending on location.
- 3) OHWM elevation is 581.5'.
- 4) Muskegon River information from previous 2014 Project (F&V #819060).







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GEI PN 1901441

Designed:	-	BM	
Checked:	-	BM	
Drawn:	-	WL	
Submitted By:	-	BM	
P.E. Number:	-	44371	
Submittal Date:	-	1/27/20	



WEST MICHIGAN SHORELINE GIONAL DEVELOPMENT COMMISSION	Muskegon Lake Nature Preserve MERES Fish and Wildlife Habitat Restoration Project

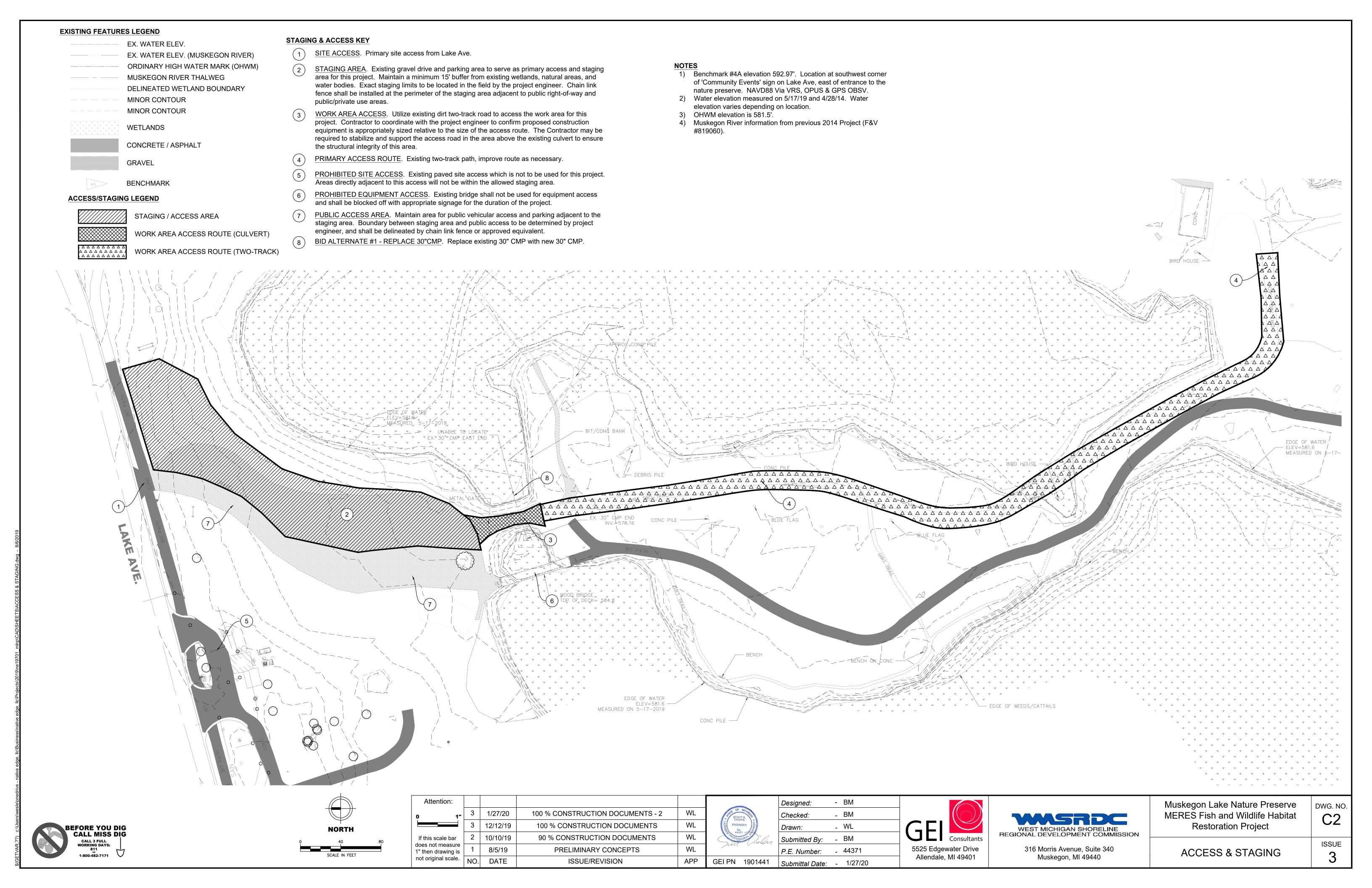
Muskegon, MI 49440

Restoration Project 316 Morris Avenue, Suite 340

,	
	ISSUE
EXISTING CONDITIONS	2

DWG. NO.

EVISTING CONDITIONS



EXISTING FEATURES LEGEND EX. WATER ELEV.

EX. WATER ELEV. (MUSKEGON RIVER) ORDINARY HIGH WATER MARK (OHWM)

MUSKEGON RIVER THALWEG DELINEATED WETLAND BOUNDARY

MINOR CONTOUR MINOR CONTOUR

WETLANDS

CONCRETE / ASPHALT GRAVEL

BENCHMARK

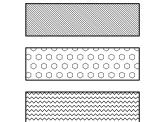
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INVASIVE SPECIES REMOVAL PHASING

- PHASE 1: Remove any woody invasive species within proposed construction areas and directly adjacent to proposed construction areas, including previously treated aresa (AREA 'A'). Total Phase 1 treatment area is 6.2 acres.
- PHASE 2: Re-treatment of all Phase 1 areas (AREA 'A') and removal of all remaining invasive species within surveyed areas, including previously treated areas (AREA 'B'). Herbaceous treatments to occur in the 2020 growing season; Woody treatments to occur in fall/winter 2020/2021. Total Phase 2 treatment area is 10.3 acres.
- PHASE 3: Follow-up treatments to all treatment areas in growing season of 2021 (AREA 'A' & 'B').

*INVASIVE SPECIES REMOVAL NOTE: The invasive species removal acreage listed above corresponds with the invasive species areas within treatment areas 'A' and 'B', not the actual footprint of the treatment areas. The treatment areas are outlined to help the contractor identify the

INVASIVE SPECIES REMOVAL LEGEND



Bell's Honeysuckle (5.1 ac) - Untreated to Date

Previously Treated Areas (2.8 ac)

Proposed Construction Area Footprints to Treat (2.4 ac)

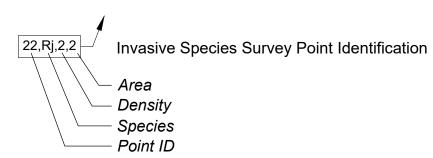
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1" then drawing is

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8/5/19

Invasive Species Survey Point



Species Key

Eu - Autumn Olive Lb - Bell's Honeysuckle A - Burdock

Ap - Garlic Mustard

Rj - Japanese Knotweed Lc - Motherwort

Co - Oriental Bittersweet Vm - Periwinkle

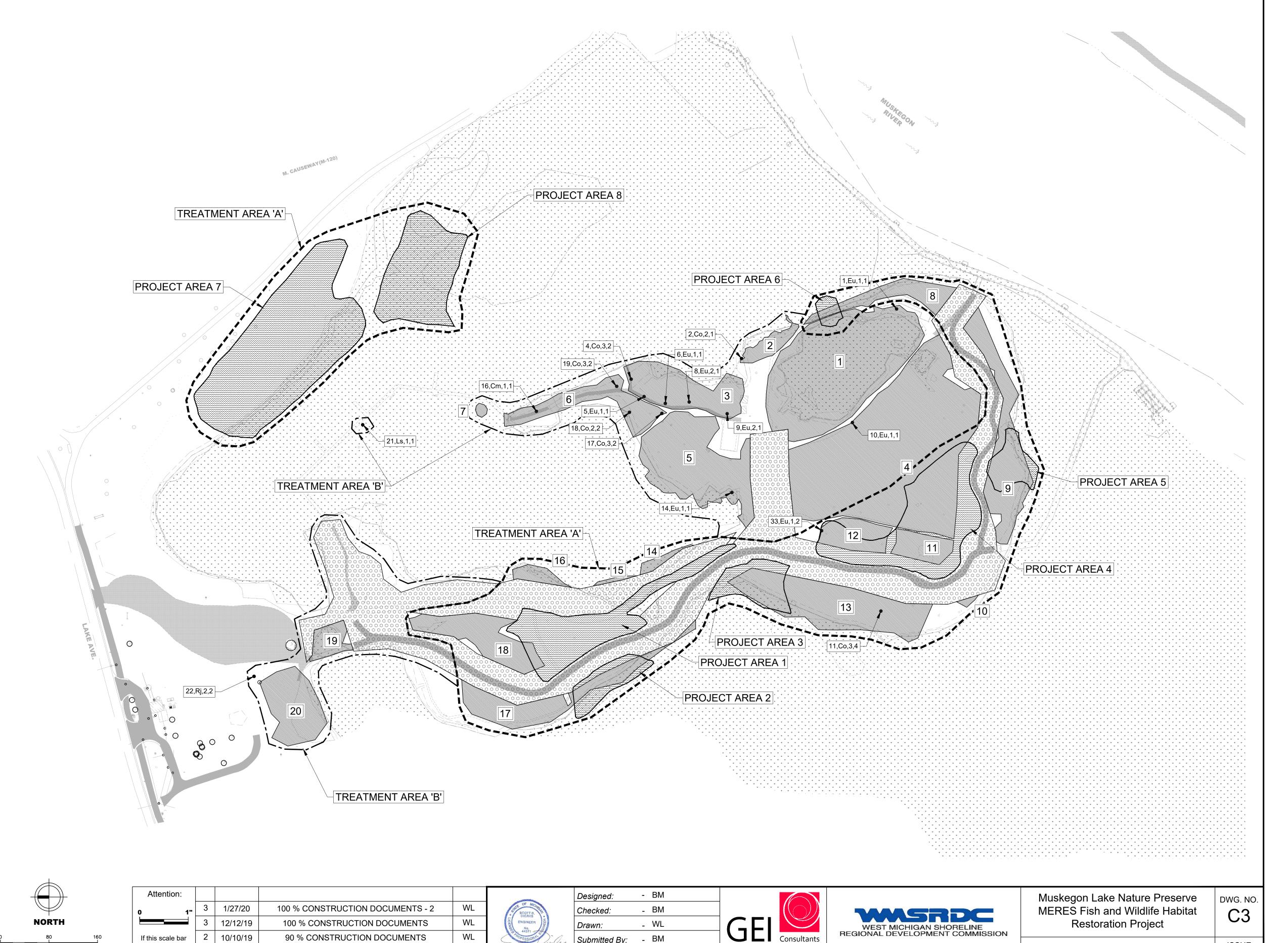
L - Privet

Ls - Purple Loosestrife

Cm - Spotted Knapweed

	Density	Area
1	Sparse	Individual / Few / Several
2	Patchy	< 1,000 sqft
3	Dense	1,000 sqft to 0.5 acre
4	Monoculture	0.5 acre to 1 acre
5	-	> 1 acre





