

Appendix B

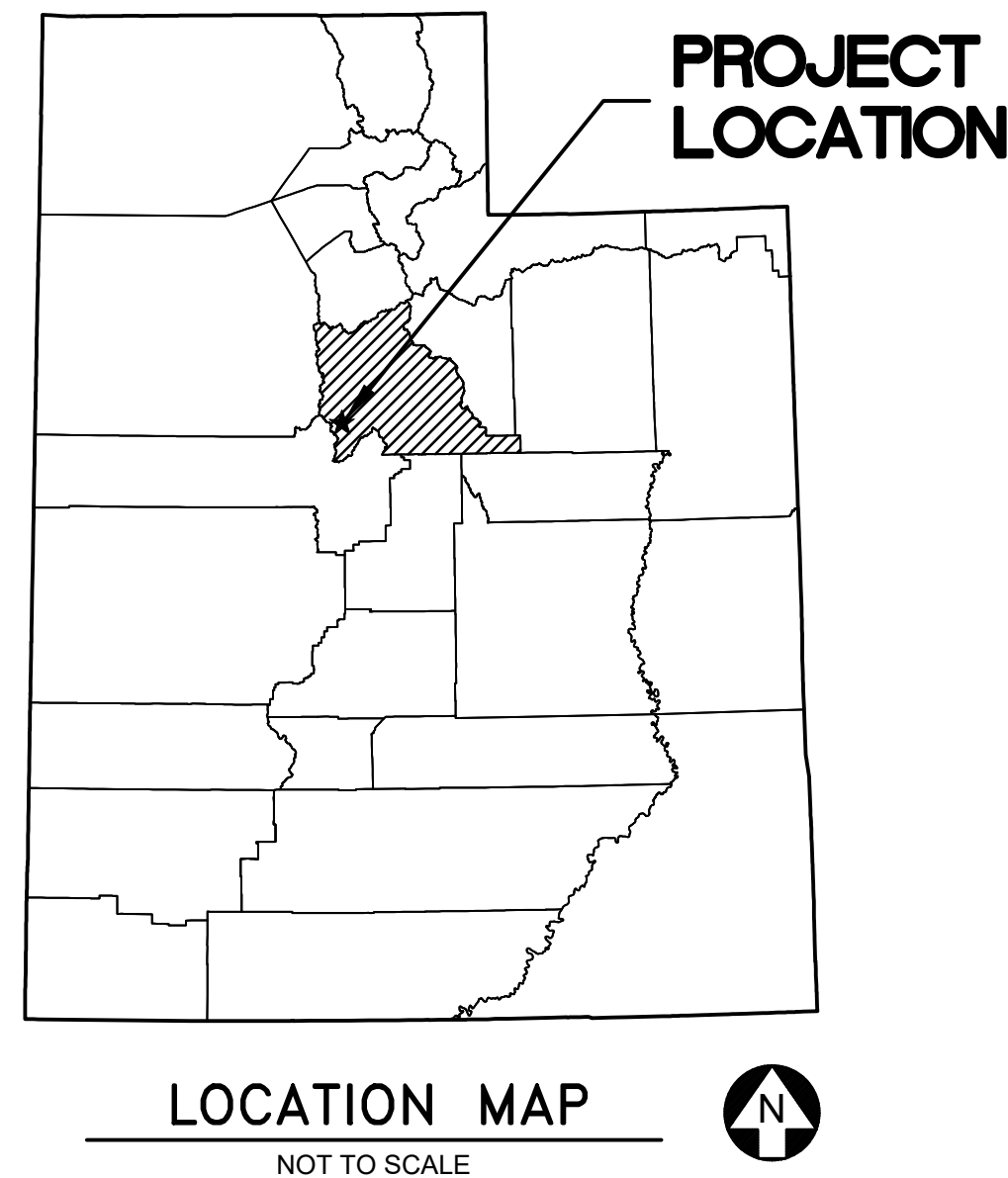
Permit Drawings

Appendix B Permit Drawings

DRY STACK TAILINGS STORAGE FACILITY

TINTIC CONSOLIDATED METALS LLC.

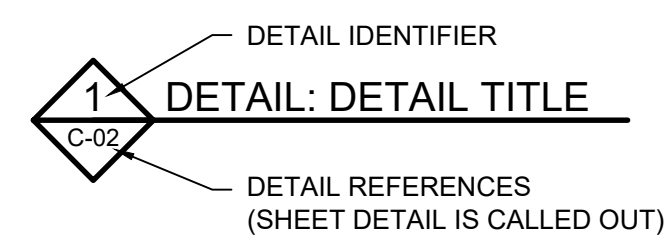
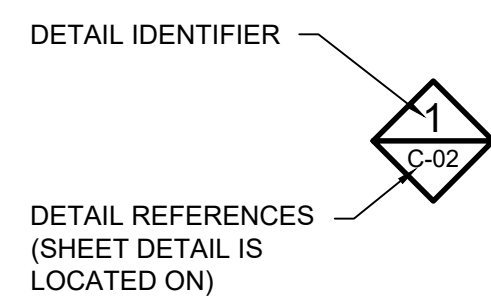
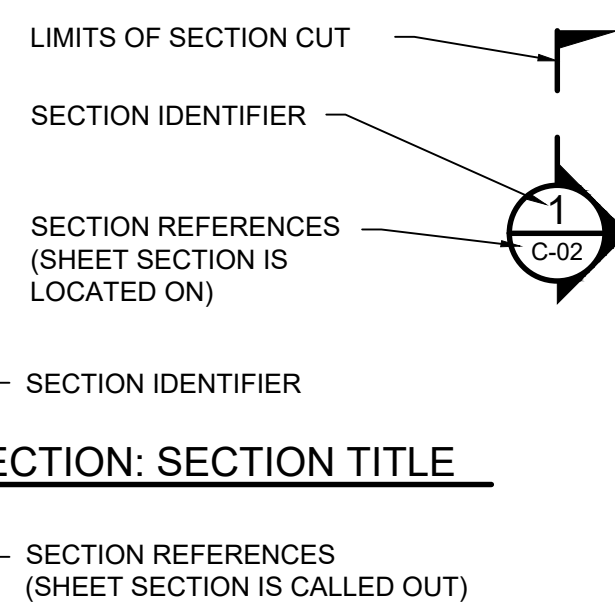
EUREKA, UTAH



SHEET INDEX

C-100	COVER SHEET
C-200	EXISTING CONDITIONS PLAN
C-201	TOPSOIL STRIPPING AND STOCKPILING PLAN
C-300	OVERALL PLAN
C-301	DRY STACK LINER GRADING PLAN
C-302	DRY STACK FINAL COVER GRADING PLAN
C-303	DRY STACK OVERALL SECTIONS
C-304	DRY STACK AND EVENT POND LINER SECTIONS AND DETAILS
C-305	DRY STACK LEACHATE COLLECTION SECTIONS AND DETAILS
C-306	NORTH PERIMETER DITCH PROFILES
C-307	SOUTH PERIMETER DITCH PROFILES
C-308	DRY STACK PERIMETER BERM AND DITCH SECTIONS AND DETAILS
C-400	EVENT POND GRADING PLAN
C-401	EVENT POND OVERALL SECTIONS
C-402	EVENT POND SUMP PLAN, SECTIONS, AND DETAILS
C-500	HAUL ROAD 1 PLAN AND PROFILE
C-501	HAUL ROAD 2 PLAN AND PROFILE
C-502	HAUL ROAD 2 PLAN AND PROFILE
C-503	HAUL ROAD 1 SECTIONS
C-504	HAUL ROAD 2 SECTIONS
C-505	HAUL ROAD 2 SECTIONS
C-506	HAUL ROAD 2 SECTIONS
C-507	HAUL ROAD TYPICAL SECTIONS
C-600	PROCESS POND GRADING PLAN
C-601	PROCESS POND SECTIONS AND DETAILS

REFERENCING



VICINITY MAP



ABBREVIATIONS AND SYMBOLS

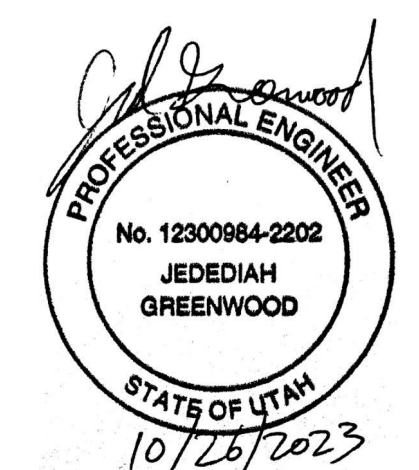
APPROX.	APPROXIMATE
APIWA	AMERICAN PUBLIC WORKS ASSOCIATION
ASCE	AMERICAN SOCIETY OF CIVIL ENGINEERS
CIP	CAST IRON PIPE
DIP	DUCTILE IRON PIPE
E	EASTING
EL.	ELEVATION
H	HORIZONTAL
I.E.	INVERT ELEVATION
MAX.	MAXIMUM
MIN.	MINIMUM
N	NORTHING
NAVD	NATIONAL AMERICAN VERTICAL DATUM
O.C.	ON CENTER
STA	STATION
SCH 80 PVC	SCHEDULE 80 POLYVINYL CHLORIDE PIPE
TBD	TO BE DETERMINED
TYP.	TYPICAL
V	VERTICAL
@	AT
Ø	DIAMETER

COORDINATE SYSTEM:

HORIZONTAL DATUM - UTAH STATE PLANE NAD83, NORTH ZONE (US SURVEY FEET)
VERTICAL DATUM - NAVD88 (FEET)

NOTES:

- COMPLY WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL CODES, PERMITS, AND REGULATIONS.
- VERIFY ALL QUANTITIES, GRADES, AND DIMENSIONS.
- TOPOGRAPHIC INFORMATION BASED ON 2022 LIDAR SURVEY PROVIDED BY TINTIC.
- FIELD-LOCATE ALL SITE UTILITIES (PRIVATE AND PUBLIC) PRIOR TO STARTING THE WORK. ALL UTILITIES SHOWN ON THE PLANS ARE APPROXIMATE. ANY UTILITIES DAMAGED BY CONTRACTOR SHALL BE REPAIRED TO THE SATISFACTION OF UTILITY OWNER AT CONTRACTOR'S COST.



ISSUE FOR CONSTRUCTION

CADD USER: LOGAN.F. MADONEY FILE: \\EDI\CADD\DESIGN\4251029\01\425102901_C-100_COVER_SHEET.DWG PLOT SCALE: 1:1 PLOT DATE: 10/26/2023 4:01 PM

		CLIENT		PERMIT		BID		CONSTRUCTION		RECORD		RELEASED TO/FOR		DATE RELEASED				Project Office: BARR ENGINEERING CO. 170 S Main St Suite 500 Salt Lake City, UT 84101 Corporate Headquarters: Minneapolis, Minnesota Ph: 1-800-333-8400 Fax: (801) 333-8401 www.barr.com		Scale: AS SHOWN Date: 02/09/2023 Drawn: RLB2 Checked: JDG Designed: ATD Approved: JDG		TINTIC CONSOLIDATED METALS LLC. EUREKA, UTAH		TINTIC MINE EXPANSION DRY STACK TAILINGS STORAGE FACILITY COVER SHEET		BARR PROJECT No. 44251029.01 CLIENT PROJECT No.		DWG. No. C-100 REV. No. A	
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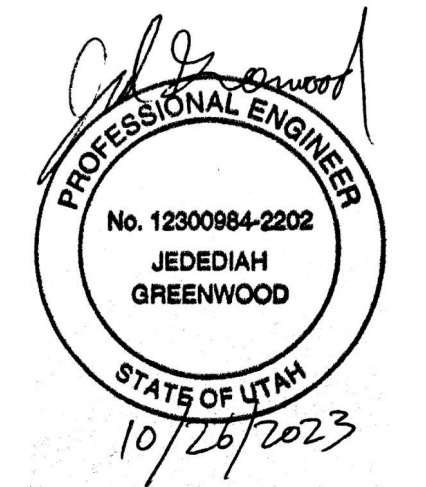
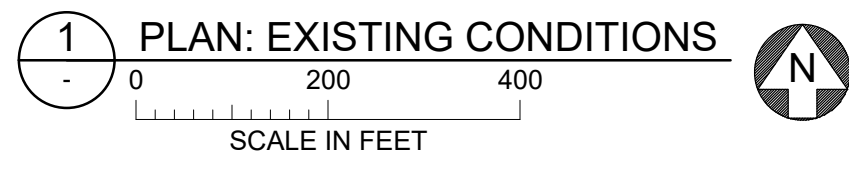


LEGEND

	1380	EXISTING MAJOR CONTOUR
		EXISTING MINOR CONTOUR
		EXISTING OVERHEAD ELECTRIC
		EXISTING EDGE OF PAVED ROAD
		EXISTING EDGE OF GRAVEL ROAD
		EXISTING CHAIN LINK FENCE
		BORING LOCATION
		TEST PIT LOCATION

NOTES:

- EXISTING UTILITY LOCATIONS ARE APPROXIMATE AND SHALL BE VERIFIED BY CONTRACTOR PRIOR TO CONSTRUCTION.