- 44371

Submittal Date: - 1/27/20

P.E. Number:

WL

GEI PN 1901441

PRELIMINARY CONCEPTS

ISSUE/REVISION

5525 Edgewater Drive

Allendale, MI 49401

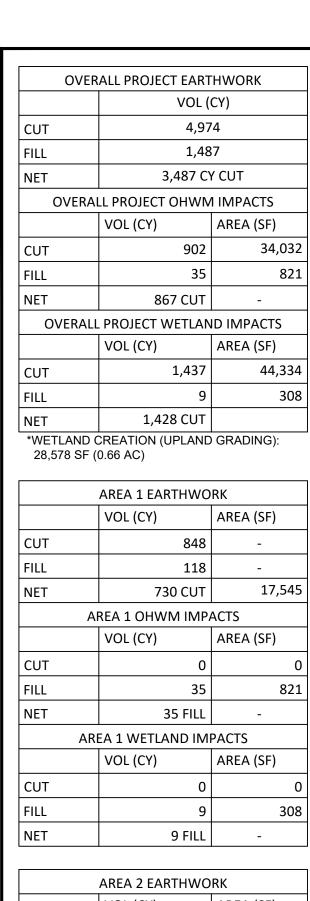
316 Morris Avenue, Suite 340

Muskegon, MI 49440

ISSUE

INVASIVE SPECIES REMOVAL

PLAN



IET	9 FILL	-		NET	53 CUT	-
	AREA 2 EARTHWO	RK			AREA 6 EARTHWO	RK
	VOL (CY)	AREA (SF)			VOL (CY)	AREA (SF)
UT	288	-		CUT	45	-
ILL	0	-		FILL	0	-
IET	288 CUT	5,918		NET	45 CUT	1,62
Al	AREA 2 OHWM IMPACTS			Al	REA 6 OHWM IMPA	ACTS
	VOL (CY)	AREA (SF)			VOL (CY)	AREA (SF)
UT	71	2,991		CUT	17	1,10
ILL	0	0		FILL	0	
IET	71 CUT	-		NET	17 CUT	-
ARI	REA 2 WETLAND IMPACTS			ARI	EA 6 WETLAND IMI	PACTS
	VOL (CY)	AREA (SF)			VOL (CY)	AREA (SF)
UT	83	3,017		CUT	36	1,46
ILL	0	0		FILL	0	
IET	83 CUT	-		NET	36 CUT	-
			_			
ARFA 3 FARTHWORK					ARFA 7 FARTHWO	RK

EXISTING FEATURES LEGEND

EX. WATER ELEV.

MINOR CONTOUR

MINOR CONTOUR

CONCRETE / ASPHALT

WETLANDS

GRAVEL

AREA 5 EARTHWORK

235

235 CUT

28 CUT

53

AREA 5 WETLAND IMPACTS

AREA 5 OHWM IMPACTS

VOL (CY)

VOL (CY)

VOL (CY)

CUT

CUT

BENCHMARK

AREA (SF)

AREA (SF)

AREA (SF)

5,050

1,360

1,843

EX. WATER ELEV. (MUSKEGON RIVER)

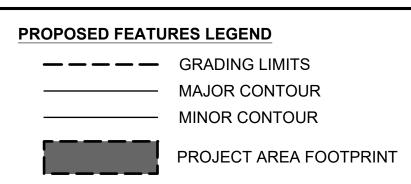
DELINEATED WETLAND BOUNDARY

MUSKEGON RIVER THALWEG

ORDINARY HIGH WATER MARK (OHWM)

NEI	83 CUT	-	NEI	36 CUT	-
	AREA 3 EARTHWO	RK		AREA 7 EARTHWO	RK
	VOL (CY)	AREA (SF)		VOL (CY)	AREA (SF)
CUT	258	-	CUT	2,570	-
FILL	0	-	FILL	0	-
NET	258 CUT	7,339	NET	2,570 CUT	44,880
	AREA 3 OHWM IMPA	ACTS	,	AREA 7 OHWM IMP	ACTS
	VOL (CY)	AREA (SF)		VOL (CY)	AREA (SF)
CUT	57	2,642	CUT	229	8,71
FILL	0	0	FILL	0	(
NET	57 CUT	-	NET	229 CUT	-
,	AREA 3 WETLAND IM	PACTS	А	REA 7 WETLAND IM	PACTS
	VOL (CY)	AREA (SF)		VOL (CY)	AREA (SF)
CUT	75	3,273	CUT	461	12,019
FILL	0	0	FILL	0	(
NET	75 CUT	-	NET	461 CUT	-

AREA 4 EARTHWORK					AREA 8 EARTHWO	RK
	VOL (CY)	AREA (SF)			VOL (CY)	AREA (SF)
CUT	1	-		CUT	744	-
ILL	1,369	-		FILL	0	-
NET	1,368 FILL	28,010		NET	744 CUT	18,624
Al	REA 4 OHWM IMPA	DHWM IMPACTS AREA 8 OHWM IMPACTS			ACTS	
	VOL (CY)	AREA (SF)			VOL (CY)	AREA (SF)
CUT	0	0		CUT	492	14,624
ILL	0	0		FILL	0	0
NET	-	-		NET	492 CUT	-
ARI	EA 4 WETLAND IMI	PACTS		ARI	EA 8 WETLAND IMI	PACTS
	VOL (CY)	AREA (SF)			VOL (CY)	AREA (SF)
CUT	0	0		CUT	744	18,624
ILL	0	0		FILL	0	0
NET	-	-		NET	744 CUT	-



12/12/19

8/5/19

If this scale bar

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- 1) Benchmark #4A elevation 592.97'. Location at southwest corner of 'Community Events' sign on Lake Ave, east of entrance to the
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- elevation varies depending on location. 3) OHWM elevation is 581.5'.

WL

WL

WL

100 % CONSTRUCTION DOCUMENTS

90 % CONSTRUCTION DOCUMENTS

PRELIMINARY CONCEPTS

ISSUE/REVISION

4) Muskegon River information from previous 2014 Project (F&V #819060).



Restoration Project

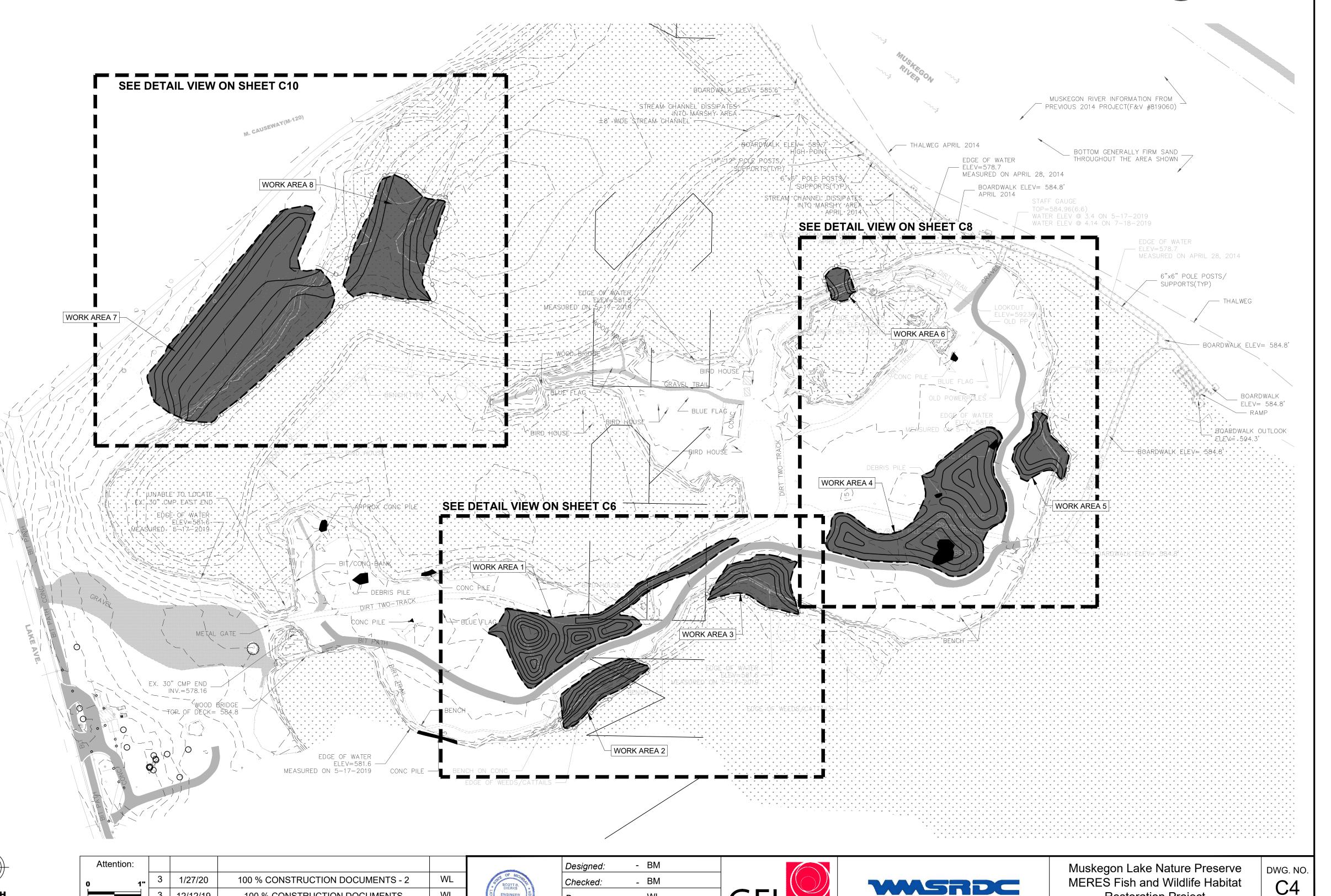
PROPOSED CONDITIONS

ISSUE

WEST MICHIGAN SHORELINE REGIONAL DEVELOPMENT COMMISSION

316 Morris Avenue, Suite 340

Muskegon, MI 49440



- WL

- BM

Submittal Date: - 1/27/20

- 44371

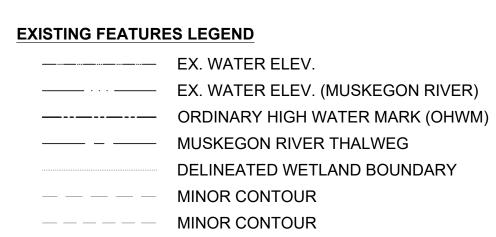
5525 Edgewater Drive

Allendale, MI 49401

Drawn:

Submitted By:

P.E. Number:



WETLANDS

CONCRETE / ASPHALT

GRAVEL

BENCHMARK

DEBRIS REMOVAL LEGEND

SURVEYED DEBRIS PILE (9 TOTAL)

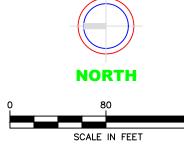
DEBRIS REMOVAL KEY

CONCRETE / DEBRIS REMOVAL LOCATION. Remove and dispose of identified piles, place clean topsoil level with adjacent grades (or as indicated on proposed grading plans) and plant with floodplain forest seed mix (see sheet D2). Number adjacent to the key call out to indicate specific debris

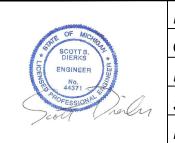
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Designed:	-	BM	
Checked:	-	BM	
Drawn:	-	WL	1
Submitted By:	-	BM	1
P.E. Number:	-	44371	
Submittal Date:	-	1/27/20	

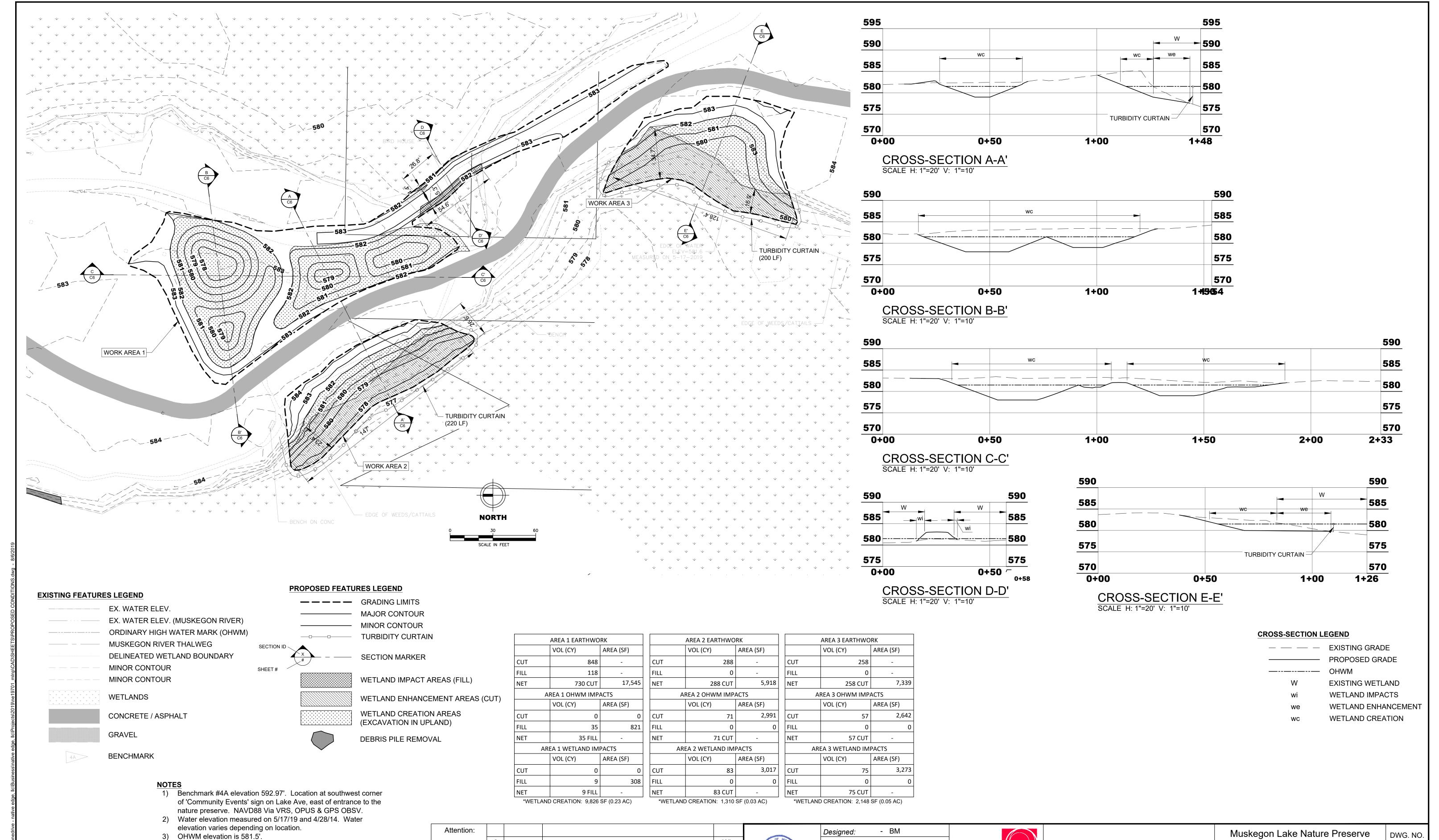


ST MICHIGAN SHORELINE AL DEVELOPMENT COMMISSION	Muskegon Lake Nature Preserve MERES Fish and Wildlife Habitat Restoration Project

DEBRIS REMOVAL PLAN

ISSUE

DWG. NO.



WL

WL

WL

WL

GEI PN 1901441

- BM

- WL

Submitted Bv: - BM

P.E. Number: - 44371

Submittal Date: - 1/27/20

Checked:

Drawn:

MERES Fish and Wildlife Habitat

Restoration Project

WORK AREAS 1, 2, & 3

WEST MICHIGAN SHORELINE REGIONAL DEVELOPMENT COMMISSION

316 Morris Avenue, Suite 340

Muskegon, MI 49440

Consultants

5525 Edgewater Drive

Allendale, MI 49401

C6

ISSUE

1/27/20

12/12/19

10/10/19

8/5/19

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100 % CONSTRUCTION DOCUMENTS - 2

100 % CONSTRUCTION DOCUMENTS

90 % CONSTRUCTION DOCUMENTS

PRELIMINARY CONCEPTS

ISSUE/REVISION

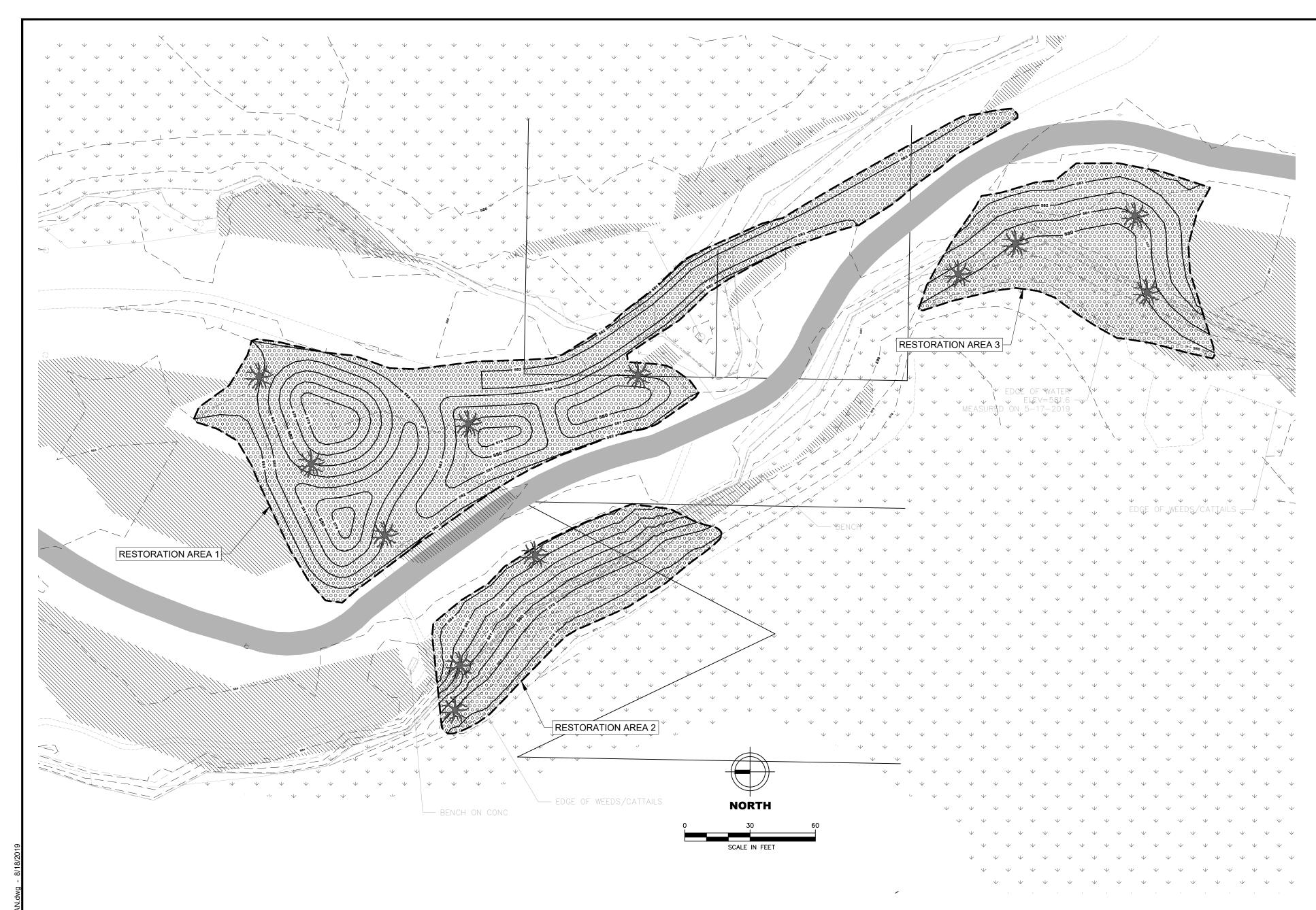


4) Muskegon River information from previous 2014 Project (F&V

project engineer prior to excavation activities.