ISSUE FOR CONSTRUCTION

				CLIENT PERMIT	06/09/23				<p>Project Office: BARR ENGINEERING CO. 4300 MARKETPOINTE DRIVE SUITE 200 MINNEAPOLIS, MN 55435</p> <p>Corporate Headquarters: Minneapolis, Minnesota Ph: 1-800-632-2277 Ph: 1-800-632-2277</p>	Scale	AS SHOWN	TINTIC CONSOLIDATED METALS LLC. EUREKA, UTAH		TINTIC MINE EXPANSION DRY STACK TAILINGS STORAGE FACILITY EXISTING CONDITIONS PLAN		BARR PROJECT No.	
				BID						Date	02/09/2023					44251029.01	
				CONSTRUCTION RECORD						Drawn	RLB2					CLIENT PROJECT No.	
				RELEASED TO/FOR	A	B	C	0		1	2					3	Checked
NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION			DATE RELEASED			Designed	ATD					
											Approved	JDG					

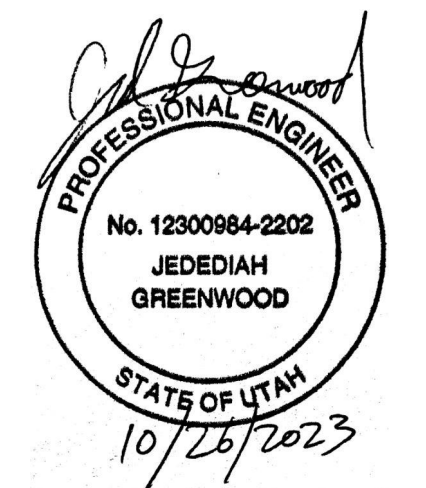
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LEGEND

— 1380 —	EXISTING MAJOR CONTOUR
- - - - -	EXISTING MINOR CONTOUR
- O - O - O - O -	EXISTING OVERHEAD ELECTRIC
— — — — —	EXISTING EDGE OF PAVED ROAD
- - - - -	EXISTING EDGE OF GRAVEL ROAD
- X - X - X - X -	EXISTING CHAIN LINK FENCE

- NOTES:**
- STRIP TOP 2 FEET OF SOIL WITHIN DISTURBANCE LIMITS AND PLACE IN DESIGNATED TOPSOIL STOCKPILE LOCATION.
 - TOP SOIL STRIPPING REQUIRED IN EXISTING UNDISTURBED AREAS ONLY. NO STRIPPING REQUIRED IN AREAS PREVIOUSLY DISTURBED OR DEVELOPED.



ISSUE FOR CONSTRUCTION

NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION

CLIENT									
PERMIT									
BID									
CONSTRUCTION									
RECORD									
RELEASED TO/FOR	A	B	C	0	1	2	3		

Project Office:
BARR ENGINEERING CO.
 4300 MARKETPOINTE DRIVE
 SUITE 200
 MINNEAPOLIS, MN 55435

Corporate Headquarters:
 Minneapolis, Minnesota
 Ph: 1-800-632-2277
 Fax: (952) 832-2601
 www.barr.com

Scale	AS SHOWN
Date	02/09/2023
Drawn	RLB2
Checked	JDG
Designed	ATD
Approved	JDG

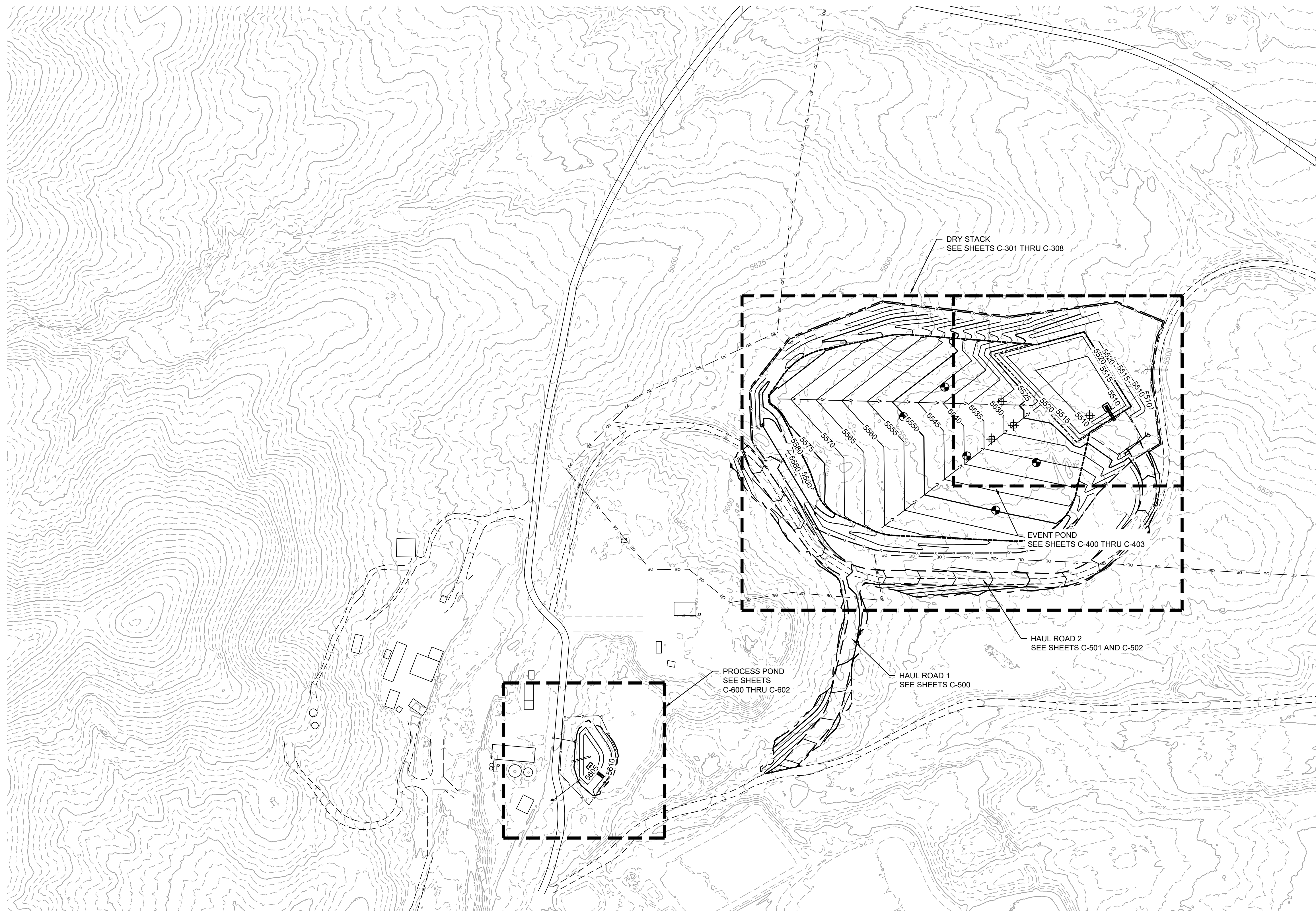
TINTIC CONSOLIDATED METALS LLC.
 EUREKA, UTAH

**TINTIC MINE EXPANSION
 DRY STACK TAILINGS STORAGE FACILITY**

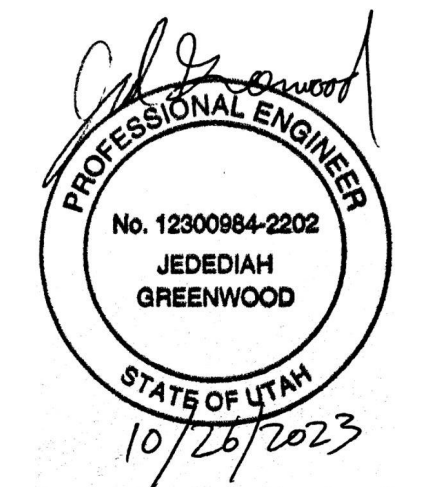
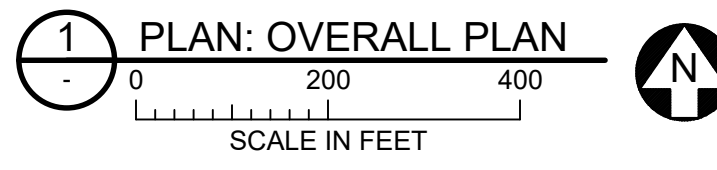
**TOPSOIL STRIPPING AND STOCKPILING
 PLAN**

BARR PROJECT No.	44251029.01
CLIENT PROJECT No.	
DWG. No.	C-201
REV. No.	A

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	EXISTING MINOR CONTOUR
	PROPOSED MAJOR CONTOUR
	PROPOSED MINOR CONTOUR
	EXISTING OVERHEAD ELECTRIC
	EXISTING EDGE OF PAVED ROAD
	EXISTING EDGE OF GRAVEL ROAD
	PROPOSED EDGE OF ROAD
	PROPOSED LEACHATE COLLECTION PIPE
	PROPOSED FENCE
	DISTURBANCE LIMITS