5) Exact location and installation of turbidity curtain to be approved by

#819060).



EXISTING FEATURES LEGEND

EX. WATER ELEV. EX. WATER ELEV. (MUSKEGON RIVER) ORDINARY HIGH WATER MARK (OHWM) MUSKEGON RIVER THALWEG

DELINEATED WETLAND BOUNDARY MINOR CONTOUR

MINOR CONTOUR

CONCRETE / ASPHALT

WETLANDS

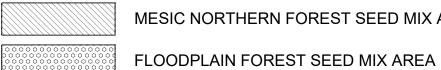
GRAVEL

BENCHMARK

PROPOSED FEATURES LEGEND

———— GRADING LIMITS **MAJOR CONTOUR** — MINOR CONTOUR

RESTORATION AREAS LEGEND



MESIC NORTHERN FOREST SEED MIX AREA

HABITAT STRUCTURES



LARGE WOODY DEBRIS

NOTES

#819060).

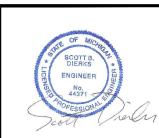
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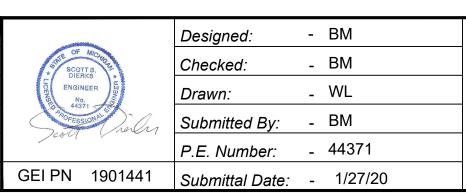
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RESTORATION NOTES

- 1) See plant lists for quantities and species information on
- 2) Mesic northern forest seed mix to be installed in all areas where invasive species will be removed (approx. 7.3 ac).
- 3) Habitat structures shall be placed throughout the restoration areas at an approximate rate of one habitat structure per 500 square feet of restoration area. Details for habitat structures can be found on sheet D1, however this is not an exhaustive list and the contractor is expected to provide examples of potential habitat structures to be installed throughout the restoration area. All proposed habitat structures to be approved by the engineer.
- 4) All grading areas to be covered with SC-150 BN erosion control blanket, or approved equivalent. Blankets to be secured using wooden stakes.

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Allendale, MI 49401



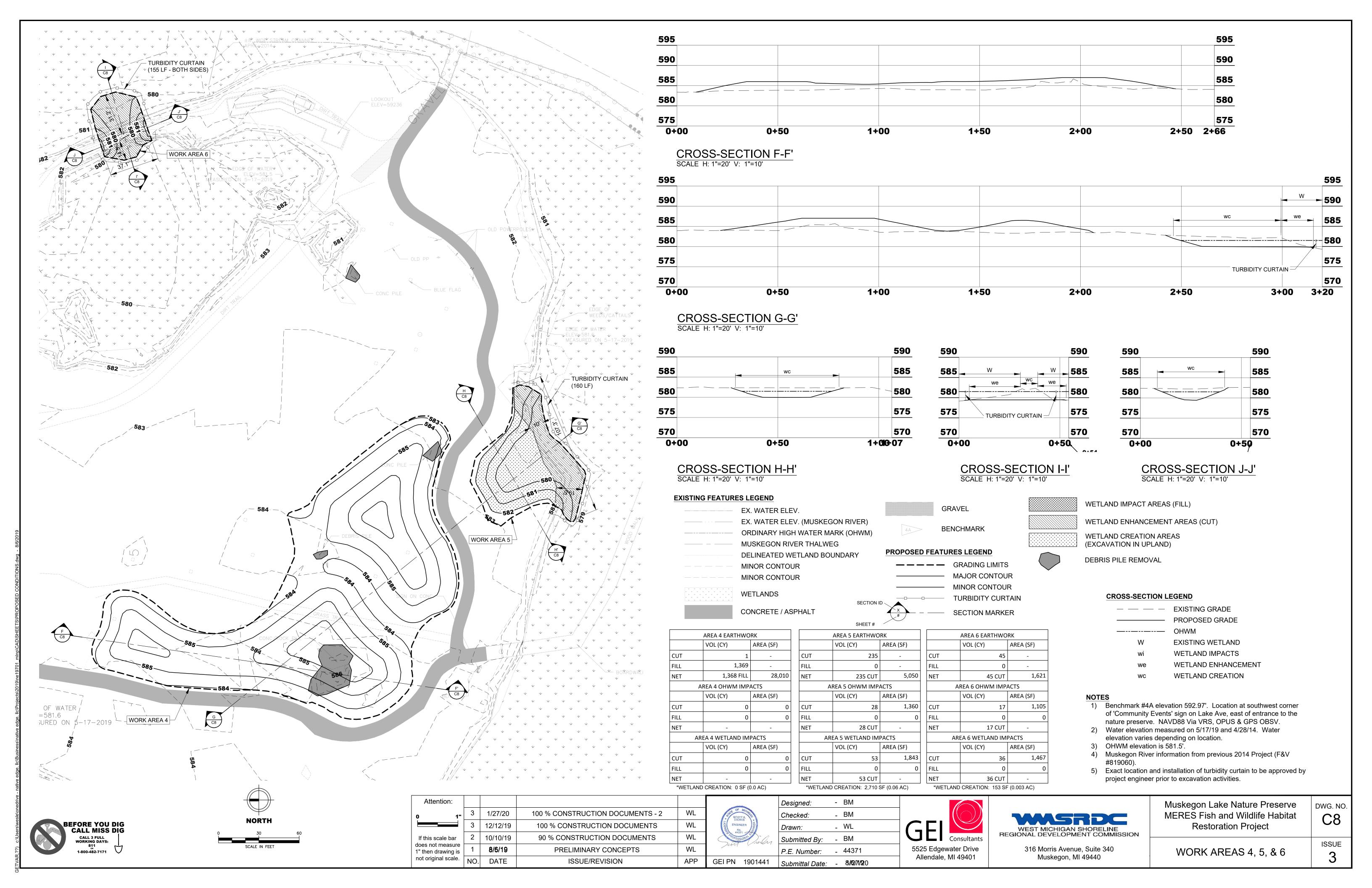
316 Morris Avenue, Suite 340 Muskegon, MI 49440

Muskegon Lake Nature Preserve DWG. NO. MERES Fish and Wildlife Habitat **Restoration Project**

C7

ISSUE RESTORATION AREAS 1, 2, & 3

BEFORE YOU DIG CALL MISS DIG





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EX. WATER ELEV. EX. WATER ELEV. (MUSKEGON RIVER) ORDINARY HIGH WATER MARK (OHWM) MUSKEGON RIVER THALWEG

> DELINEATED WETLAND BOUNDARY MINOR CONTOUR

> > MINOR CONTOUR

WETLANDS

CONCRETE / ASPHALT

GRAVEL

BENCHMARK

PROPOSED FEATURES LEGEND

- GRADING LIMITS MAJOR CONTOUR MINOR CONTOUR

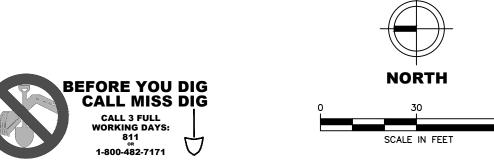
RESTORATION AREAS LEGEND

MESIC NORTHERN FOREST SEED MIX AREA

FLOODPLAIN FOREST SEED MIX AREA OAK-PINE BARRENS SEED MIX AREA

HABITAT STRUCTURES

LARGE WOODY DEBRIS



100 % CONSTRUCTION DOCUMENTS - 2 100 % CONSTRUCTION DOCUMENTS WL90 % CONSTRUCTION DOCUMENTS If this scale bar does not measure WL8/5/19 PRELIMINARY CONCEPTS 1" then drawing is not original scale. NO. DATE ISSUE/REVISION



	Designed:	-	ВМ
SCOTT B. * DIERKS	Checked:	-	ВМ
LICENGINEER No.	Drawn:	-	WL
ASOFESSION PLANT	Submitted By:	-	ВМ
Just 4	P.E. Number:	-	44371
GEI PN 1901441	Submittal Date:	-	81127120





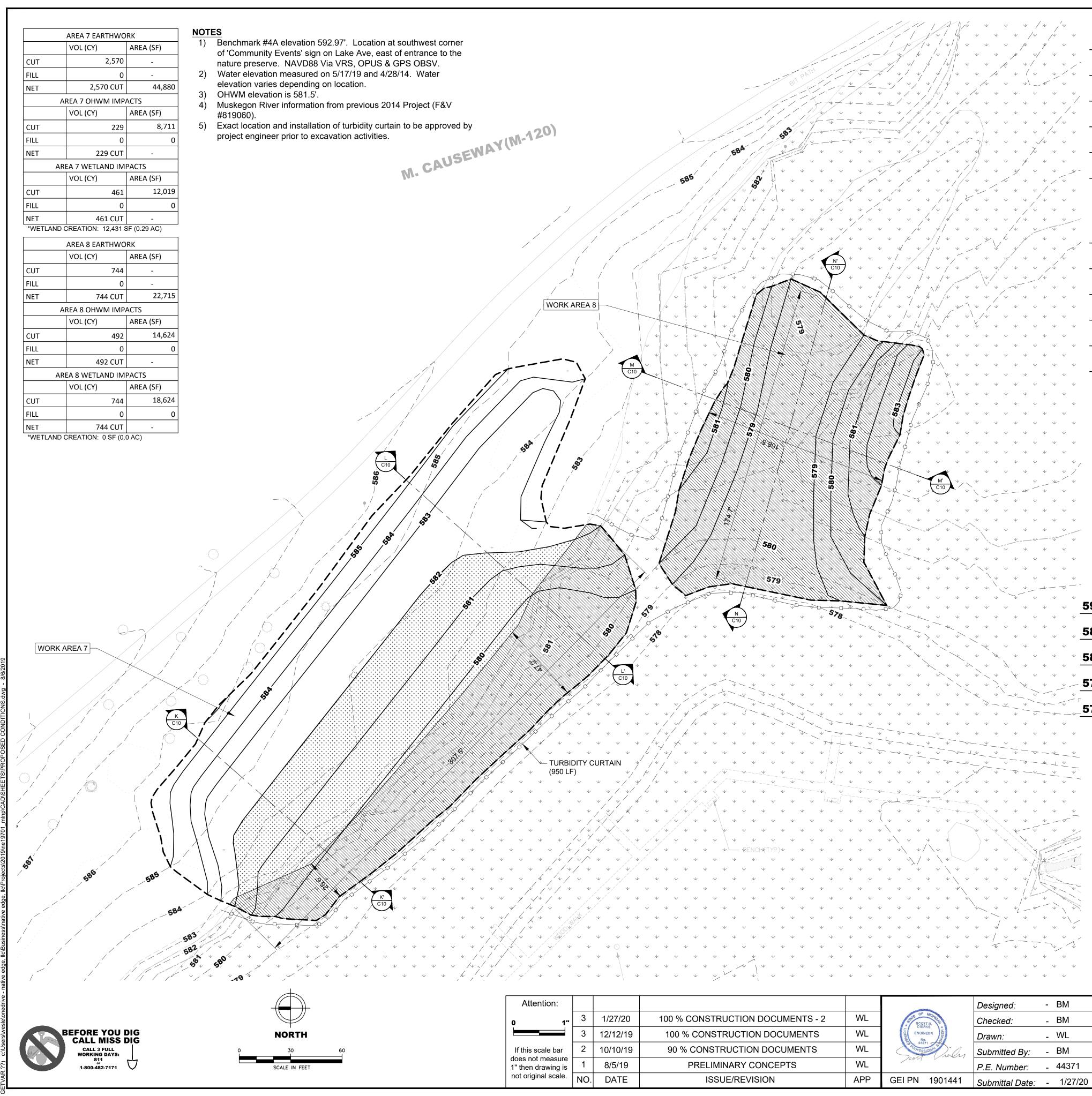
316 Morris Avenue, Suite 340 Muskegon, MI 49440

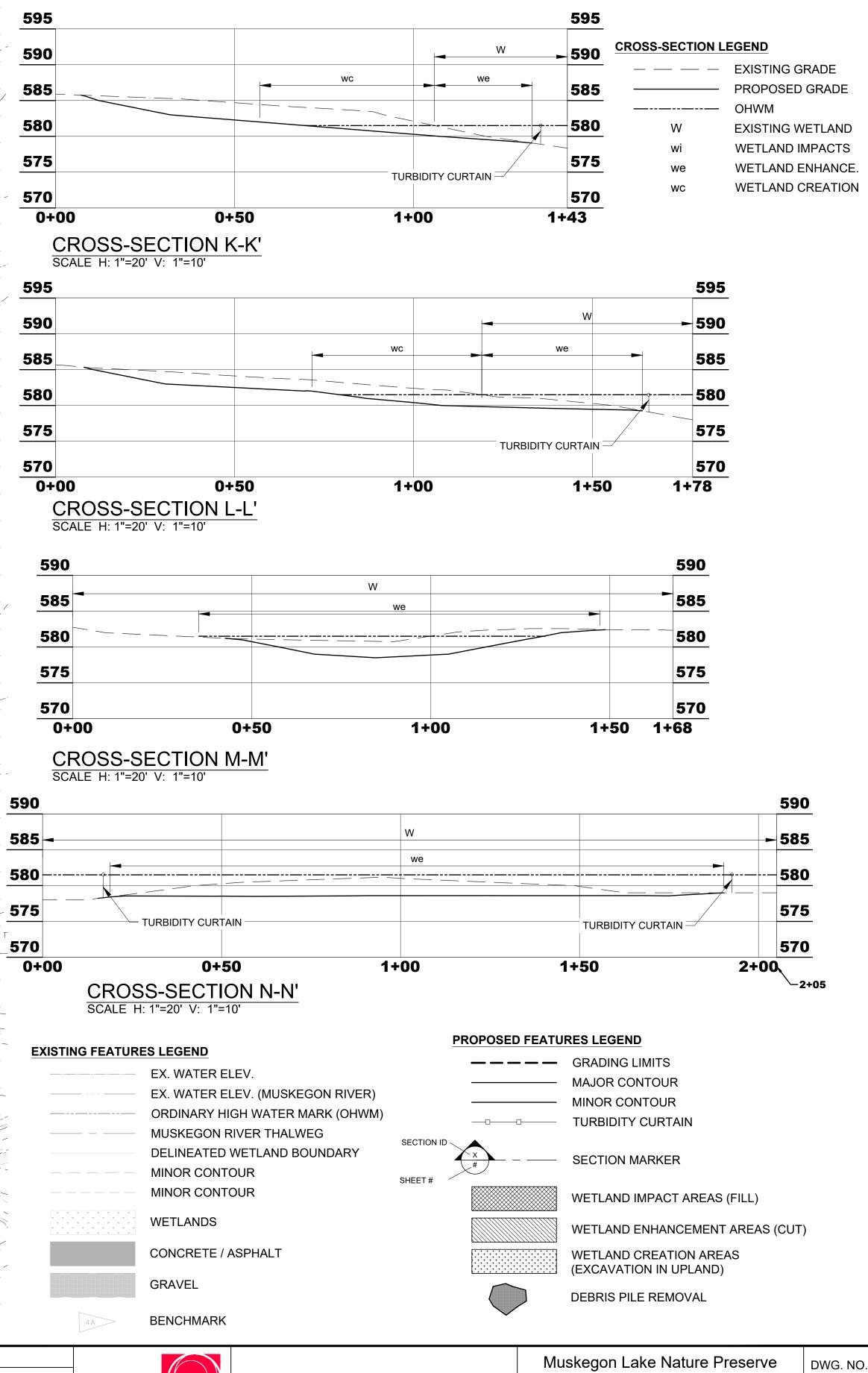
Muskegon Lake Nature Preserve DWG. NO. MERES Fish and Wildlife Habitat **Restoration Project**

RESTORATION AREAS 4, 5, & 6

ISSUE

C9





WEST MICHIGAN SHORELINE REGIONAL DEVELOPMENT COMMISSION

316 Morris Avenue, Suite 340

Muskegon, MI 49440

5525 Edgewater Drive

Allendale, MI 49401

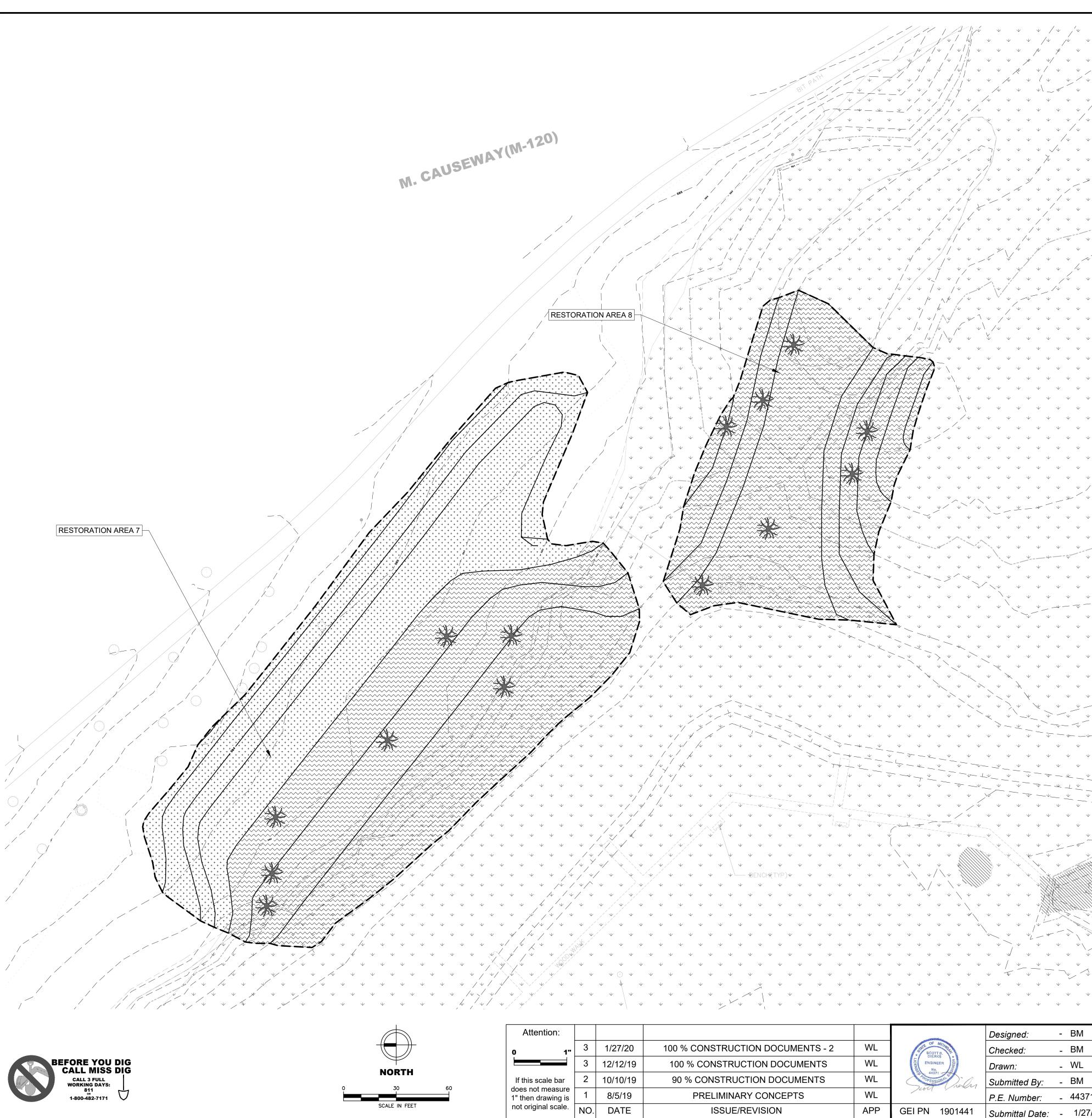
MERES Fish and Wildlife Habitat

Restoration Project

WORK AREAS 7 & 8

C10

ISSUE



- 1) Benchmark #4A elevation 592.97'. Location at southwest corner of 'Community Events' sign on Lake Ave, east of entrance to the nature preserve. NAVD88 Via VRS, OPUS & GPS OBSV.
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EX. WATER ELEV. EX. WATER ELEV. (MUSKEGON RIVER) ORDINARY HIGH WATER MARK (OHWM) MUSKEGON RIVER THALWEG DELINEATED WETLAND BOUNDARY MINOR CONTOUR MINOR CONTOUR