ISSUE FOR CONSTRUCTION

NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION

CLIENT	PERMIT	BID	CONSTRUCTION	RECORD
	06/09/23			

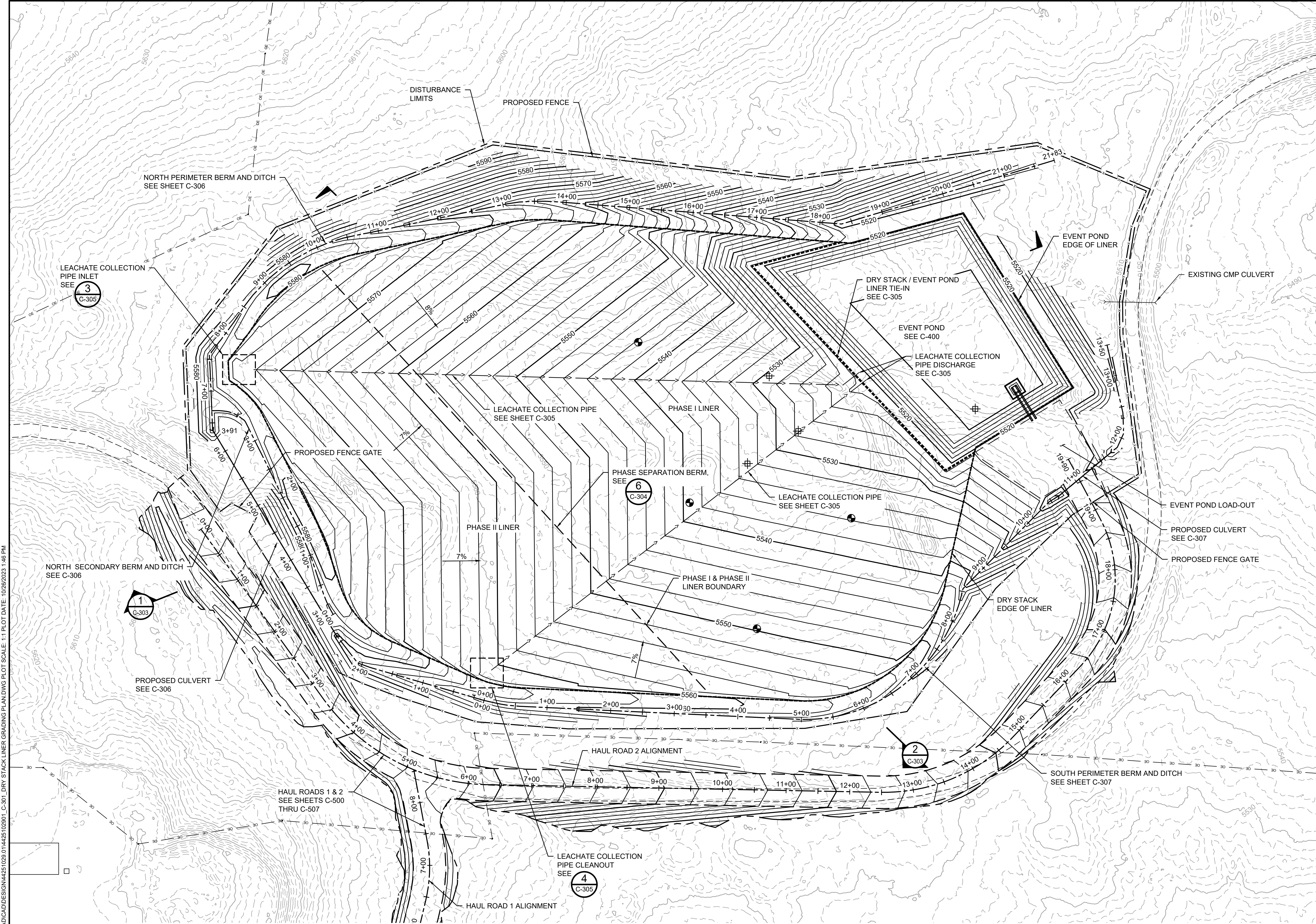
BARR Project Office:
BARR ENGINEERING CO.
4300 MARKETPOINTE DRIVE
SUITE 200
MINNEAPOLIS, MN 55435
Corporate Headquarters:
Minneapolis, Minnesota
Ph: 1-800-632-2277
Ph: 1-800-632-2277

Scale	AS SHOWN
Date	02/09/2023
Drawn	RLB2
Checked	JDG
Designed	ATD
Approved	JDG

TINTIC CONSOLIDATED METALS LLC.
EUREKA, UTAH

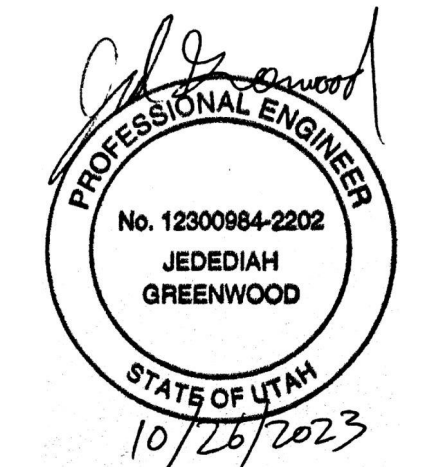
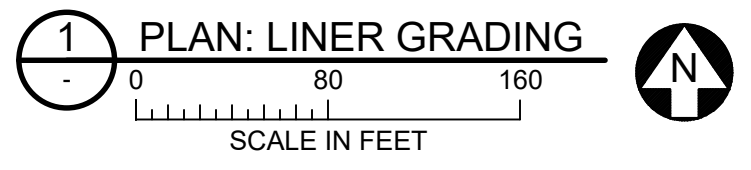
TINTIC MINE EXPANSION
DRY STACK TAILINGS STORAGE FACILITY
OVERALL PLAN

BARR PROJECT No. 44251029.01	
CLIENT PROJECT No.	
DWG. No. C-300	REV. No. A



LEGEND

	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
	PROPOSED MAJOR CONTOUR
	PROPOSED MINOR CONTOUR
	EXISTING OVERHEAD ELECTRIC
	EXISTING EDGE OF PAVED ROAD
	EXISTING EDGE OF GRAVEL ROAD
	PROPOSED LEACHATE COLLECTION PIPE
	PROPOSED EDGE OF LINER
	PROPOSED CULVERT
	PROPOSED FENCE
	DISTURBANCE LIMITS



ISSUE FOR CONSTRUCTION

NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION

CLIENT	
PERMIT	06/09/23
BID	
CONSTRUCTION	
RECORD	
RELEASED TO/FOR	A B C 0 1 2 3
DATE RELEASED	

BARR Engineering

Project Office:
BARR ENGINEERING CO.
4300 MARKETPOINTE DRIVE
SUITE 200
MINNEAPOLIS, MN 55435

Corporate Headquarters:
Minneapolis, Minnesota
Ph: 1-800-632-2277
Ph: 1-800-632-2277

Scale	AS SHOWN
Date	02/09/2023
Drawn	RLB2
Checked	JDG
Designed	ATD
Approved	JDG

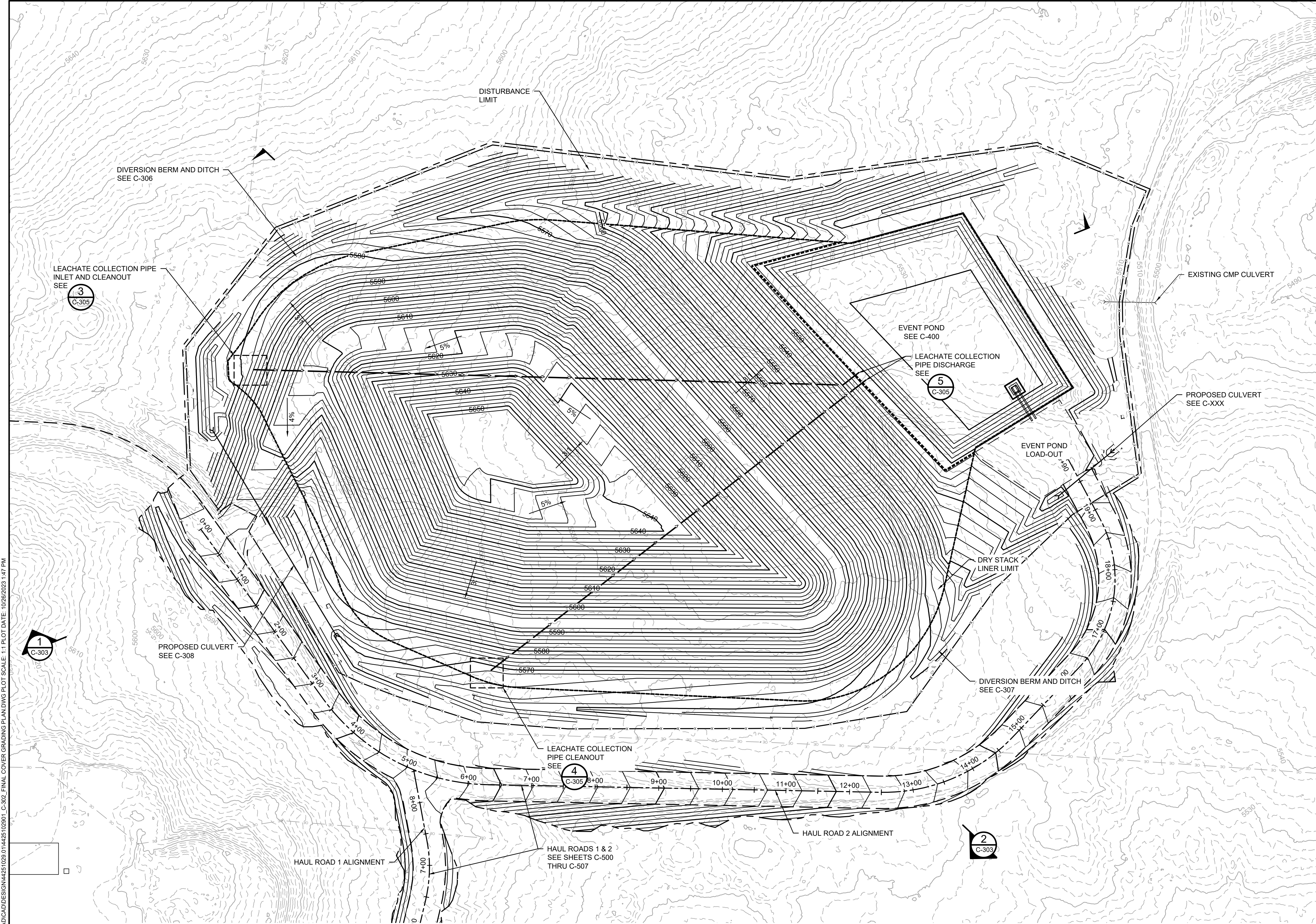
TINTIC CONSOLIDATED METALS LLC.
EUREKA, UTAH

**TINTIC MINE EXPANSION
DRY STACK TAILINGS STORAGE FACILITY**

**DRY STACK LINER
GRADING PLAN**

BARR PROJECT No.	44251029.01
CLIENT PROJECT No.	
DWG. No.	C-301
REV. No.	A

CADD USER: LOGAN.F. MAHONEY FILE: \\VEDI-CAD\CADD\DESIGN\4251029\028\01\4425102901_C-301_DRY STACK LINER GRADING PLAN.DWG PLOT SCALE: 1:1 PLOT DATE: 10/26/2023 1:46 PM

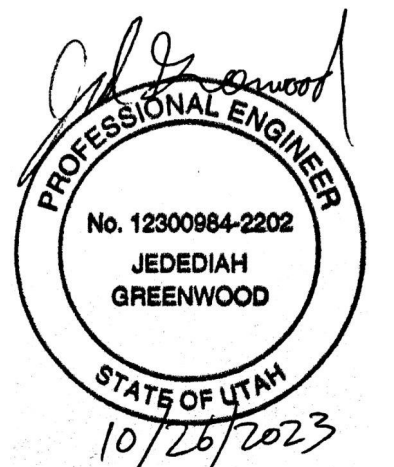


LEGEND

	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
	PROPOSED MAJOR CONTOUR
	PROPOSED MINOR CONTOUR
	EXISTING OVERHEAD ELECTRIC
	PROPOSED CHAIN LINK FENCE
	DISTURBANCE LIMITS

- NOTES:**
- OVERALL SECTION 1 (SEE SHEET C-303) USED FOR STABILITY MODELING.
 - PROVIDE CHAIN LINK FENCE AND GATES ACCORDING TO UDOT STANDARD SPECIFICATION SECTION 02821 CHAIN LINK FENCING AND GATES AND UDOT STANDARD DRAWING FG6

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ISSUE FOR CONSTRUCTION

1 PLAN: FINAL COVER GRADING

0 80 160
SCALE IN FEET

NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION

CLIENT									
PERMIT									
BID									
CONSTRUCTION									
RECORD									
RELEASED TO/FOR	A	B	C	0	1	2	3		

BARR Engineering

Project Office:
BARR ENGINEERING CO.
4300 MARKETPOINTE DRIVE
SUITE 200
MINNEAPOLIS, MN 55435

Corporate Headquarters:
Minneapolis, Minnesota
Ph: 1-800-632-2277

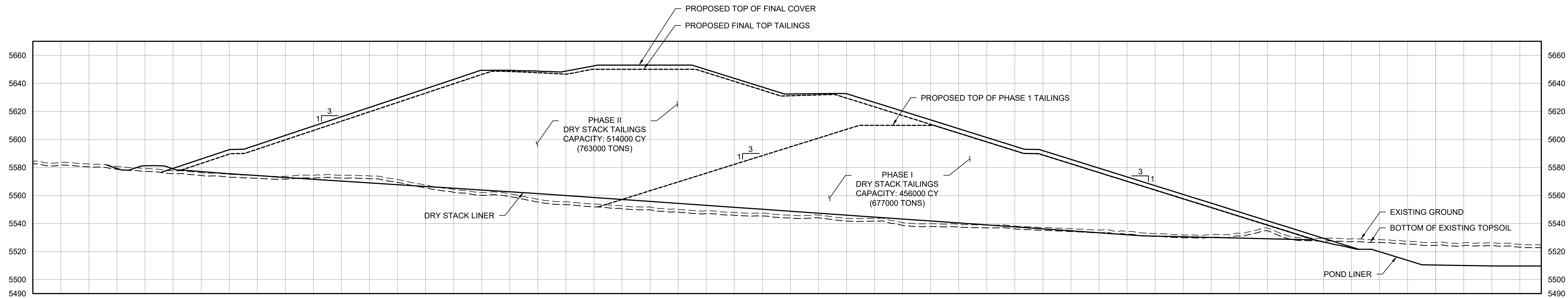
Scale	AS SHOWN
Date	02/09/2023
Drawn	RLB2
Checked	JDG
Designed	ATD
Approved	JDG