WETLANDS

CONCRETE / ASPHALT GRAVEL

BENCHMARK

PROPOSED FEATURES LEGEND

———— GRADING LIMITS **MAJOR CONTOUR** MINOR CONTOUR

RESTORATION AREAS LEGEND

MESIC NORTHERN FOREST SEED MIX AREA FLOODPLAIN FOREST SEED MIX AREA OAK-PINE BARRENS SEED MIX AREA

GREAT LAKES MARSH SEED MIX AREA

HABITAT STRUCTURES



LARGE WOODY DEBRIS

	Designed:	-	BM	
	Checked:	-	BM	
	Drawn:	-	WL	
7	Submitted By:	-	BM	
	P.E. Number:	-	44371	
·	Submittal Date:	-	1/27/20	
				_





316 Morris Avenue, Suite 340 Muskegon, MI 49440

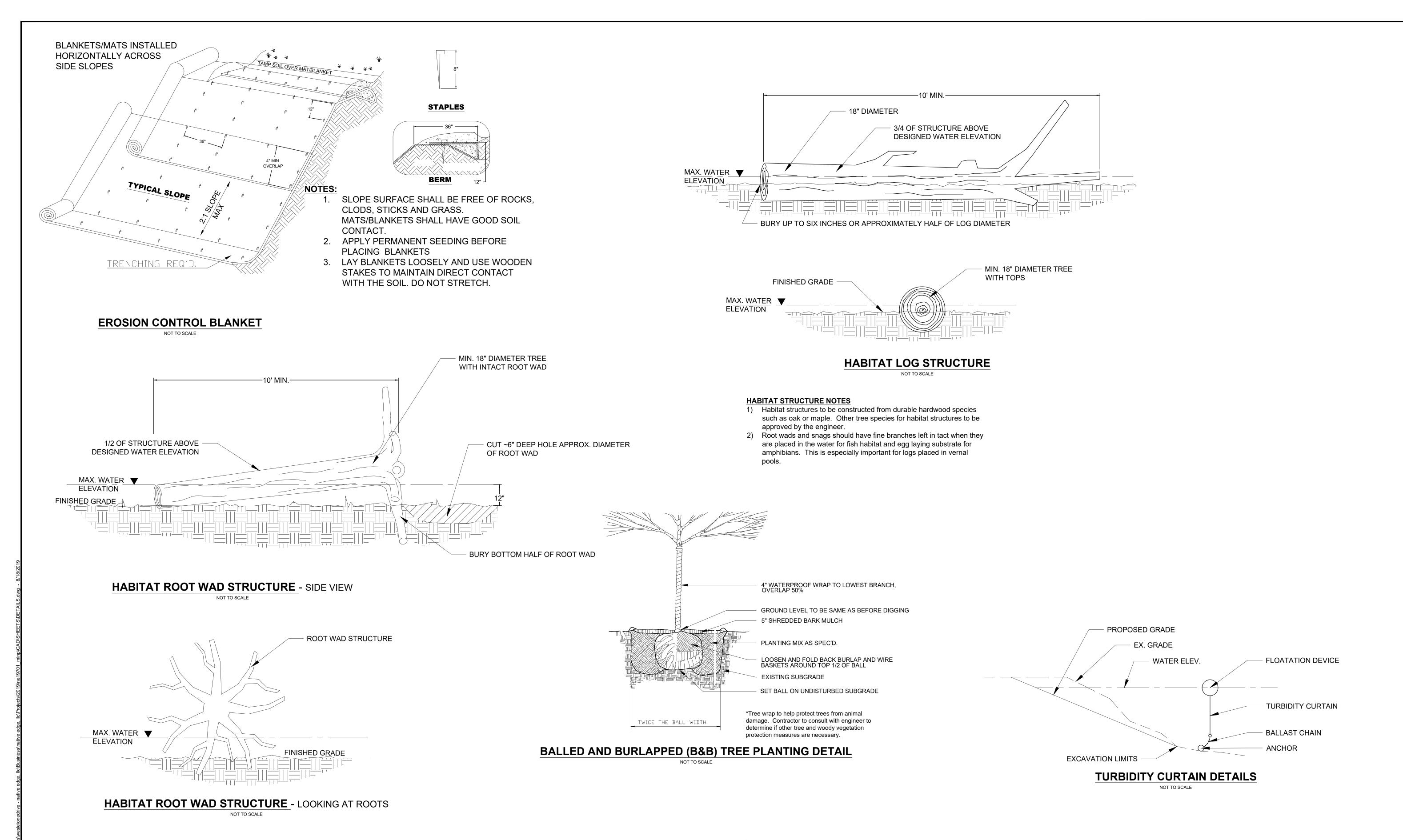
Muskegon Lake Nature Preserve
MERES Fish and Wildlife Habita
Restoration Project

RESTORATION AREAS 7 & 8

ISSUE

DWG. NO.

C11



Attention:				
0 1"	3	1/27/20	100 % CONSTRUCTION DOCUMENTS - 2	WL
	3	12/12/19	100 % CONSTRUCTION DOCUMENTS	WL
If this scale bar	2	10/10/19	90 % CONSTRUCTION DOCUMENTS	WL
does not measure 1" then drawing is	1	8/5/19	PRELIMINARY CONCEPTS	WL
not original scale.	NO.	DATE	ISSUE/REVISION	APP



GEI PN 1901441

Designed:	-	ВМ
Checked:	-	ВМ
Drawn:	-	WL
Submitted By:	-	BM
P.E. Number:	-	44371
Submittal Date:	-	1/27/20

Allendale, MI 49401



Muskegon, MI 49440

Muskegon Lake Nature Preserve MERES Fish and Wildlife Habitat Restoration Project	DWG. NO.