TINTIC CONSOLIDATED METALS LLC.
EUREKA, UTAH

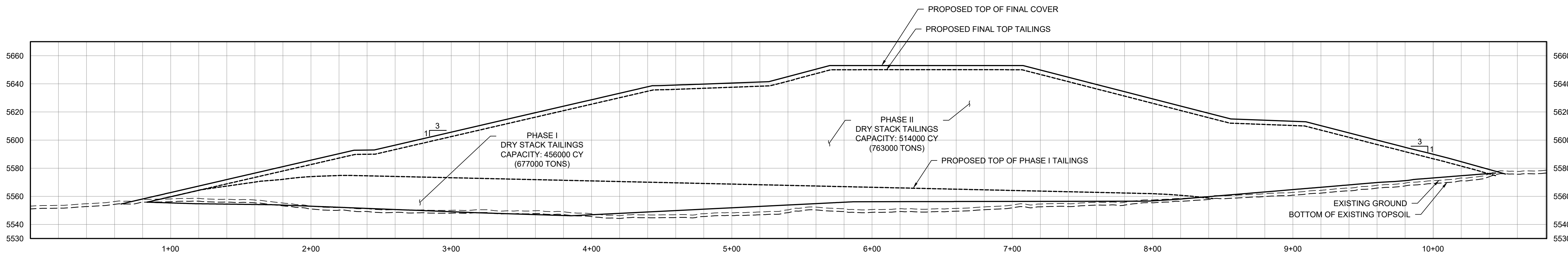
**TINTIC MINE EXPANSION
DRY STACK TAILINGS STORAGE FACILITY**

**DRY STACK FINAL COVER
GRADING PLAN**

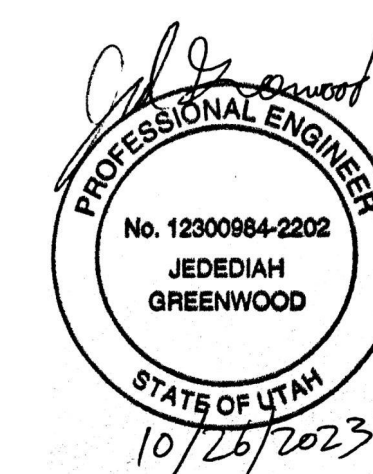
BARR PROJECT No.	44251029.01
CLIENT PROJECT No.	
DWG. No.	C-302
REV. No.	A



1 SECTION: OVERALL SW-NE
C-302
0 40 80
SCALE IN FEET



2 SECTION: OVERALL SE-NW
C-302
0 40 80
SCALE IN FEET

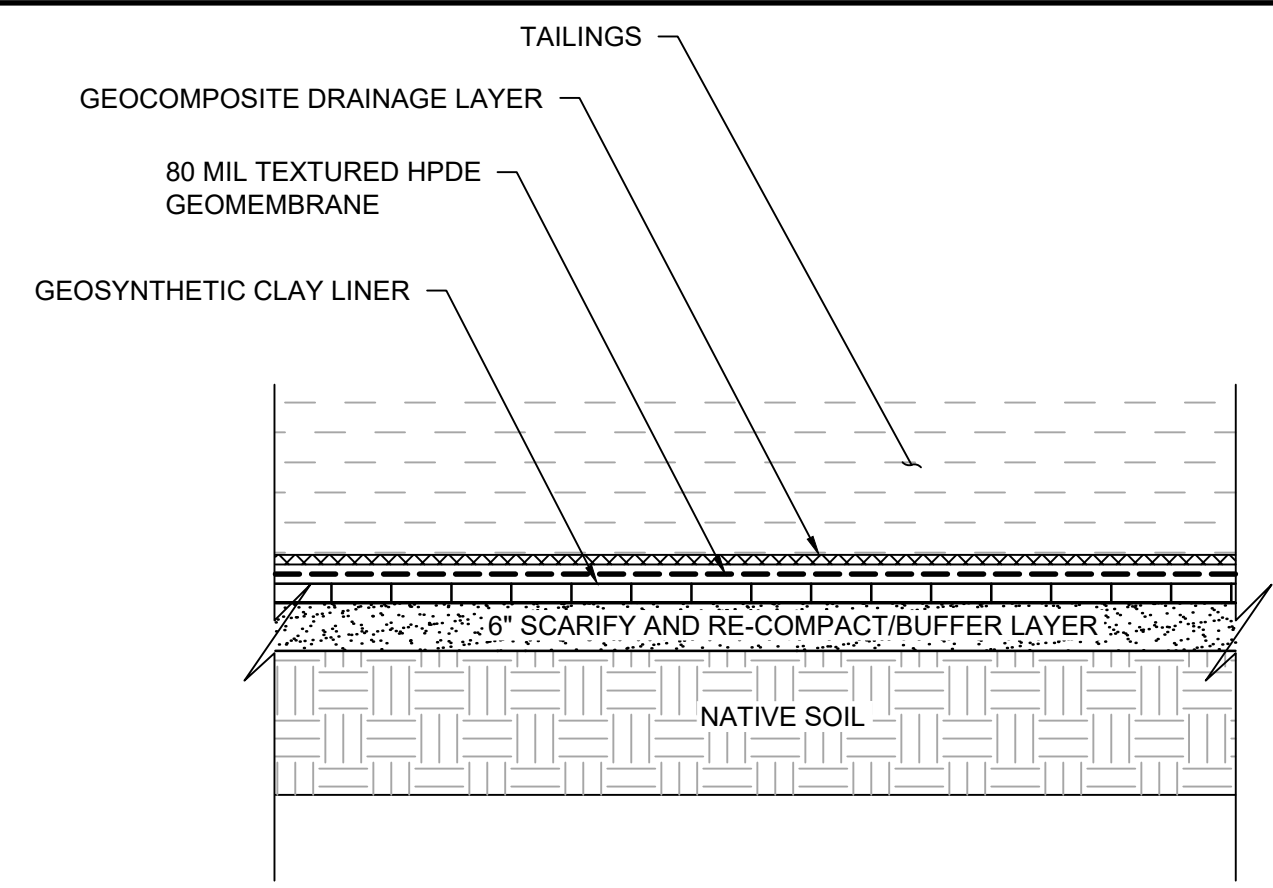


ISSUE FOR CONSTRUCTION

CADD USER: LCGAN.F; MADDNEY FILE: \\EDI-CADD\CADD\DESIGN\42510291_01\42510291_C-303_DRY STACK OVERALL SECTIONS.DWG PLOT SCALE: 1:1 PLOT DATE: 10/26/2023 1:48 PM

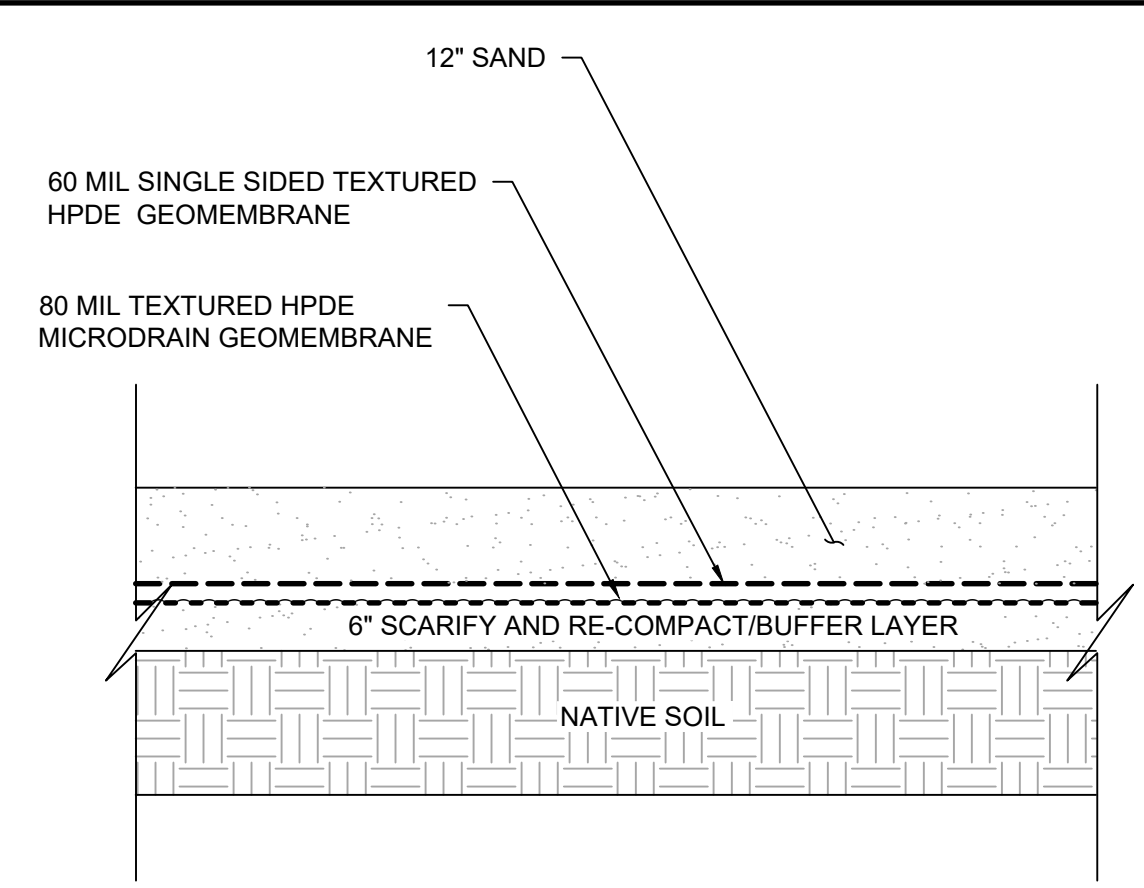
		CLIENT		PERMIT		BID		CONSTRUCTION		RECORD		RELEASED TO/FOR		DATE RELEASED				Project Office: BARR ENGINEERING CO. 4300 MARKETPOINTE DRIVE SUITE 200 MINNEAPOLIS, MN 55435 Corporate Headquarters: Minneapolis, Minnesota Ph: 1-800-632-2277 Fax: (952) 832-2601 www.barr.com		Scale: AS SHOWN Date: 02/09/2023 Drawn: RLB2 Checked: JDG Designed: ATD Approved: JDG		TINTIC CONSOLIDATED METALS LLC. EUREKA, UTAH		TINTIC MINE EXPANSION DRY STACK TAILINGS STORAGE FACILITY		BARR PROJECT No. 44251029.01	
				06/09/23														TINTIC CONSOLIDATED METALS LLC. EUREKA, UTAH		DRY STACK OVERALL SECTIONS		CLIENT PROJECT No. DWG. No. C-303 REV. No. A					
NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION																						