DETAILS

ISSUE

		Watland Indicator	Mator	Aron 1	Aro 2 2	Aron 2	A ro 2 4	Aro a E / E 0E0	Aros 6	Aro 2 7	Aros 9	Inv Species Removal Areas
Scientific Name	Common Name	Wetland Indicator Status	Water Depth	Area 1 (17,545 sf)	Area 2 (5918 sf)	Area 3 (7339 sf)		Area 5 (5,050 sf)	Area 6 (1.621 sf)	Area 7 (44,880 sf)	Area 8 (22,715 sf)	(4.5 ac
Allium cernuum	Nodding wild onion	FACU					456					
Aquilegia canadensis	Wild columbine	FACU			114	114	456	76		114		
Asclepia incarnata Asclepias tuberosa	Swamp milkweed Butterfly weed	OBL UPL			114	114	494	76		380		
Athyrium filix-femina	Lady fern	FAC		25								20
Ceanothus americanus	New Jersey tea	UPL					456	70				
Chelone glabra Dryopteris marginalis	Turtlehead Leatherleaf woodfern	OBL FACU		380 25	114 10	114 10		76 10				20
Euphorbia corollata	Flowering spurge	UPL		23	10	10	456	10				20
Eutrochium maculatum	Joe-Pye weed	OBL								152		
Eutrochium purpureum Helianthus divaricatus	Purple joe-pye weed Woodland sunflower	FAC					456					
Hibiscus moscheutos	Rose mallow	UPL OBL			114	114	456	114		380		
Iris virginica shrevei	Blue flag iris	OBL		520	152	190		152		560		
Liatris aspera	Rough blazing star	UPL					380			114		
Liatris cylindracea Liatris spicata	Cylindrical blazing star Marsh blazing star	FAC FAC					380			380		
Lobelia cardinalis	Cardinal flower	OBL		380	152	190		76		380		
Lobelia siphilitica	Blue lobelia	FACW+					380					
Mimulus ringens	Monkeyflower	OBL					222			380		
Monarda fistulosa Monarda punctata	Wild bergamot Horse mint/ dotted mint	FACU UPL					380 380			380		
Nupharadvena	Spatterdock	OBL				76	300			760	400	
Nymphaea tuberosa	White water lily	OBL				76				760	400	
Osumunda cinnnamomeum	Cinnamon fern	FACW		100	15	15 15		15				
Osmunda regalis Peltandra virginica	Royal fern Arrow arum	OBL OBL		100	15 152	15 152		15 152		760		
Phlox pilosa	Sand prairie phlox	FACU			132	132	494	132		700		
Physostegia virginiana	Obedient plant/ false dragonhead	FACW+					494					
Pontederia cordata Pycnanthemum virginianum	Pickerelweed Common mountain mint	OBL			152	152	40.5	114		760	500	
Pycnanthemum virginianum Sagittaria latifolia	Arrowhead	FACW+ OBL					494			760	500	
Saururus cernuus	Lizard's tail	OBL		380	114	152		114		700	300	
Solidago speciosa	Showy goldenrod	UPL					494					
Tradescantia ohiensis Veronicastrum virginicum	Common spiderwort Culver's root	FACU FAC					380 456			114		
veronicastrum virginicum	Culver's 100t	FAC					456			114		
Carex crinita	Fringed sedge	OBL		520								
Carex lupulina	Hop sedge	OBL										
Carex muskingumensis	Sand bracted sedge	OBL		520						F70		
Carex stricta Carex vulpinoidea	Tussock sedge Brown fox sedge	OBL OBL		520						570 570		
Juncus effusus	Soft rush	OBL								570		
Schoenoplectus acutus	Hardstem bulrush	OBL								760		
Schoenoplectus pungens	Common threesquare	OBL			152	190		152		760	200	
Schoenoplectus tabernaemontani Scirpus cyperinus	Softstem bulrush Wool Grass	OBL OBL			152	190		152		152	380	
Sparganium eurycarpum	Common burreeed	OBL			114	152		114		760	380	
	Total (by zone)			3,470	1,522	1,902	7,030	1,332	0	11,276	2,560	
Shrubs (24-36" bare root, 8' spacing) Aronia melanocarpa	Black chokeberry	FACW			10	15		10				25
Ceanothus americanus	New Jersey Tea	UPL			10	13	200	10				20
Cornus amomum	Silky dogwood	FACW+			10	10		10				10
Cornus sericea	Red-osier dogwood	FACW+			10	10		10				10
Diervilla lonicera Ilex verticillata	Northern bush honeysuckle Winterberry	UPL FACW			10 10	10 10		10 10				50 10
	Sweet gale	OBL			10	10		10				20
Physocarpus opulifolius	Ninebark	FACW			10	10		10				20
Sambucus canadensis	Elderberry	FACW-			10	25		10				25
Symphoricarpos albus var. laevigatus Vaccinium angustifolum	Snowberry Low bush blueberry	FACU FACU			10 10	10 10		10 10				25 25
Viburnum dentatum	Arrowwood	FAC			10	10		10				25
Viburnum lentago	Nannyberry	FAC			10	10		10				25
Viburnum opulus v. americanum	American highbush cranberry	FACW			10	10		10				25
Trees (minmum 24", 390/acre)	Total (by zone)			0	130	150	200	130	0	0	0	315
Acer rubrum	Red maple	FAC			5	10		5				7
Celtis occidentalis	Hackberry	FAC			5	10						7
	Redbud	FACU										5
Cercis canadensis		FACIL			1							5 30
Cornus florida	Flowering dogwood	FACU FACU			+							10
		FACU FACU FACW+										
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus	Flowering dogwood Eastern red cedar	FACU FACW+ FACU			5	10		5				30
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis	Flowering dogwood Eastern red cedar Black gum White pine Sycamore	FACU FACW+ FACU FACW			5	10 10		5				30 15
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis Prunus serotina	Flowering dogwood Eastern red cedar Black gum White pine Sycamore Wild black cherry	FACU FACW+ FACU FACW			5 5			5				30 15 20
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis	Flowering dogwood Eastern red cedar Black gum White pine Sycamore	FACU FACW+ FACU FACW			5 5 5 5			5 5 5 5				30 15 20 7
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis Prunus serotina Quercus bicolor	Flowering dogwood Eastern red cedar Black gum White pine Sycamore Wild black cherry Swamp white oak Pin oak Eastern hemlock	FACU FACU FACW FACU FACW FACU			5 5 5 5	10		5 5 5				30 15 20 7 7 30
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis Prunus serotina Quercus bicolor Quercus palustris Tsuga canadensis	Flowering dogwood Eastern red cedar Black gum White pine Sycamore Wild black cherry Swamp white oak Pin oak	FACU FACW FACW FACW FACW FACW FACW		0	5 5 5 5 30		0	5	0	0	0	30 15 20 7 7 30 175
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis Prunus serotina Quercus bicolor Quercus palustris Tsuga canadensis Trees (min 6' tall)	Flowering dogwood Eastern red cedar Black gum White pine Sycamore Wild black cherry Swamp white oak Pin oak Eastern hemlock Total (by zone)	FACU FACW+ FACU FACW FACU FACW+ FACW+ FACW		0		10	0	5 5 5	0	0	0	30 15 20 7 7 30 175
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis Prunus serotina Quercus bicolor Quercus palustris Tsuga canadensis	Flowering dogwood Eastern red cedar Black gum White pine Sycamore Wild black cherry Swamp white oak Pin oak Eastern hemlock	FACU FACW FACW FACW FACW FACW FACW		0	5 5 5 5 30	10	0	5 5 5	0	0	0	30 15 20 7 7 30 175
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis Prunus serotina Quercus bicolor Quercus palustris Tsuga canadensis Trees (min 6' tall) Acer rubrum Celtis occidentalis Cercis canadensis	Flowering dogwood Eastern red cedar Black gum White pine Sycamore Wild black cherry Swamp white oak Pin oak Eastern hemlock Total (by zone) Red maple Hackberry Redbud	FACU FACW+ FACU FACW FACW FACW FACW FACW FACW FACW FACU FACU FACU		0		10	0	5 5 5	0	0	0	30 15 20 7 7 30 175
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis Prunus serotina Quercus bicolor Quercus palustris Tsuga canadensis Trees (min 6' tall) Acer rubrum Celtis occidentalis Cercis canadensis Cornus florida	Flowering dogwood Eastern red cedar Black gum White pine Sycamore Wild black cherry Swamp white oak Pin oak Eastern hemlock Total (by zone) Red maple Hackberry Redbud Flowering dogwood	FACU FACW+ FACU FACW FACU FACW FACW FACW FACW FACW FACU FACW FACU		0		10	0	5 5 5	0	0	0	30 15 20 7 7 30 175
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis Prunus serotina Quercus bicolor Quercus palustris Tsuga canadensis Trees (min 6' tall) Acer rubrum Celtis occidentalis Cercis canadensis Cornus florida Juniperus virginiana	Flowering dogwood Eastern red cedar Black gum White pine Sycamore Wild black cherry Swamp white oak Pin oak Eastern hemlock Total (by zone) Red maple Hackberry Redbud Flowering dogwood Eastern red cedar	FACU FACW+ FACU FACW FACU FACW+ FACW FACW FACW FACU FACU FACU FACU FACU FACU FACU		0		10	0	5 5 5	0	0	0	30 15 20 7 7 30 175 1
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis Prunus serotina Quercus bicolor Quercus palustris Tsuga canadensis Trees (min 6' tall) Acer rubrum Celtis occidentalis Cercis canadensis Cornus florida Juniperus virginiana Nyssa sylvatica	Flowering dogwood Eastern red cedar Black gum White pine Sycamore Wild black cherry Swamp white oak Pin oak Eastern hemlock Total (by zone) Red maple Hackberry Redbud Flowering dogwood Eastern red cedar Black gum	FACU FACW+ FACU FACW FACU FACW FACW FACW FACW FACW FACU FACW FACU		0		10	5	5 5 5	0	0	0	30 15 20 7 7 30 175 1 1
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis Prunus serotina Quercus bicolor Quercus palustris Tsuga canadensis Trees (min 6' tall) Acer rubrum Celtis occidentalis Cercis canadensis Cornus florida Juniperus virginiana	Flowering dogwood Eastern red cedar Black gum White pine Sycamore Wild black cherry Swamp white oak Pin oak Eastern hemlock Total (by zone) Red maple Hackberry Redbud Flowering dogwood Eastern red cedar	FACU FACW+ FACU FACW FACU FACW FACW FACW FACW FACW FACU FACU FACU FACU FACU FACU FACU FACU		0		10	5 5 10	5 5 5	0	0	0	30 15 20 7 30 175 1 1 1
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis Prunus serotina Quercus bicolor Quercus palustris Tsuga canadensis Trees (min 6' tall) Acer rubrum Celtis occidentalis Cercis canadensis Cornus florida Juniperus virginiana Nyssa sylvatica Picea glauca Pinus strobus Platanus occidentalis	Flowering dogwood Eastern red cedar Black gum White pine Sycamore Wild black cherry Swamp white oak Pin oak Eastern hemlock Total (by zone) Red maple Hackberry Redbud Flowering dogwood Eastern red cedar Black gum White spruce Eastern white pine Sycamore	FACU FACW+ FACU FACW FACU FACW+ FACW FACW FACU FACW FACU FACU FACU FACU FACU FACU FACU FACU		0		10	5 10	5 5 5	0	0	0	30 15 20 7 30 175 1 1 1 2 3
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis Prunus serotina Quercus bicolor Quercus palustris Tsuga canadensis Trees (min 6' tall) Acer rubrum Celtis occidentalis Cercis canadensis Cornus florida Juniperus virginiana Nyssa sylvatica Picea glauca Pinus strobus Platanus occidentalis Prunus serotina	Flowering dogwood Eastern red cedar Black gum White pine Sycamore Wild black cherry Swamp white oak Pin oak Eastern hemlock Total (by zone) Red maple Hackberry Redbud Flowering dogwood Eastern red cedar Black gum White spruce Eastern white pine Sycamore Wild black cherry	FACU FACW+ FACU FACW FACU FACW+ FACW FACU FACU FACU FACU FACU FACU FACU FACU		0		10	5 5 10	5 5 5	0	0	0	30 15 20 7 7 30 175 1 1 1 2 3 1 2 3
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis Prunus serotina Quercus bicolor Quercus palustris Tsuga canadensis Trees (min 6' tall) Acer rubrum Celtis occidentalis Cercis canadensis Cornus florida Juniperus virginiana Nyssa sylvatica Picea glauca Pinus strobus Platanus occidentalis Prunus serotina Quercus bicolor	Flowering dogwood Eastern red cedar Black gum White pine Sycamore Wild black cherry Swamp white oak Pin oak Eastern hemlock Total (by zone) Red maple Hackberry Redbud Flowering dogwood Eastern red cedar Black gum White spruce Eastern white pine Sycamore Wild black cherry Swamp white oak	FACU FACW+ FACU FACW FACW FACW FACW FACW FACU FACU FACU FACU FACU FACU FACU FACU		0		10		5 5 5	0	0	0	30 15 20 7 7 30 175 1 1 1 2 3
Cornus florida Juniperus virginiana Nyssa sylvatica Pinus strobus Platanus occidentalis Prunus serotina Quercus bicolor Quercus palustris Tsuga canadensis Trees (min 6' tall) Acer rubrum Celtis occidentalis Cercis canadensis Cornus florida Juniperus virginiana Nyssa sylvatica Picea glauca Pinus strobus Platanus occidentalis Prunus serotina	Flowering dogwood Eastern red cedar Black gum White pine Sycamore Wild black cherry Swamp white oak Pin oak Eastern hemlock Total (by zone) Red maple Hackberry Redbud Flowering dogwood Eastern red cedar Black gum White spruce Eastern white pine Sycamore Wild black cherry	FACU FACW+ FACU FACW FACU FACW+ FACW FACU FACU FACU FACU FACU FACU FACU FACU		0		10	10	5 5 5	0	0	0	30 15 20 7 30 175 1 1 1 2 3 2 1 1