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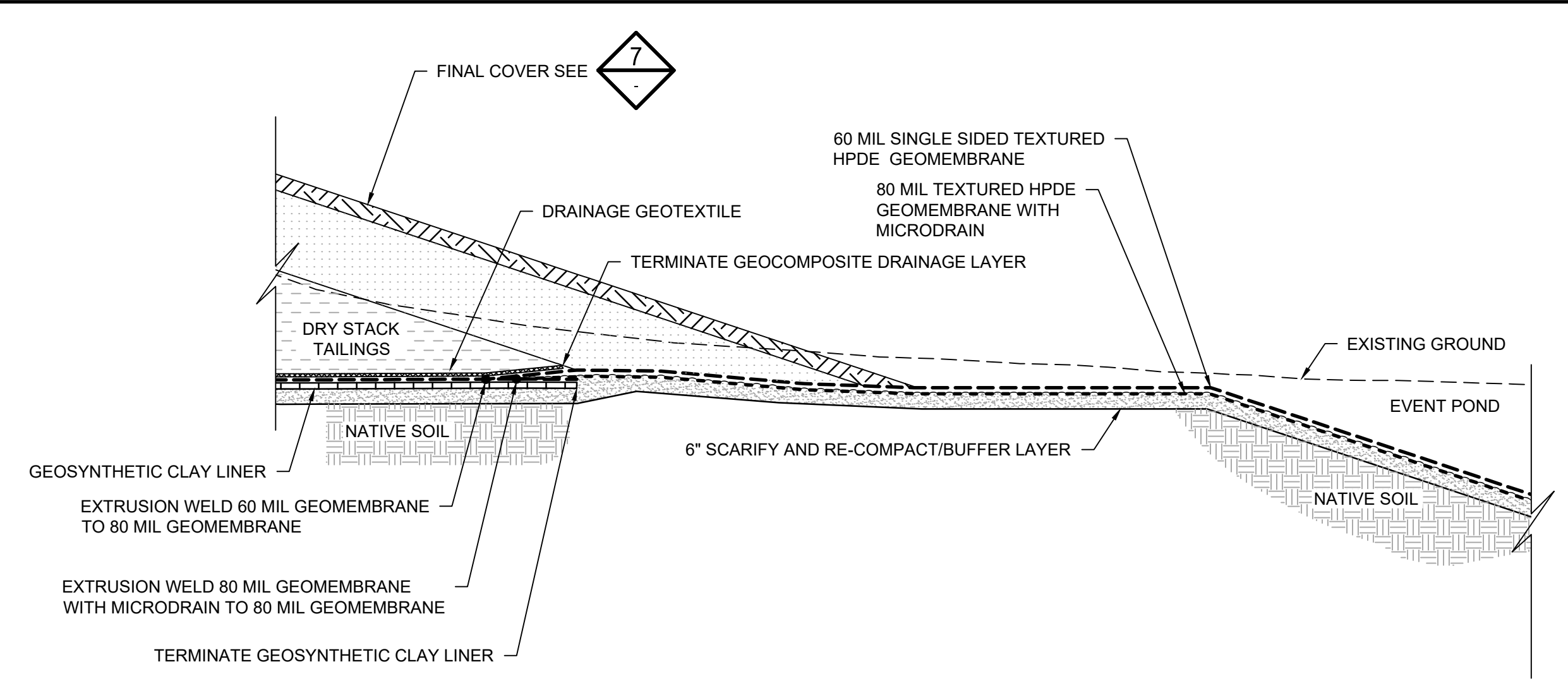
1 **DETAIL: DRY STACK LINER**
 0 1 2 3 4
 SCALE IN FEET

NOTE:
 80 MIL TEXTURED HPDE GEOMEMBRANE TO BE PLACED WITH INTIMATE CONTACT WITH THE GEOSYNTHETIC CLAY LINER.

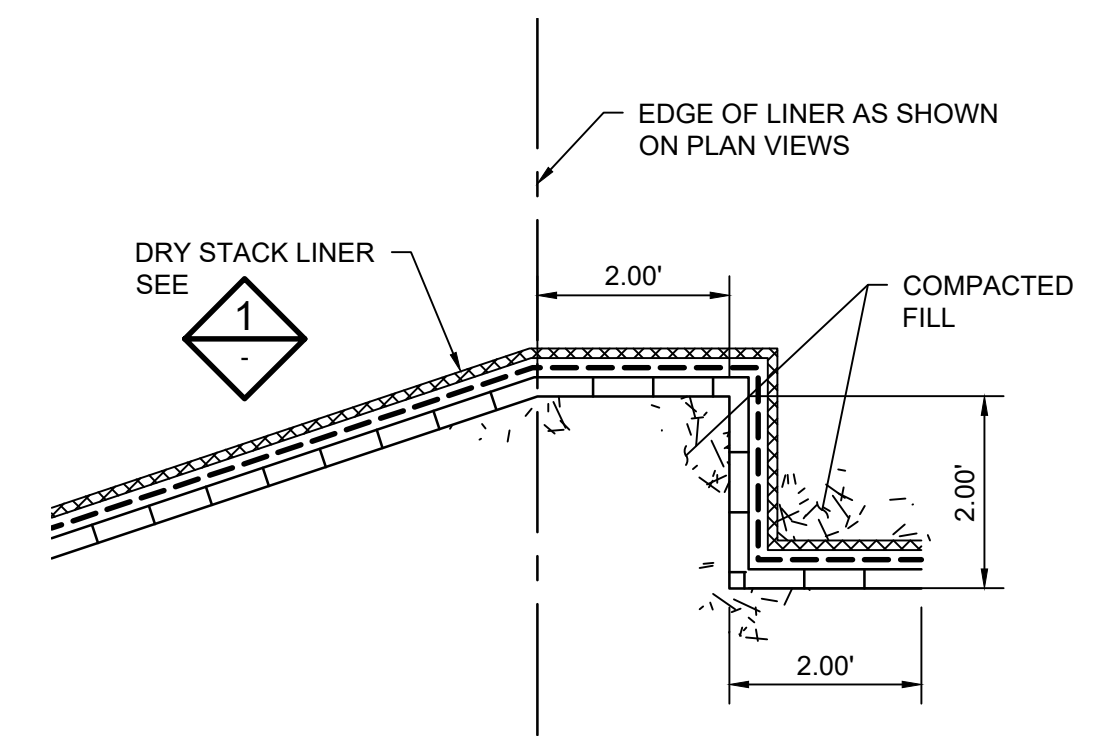


2 **DETAIL: EVENT POND LINER**
 0 1 2 3 4
 SCALE IN FEET

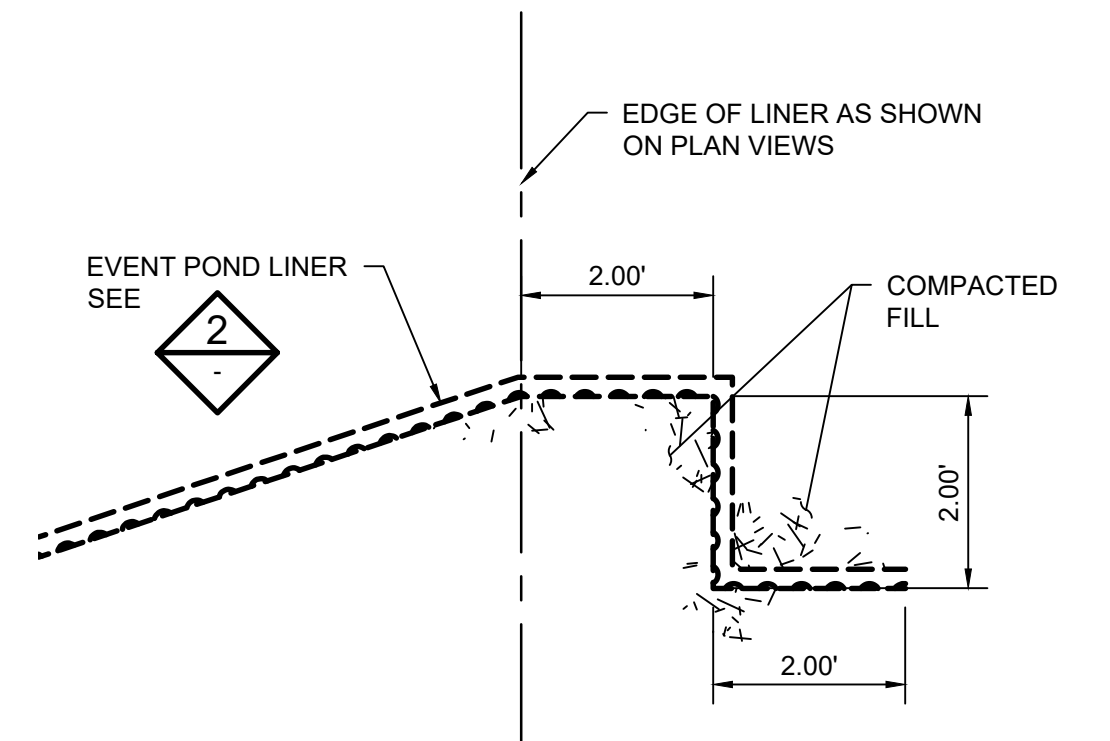
NOTES:
 1. 80 MIL TEXTURED HPDE MICRODRAIN GEOMEMBRANE TO BE PLACED WITH MICRODRAIN STUDS FACING UP.
 2. 12" SAND LAYER REQUIRED ON POND BOTTOM ONLY.