MESIC NORTHERN FOREST SEED MIX - ALL INVASIVE SPECIES REMOVAL AREAS (316,721 SF; 7.3 AC)

		PLS Oz
Scientific Name	Common Name	Per Acre
Allium cernuum	Nodding wild onion	2
Anemone canadensis	Canada anemone	1
Anemone cylindrica	Thimbleweed	1
Anemone virginiana	Tall anemone/ thimbleweed	2
Aquilegia canadensis	Wild columbine	2
Bromus pubescens	Canada brome/ woodland brome	6
Campanulastrum americanum	Tall bellflower/ American bellflower	1
Ceanothus americanus	New Jersey tea	2
Cinna arundinacea	Wood reedgrass/ common wood reed	2
Elymus hystrix	Bottlebrush grass	16
Elymus virginicus	Virginia wild rye	8
Eupatorium rugosum	Snakeroot	2
Eutrochium purpureum	Green stemmed joe-pye weed/ purple joe-pye weed	2
Geranium maculatum	Wild geranium	1
Helianthus divaricatus	Woodland sunflower	2
Juncus tenuis	Path rush	1
Lobelia siphilitica	Great blue lobelia	1
Lupinus perennis	Wild lupine	4
Phlox divaricata	Wild blue phlox/ woodland phlox	0.25
Solidago caesia	Bluestem goldenrod	0.5
Symphyotrichum oolentangiense	Sky-blue aster	0.25
Thalictrum dasycarpum	Purple meadow rue	1
Thalictrum dioicum	Early meadow rue	0.75
	Total PLS Ounces Per Acre	58.75
	Total PLS Pounds Per Acre	3.67
Avena sativa	Seed oats	\$0.05
Lolium multiflorum	Annual rye	\$0.12

OAK-PINE BARRENS SEED MIX - AREA 4 AND UPLAND AREA OF AREA 7 (48,435 SF; 1.1 AC)

		PLS Oz
Scientific Name	Common Name	Per Acre
Allium cernuum	Nodding wild onion	
Anemone cylindrica	Thimbleweed	0.5
Anemone virginiana	Tall anemone/ thimbleweed	
Aquilegia canadensis	Wild columbine	
Asclepias purpurascens	Purple milkweed	0.2
Asclepias tuberosa	Butterfly weed	
Asclepias verticillata	Whorled milkweed	0.2
Bouteloua curtipendula	Grama grass/ side-oats grama	(
Ceanothus americanus	New Jersey tea	0.2
Coreopsis lanceolata	Sand coreopsis	4
Coreopsis tripteris	Tall tickseed/ tall coreopsis	•
Elymus canadensis	Canada wild rye	(
Eragrostis spectabilis	Tumble grass/ purple love grass	•
Euphorbia corollata	Flowering spurge	0.2
Eutrochium purpureum	Green stemmed joe-pye weed/ purple joe-pye weed	0.9
Helianthus divaricatus	Woodland sunflower	
Helianthus tuberosus	Jerusalem artichoke	0.
Lespedeza capitata	Round-headed bush clover	
Liatris aspera	Rough blazing star	0.2
Liatris cylindracea	Cylindrical blazing star	0.2
Liatris scariosa	Northern blazing star/ savanna blazing star	0.2
Lobelia siphilitica	Great blue lobelia	0.2
Lupinus perennis	Wild lupine	
Monarda fistulosa	Wild bergamot	
Monarda punctata	Horse mint/ dotted mint	
Panicum virgatum	Switch grass	
Penstemon hirsutus	Hairy beard tongue	•
Penstemon calycosus	Smooth beard tongue	
Phlox pilosa	Prairie phlox	0.2
Physostegia virginiana	Obedient plant/ false dragonhead	0.2
Pycnanthemum virginianum	Common mountain mint	
Rudbeckia hirta	Black-eyed Susan	
Schizachyrium scoparium	Little bluestem grass	4
Solidago speciosa	Showy goldenrod	
Symphyotrichum laeve	Smooth blue aster	
Tradescantia ohiensis	Common spiderwort	
Veronicastrum virginicum	Culver's root	0.2
veronicastrum virginicum	Total PLS Ounces Per Acre	
	Total PLS Ounces Per Acre Total PLS Pounds Per Acre	102.75 6.42
 Avena sativa	Seed oats	\$0.05
Avena sauva Lolium multiflorum	<u> </u>	
LONAIN MUNUNOLUM	Annual rye	\$0.12

FLOODPLAIN FOREST SEED MIX - AREAS 1, 2, 3, 5, & 6 (37,475 SF; 0.9 AC)

		PLS Oz
Scientific Name	Common Name	Per Acre
Calamagrostis canadensis	Blue-joint	2
Carex crinita	Fringed sedge	3
Carex lupulina	Common hop sedge	4
Carex lurida	Bottlebrush sedge	3
Chelone glabra	Turtlehead	•
Cinna arundinacea	Wood reedgrass/ common wood reed	1.5
Elymus virginicus	Virginia wild rye	24
Eutrochium maculatum	Spotted joe-pye weed/ joe-pye weed	2.5
Eutrochium purpureum	Green stemmed joe-pye weed/ purple joe-pye weed	2.
Glyceria striata	Fowl manna grass	
Iris virginica	Southern blue flag/ blue flag iris	
Liatris spicata	Marsh blazing star	1.5
Lobelia cardinalis	Red lobelia/ cardinal flower	
Lobelia siphilitica	Great blue lobelia	
Peltandra virginica	Arrow arum/ tuckahoe	
Rudbeckia laciniata	Wild golden glow/ cut-leaf coneflower	:
Saururus cernuus	Lizard's tail	
Scirpus cyperinus	Wool grass	
Symphyotrichum lateriflorum	Calico aster/ side-flowering aster	
Symphyotrichum puniceum	Swamp aster/ bristly aster	
	Total PLS Ounces Per Acre	64.0
	Total PLS Pounds Per Acre	4.00
Avena sativa	Seed oats	\$0.0
Lolium multiflorum	Annual rye	\$0.12

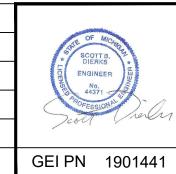
GREAT LAKES MARSH SEED MIX - AREAS 7 & 8 (43,076 SF; 1.0 AC)

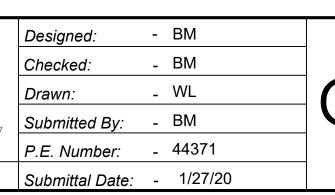
	Common Name	PLS Oz	Wetland Status
Scientific Name		Per Acre	
Acorus calamus	Sweet flag	4	OBL
Asclepias incarnata	Swamp milkweed	4	OBL
Avena sativa	Seed oats	512	UPL
Bidens cernua	Nodding bur marigold	2	OBL
Calamagrostis canadensis	Blue joint grass	2	OBL
Carex vulpinoidea	Brown fox sedge	4	OBL
Decodon verticillatus	Swamp loosestrife	0.25	OBL
Eleocharis acicularis	Needle spike rush	0.5	OBL
Eleocharis palustris	Great spike rush	1	OBL
Glyceria striata	Fowl manna grass	1	OBL
Hibiscus moscheutos	Swamp rose mallow	4	OBL
Iris virginica shrevei	Blue flag iris	6	OBL
Juncus canadensis	Canadian rush	1	OBL
Juncus effusus	Common rush	3	OBL
Juncus torreyi	Torrey's rush	0.25	FACW
Leersia oryzoides	Rice cut grass	2	OBL
Lolium multiflorum	Annual rye	160	UPL
Mimulus ringens	Monkey flower	1	OBL
Peltandra virginica	Arrow arum	6	OBL
Pontederia cordata	Pickerel weed	4	OBL
Rumex orbiculatus	Great water dock	1	OBL
Sagittaria latifolia	Common arrowhead	2	OBL
Saururus cernuus	Lizard's tail	0.5	OBL
Scirpus acutus	Hard-stemmed bulrush	2	OBL
Scirpus atrovirens	Dark green rush	2	OBL
Scirpus cyperinus	Wool grass	1	OBL
Scirpus fluviatilis	River bulrush	2	OBL
Scirpus pungens	Chairmaker's rush	3	OBL
Scirpus validus creber	Great bulrush	4	OBL
Sparganium eurycarpum	Common bur reed	2	OBL
Zizania aquatica	Wild rice	50	OBL

Attention:

3 1/27/20 100 % CONSTRUCTION DOCUMENTS - 2 WL WL 3 12/12/19 100 % CONSTRUCTION DOCUMENTS 90 % CONSTRUCTION DOCUMENTS WL If this scale bar does not measure 8/5/19 PRELIMINARY CONCEPTS WL 1" then drawing is not original scale.

1" then drawing is NO. DATE ISSUE/REVISION







WASBOC	
WEST MICHIGAN SHORELINE	
REGIONAL DEVELOPMENT COMMISSION	L
	- 1

316 Morris Avenue, Suite 340 Muskegon, MI 49440

Restoration Project

Muskegon Lake Nature Preserve MERES Fish and Wildlife Habitat DWG. NO. D2

PLANT LISTS

ISSUE