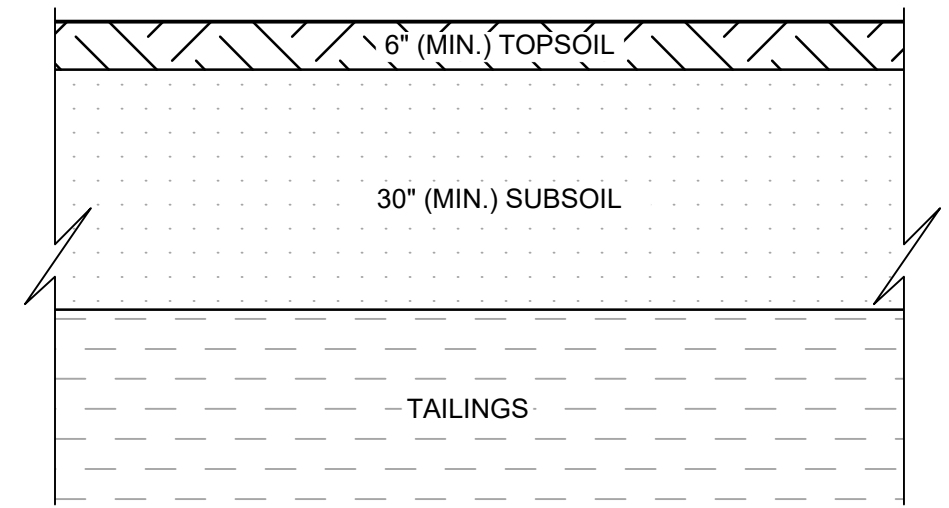
5 **DETAIL: DRY STACK / EVENT POND LINER TIE-IN**
 0 2 4 6 8
 SCALE IN FEET



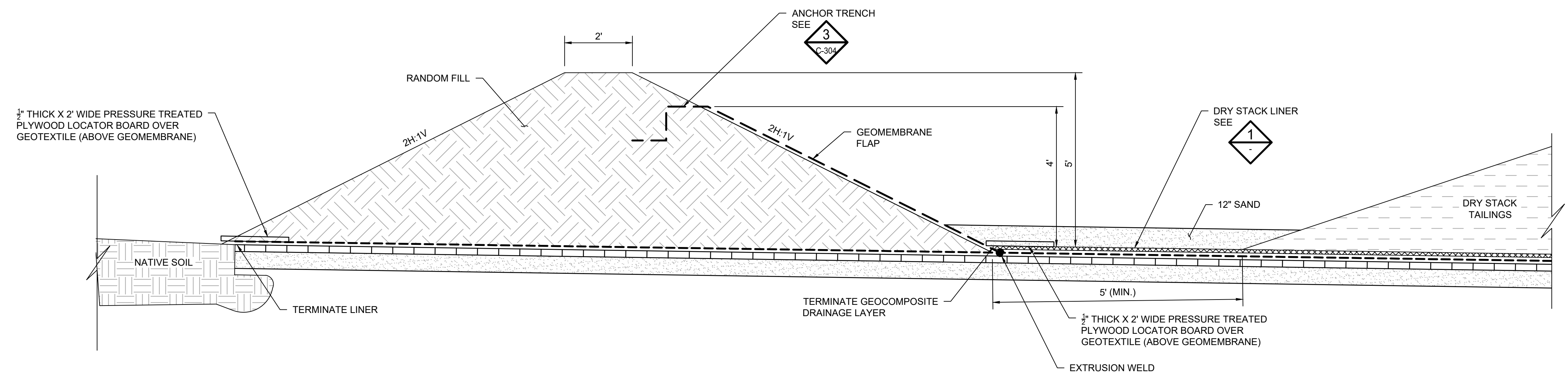
3 **DETAIL: DRY STACK LINER ANCHOR TRENCH (TYP.)**
 0 1 2 3 4
 SCALE IN FEET



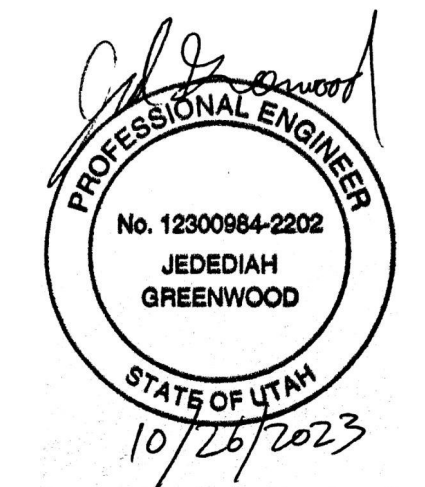
4 **DETAIL: EVENT POND LINER ANCHOR TRENCH (TYP.)**
 0 1 2 3 4
 SCALE IN FEET



7 **DETAIL: FINAL COVER**
 0 1 2 3 4
 SCALE IN FEET



6 **SECTION: PHASE SEPARATION BERM (TYP.)**
 0 1 2 3 4
 SCALE IN FEET



ISSUE FOR CONSTRUCTION

NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION

CLIENT	PERMIT	BID	CONSTRUCTION	RECORD	RELEASED TO/FOR	A	B	C	0	1	2	3

Project Office:
BARR ENGINEERING CO.
 4300 MARKETPOINTE DRIVE
 SUITE 200
 MINNEAPOLIS, MN 55435

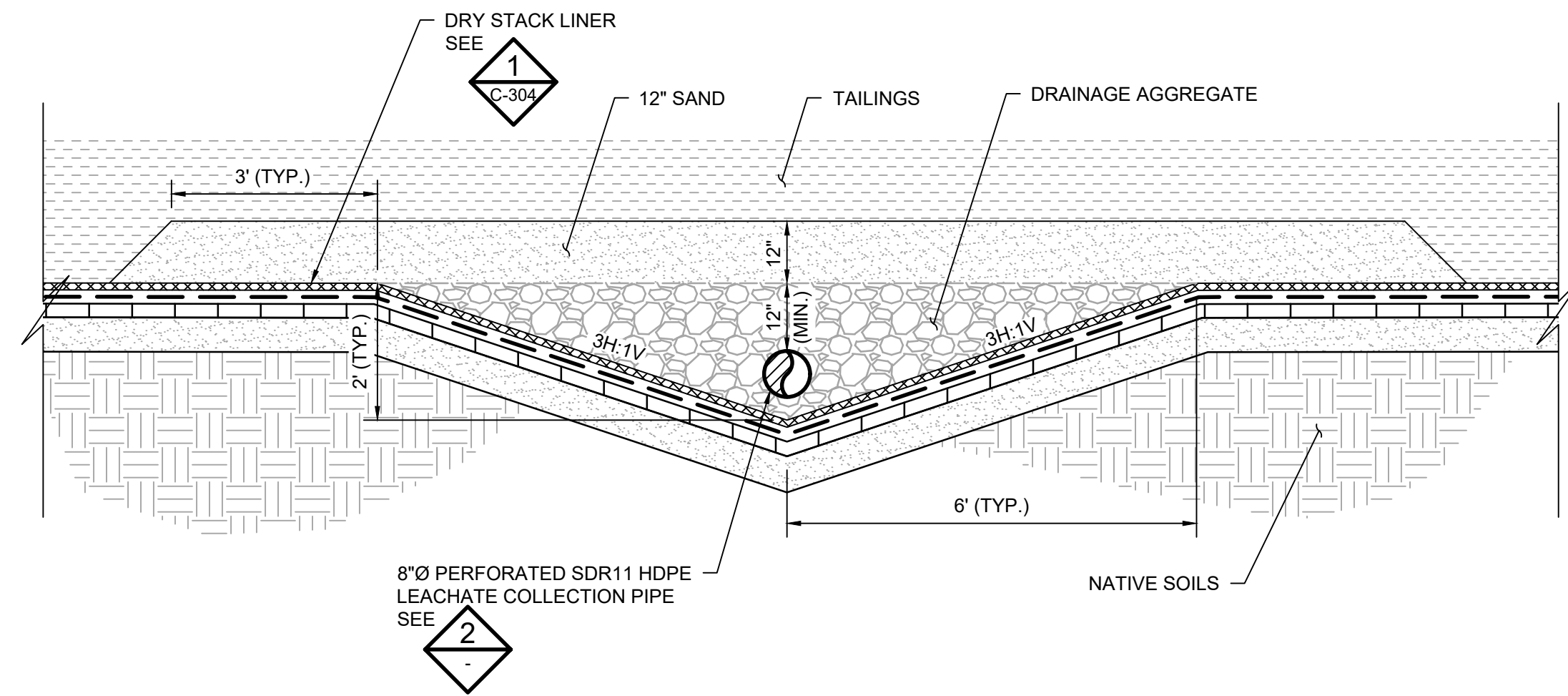
Corporate Headquarters:
 Minneapolis, Minnesota
 Ph: 1-800-632-2277
 Fax: (952) 832-2601
 www.barr.com

Scale	AS SHOWN
Date	02/09/2023
Drawn	RLB2
Checked	JDG
Designed	ATD
Approved	JDG

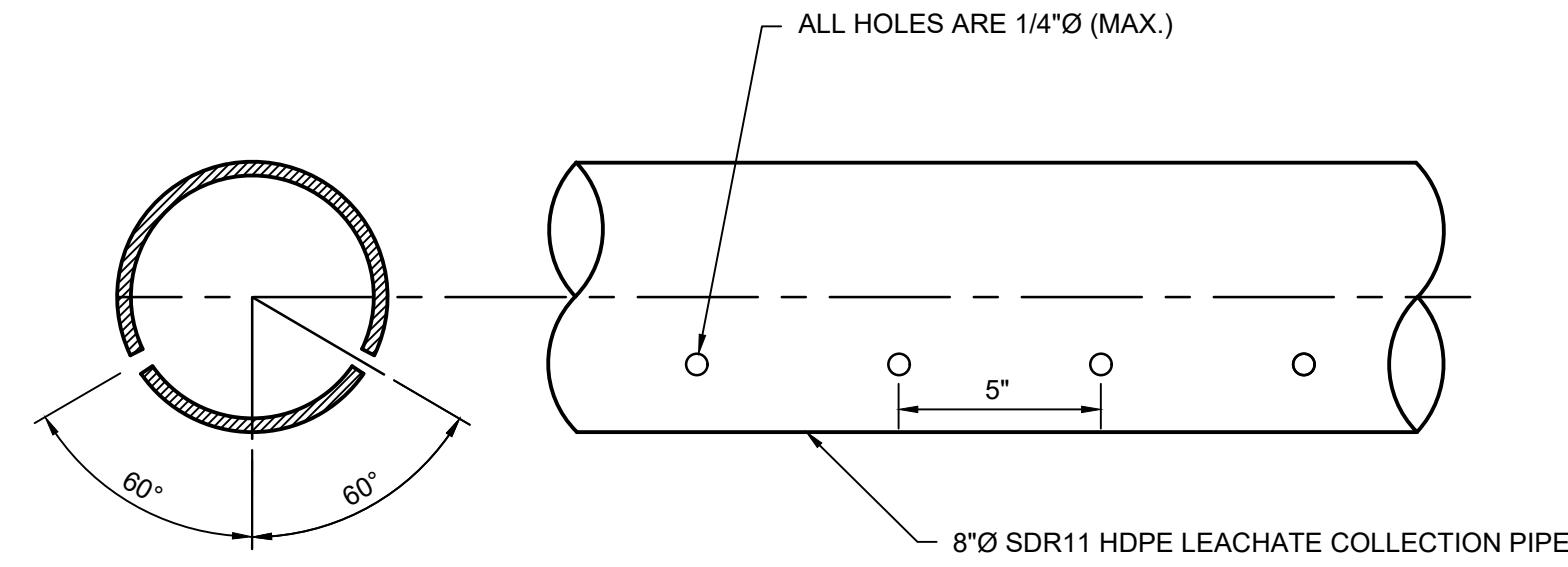
TINTIC CONSOLIDATED METALS LLC.
 EUREKA, UTAH

**TINTIC MINE EXPANSION
 DRY STACK TAILINGS STORAGE FACILITY**
 DRY STACK AND EVENT POND LINER
 SECTIONS AND DETAILS

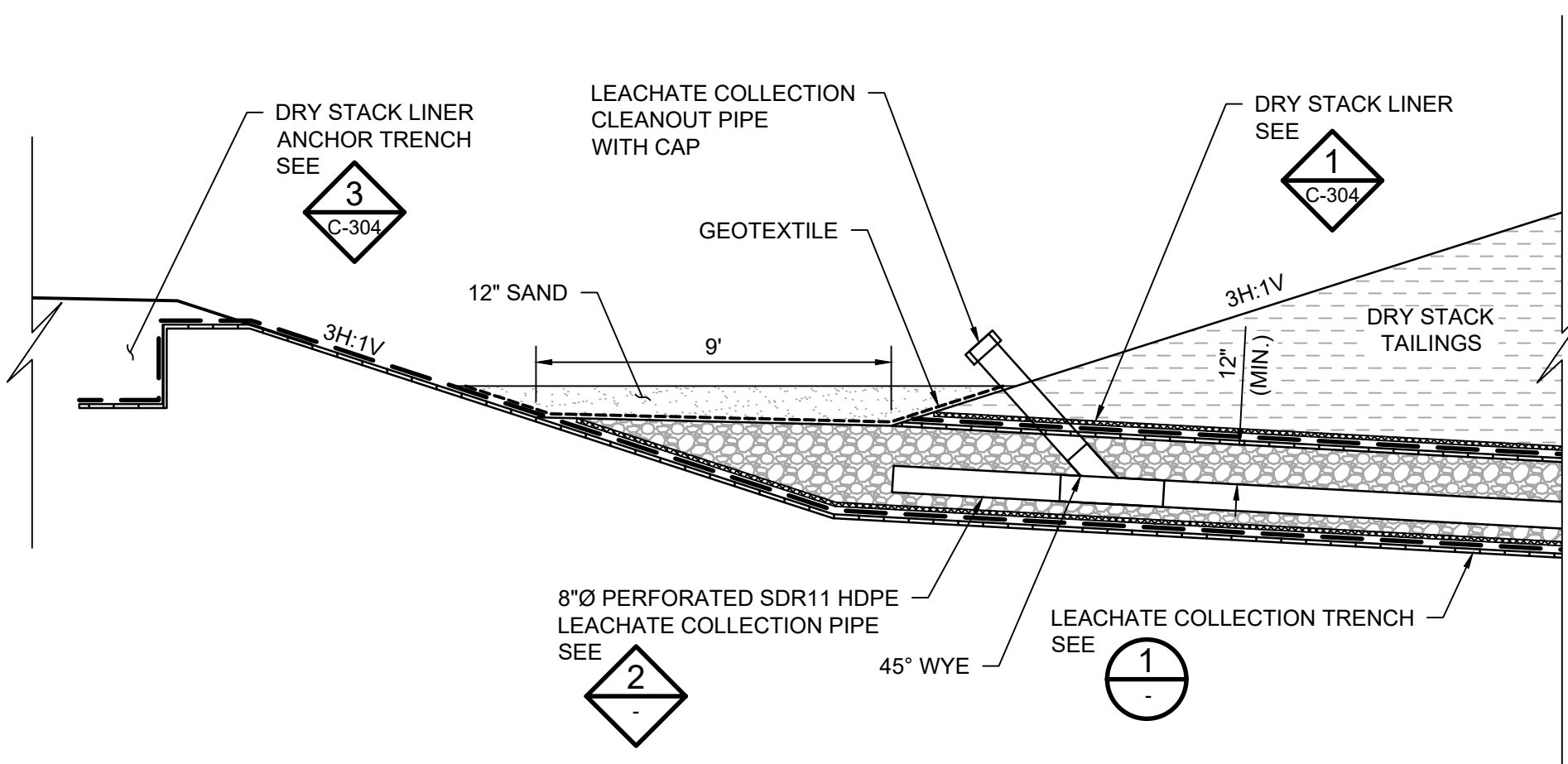
BARR PROJECT No. 44251029.01	
CLIENT PROJECT No.	
DWG. No. C-304	REV. No. A



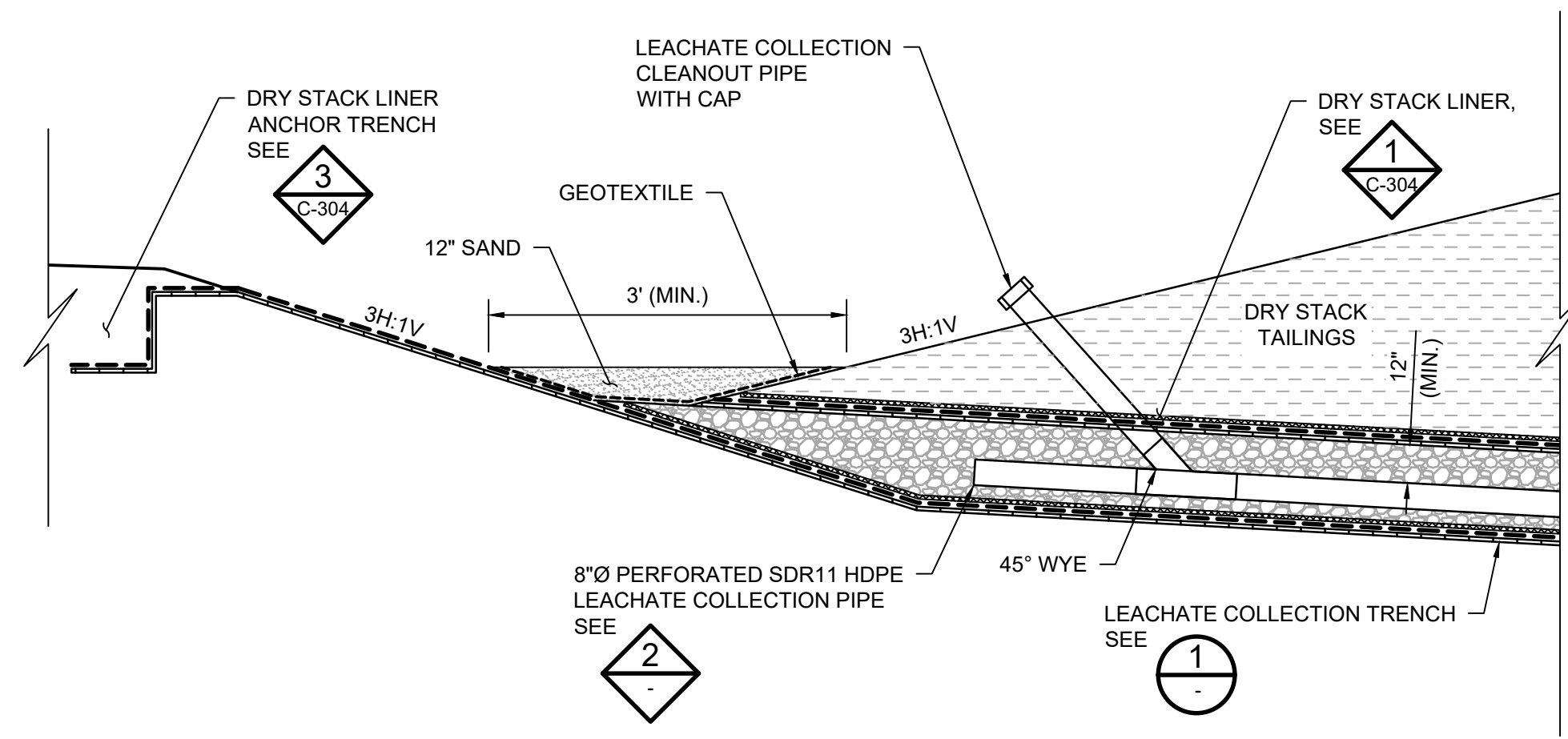
1 SECTION: LEACHATE COLLECTION TRENCH
 C-301 0 1 2 3 4
 SCALE IN FEET



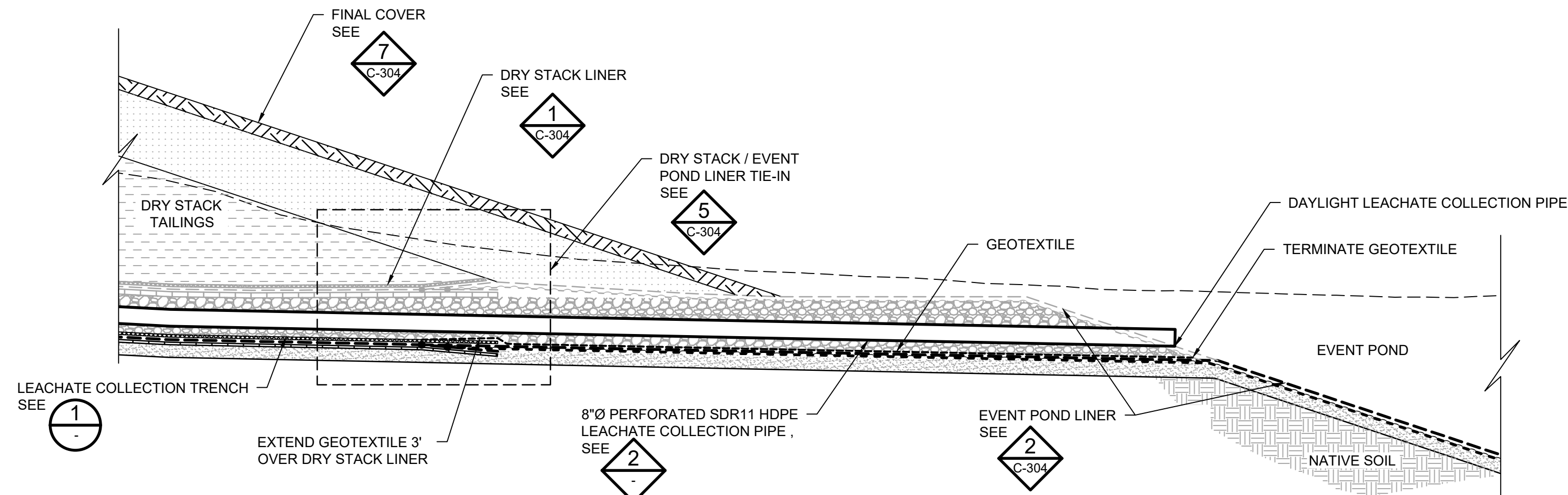
2 DETAIL: LEACHATE COLLECTION PIPE PERFORATION
 NOT TO SCALE



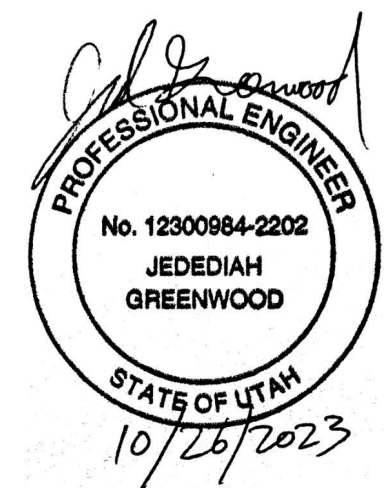
3 SECTION: INTERIOR DITCH LEACHATE COLLECTION PIPE INLET
 C-301 0 2 4 6 8
 SCALE IN FEET
 NOTE: PROVIDE CLEANOUT AT PHASE I BOUNDARY.



4 SECTION: LEACHATE COLLECTION PIPE CLEANOUT
 C-301 0 2 4 6 8
 SCALE IN FEET
 NOTE: PROVIDE CLEANOUT AT PHASE I BOUNDARY.



5 SECTION: LEACHATE COLLECTION PIPE DISCHARGE
 C-301 0 2 4 6 8
 SCALE IN FEET



ISSUE FOR CONSTRUCTION

CADD USER: LCGAN.F. MADDNEY FILE: \\EDI\CADD\DESIGN\4251029\01\44\23\02901_C-305_DRY STACK LEACHATE COLLECTION DETAILS.DWG PLOT SCALE: 1:1 PLOT DATE: 10/26/2023 1:52 PM

NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION

CLIENT	PERMIT	BID	CONSTRUCTION	RECORD	RELEASED TO/FOR	DATE RELEASED
	06/08/23				A B C 0 1 2 3	

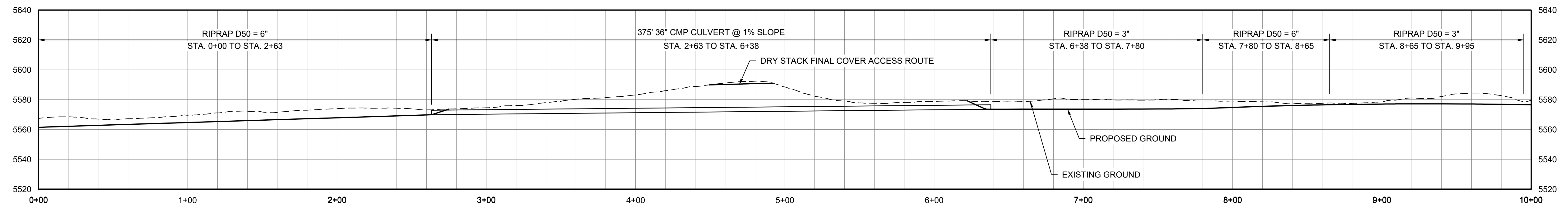
BARR Project Office:
 BARR ENGINEERING CO.
 4300 MARKETPOINTE DRIVE
 SUITE 200
 MINNEAPOLIS, MN 55435
 Corporate Headquarters:
 Minneapolis, Minnesota
 Ph: 1-800-632-2277
 Fax: (952) 832-2601
 www.barr.com

Scale	AS SHOWN
Date	02/09/2023
Drawn	RLB2
Checked	JDG
Designed	ATD
Approved	JDG

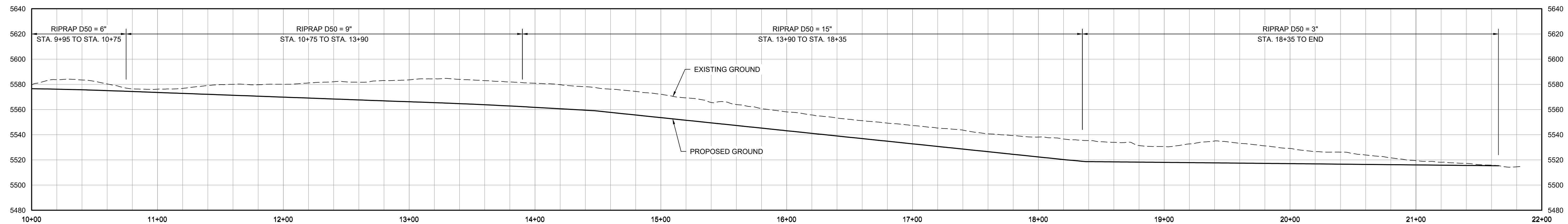
TINTIC CONSOLIDATED METALS LLC.
 EUREKA, UTAH

**TINTIC MINE EXPANSION
 DRY STACK TAILINGS STORAGE FACILITY**
 DRY STACK LEACHATE COLLECTION
 SECTIONS AND DETAILS

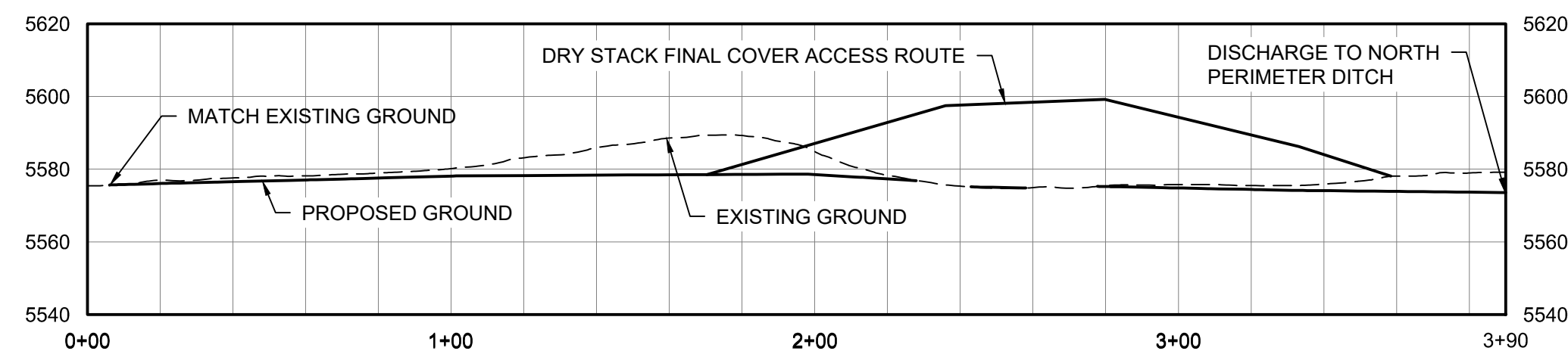
BARR PROJECT No.	44251029.01
CLIENT PROJECT No.	
DWG. No.	C-305
REV. No.	A



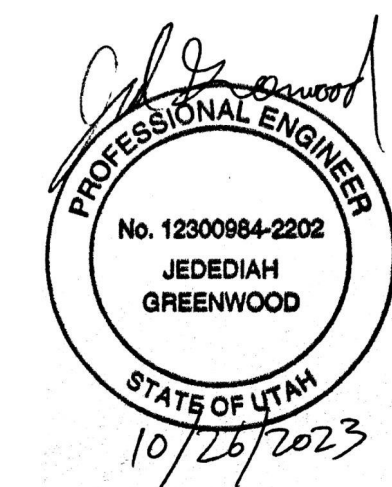
1 PROFILE: NORTH PERIMETER DITCH STA. 0+00 TO STA. 10+00
 C-301 0 40 80
 SCALE IN FEET



2 PROFILE: NORTH PERIMETER DITCH STA. 10+00 TO END
 C-301 0 40 80
 SCALE IN FEET



3 PROFILE: INTERMEDIATE DITCH
 C-301 0 40 80
 SCALE IN FEET
 NOTE: LINE INTERMEDIATE DITCH WITH D50 = 3" RIPRAP



ISSUE FOR CONSTRUCTION

CADD USER: LCGAN.F; MADDNEY FILE: \\EDI-CADD\DESIGN\4251028\01\425102801_C-306_NORTH PERIMETER BERM AND DITCH PROFILE.DWG; PLOT SCALE: 1:1; PLOT DATE: 10/26/2023 1:54 PM

NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION

CLIENT									
PERMIT	06/08/23								
BID									
CONSTRUCTION									
RECORD									
RELEASED TO/FOR	A	B	C	0	1	2	3		

BARR
 Project Office:
 BARR ENGINEERING CO.
 4300 MARKETPOINTE DRIVE
 SUITE 200
 MINNEAPOLIS, MN 55435
 Corporate Headquarters:
 Minneapolis, Minnesota
 Ph: 1-800-632-2277
 Ph: 1-800-632-2601
 www.barr.com

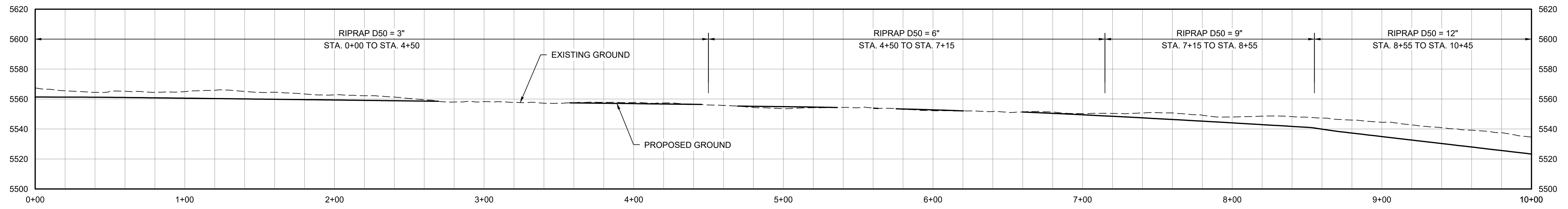
Scale	AS SHOWN
Date	05/04/2023
Drawn	AJB2
Checked	ATD
Designed	LFM
Approved	JDG

TINTIC CONSOLIDATED METALS LLC.
 EUREKA, UTAH

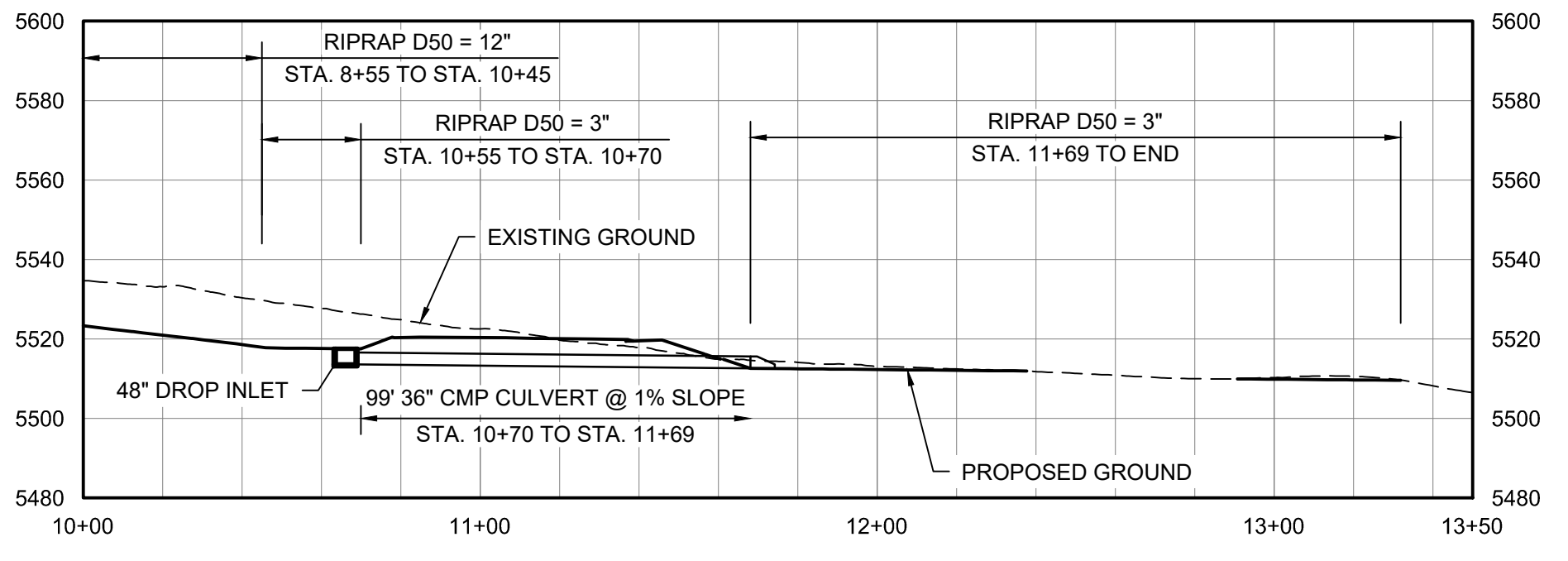
**TINTIC MINE EXPANSION
 DRY STACK TAILINGS STORAGE FACILITY**
 NORTH PERIMETER DITCH
 PROFILES

BARR PROJECT No.	44251029.01
CLIENT PROJECT No.	
DWG. No.	C-306
REV. No.	A

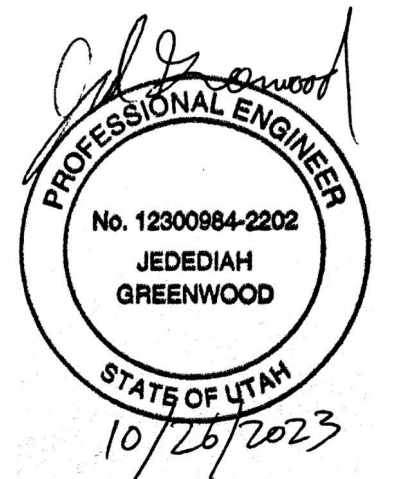
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1 PROFILE: SOUTH PERIMETER DITCH STA. 0+00 TO STA. 10+00
 C-301 0 40 80
 SCALE IN FEET



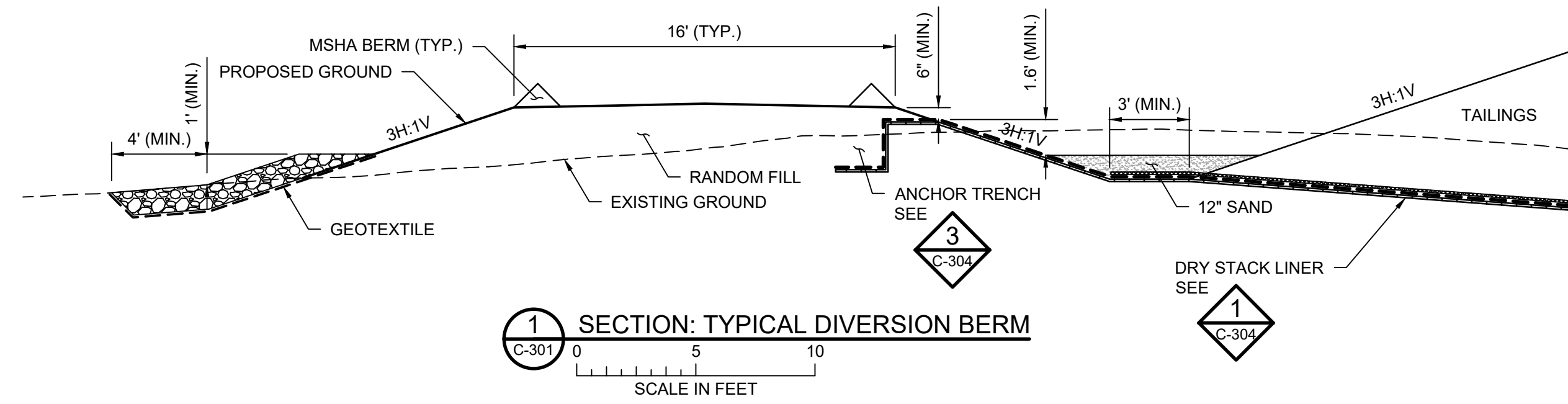
2 PROFILE: SOUTH PERIMETER DITCH STA. 10+00 TO END
 C-301 0 40 80
 SCALE IN FEET



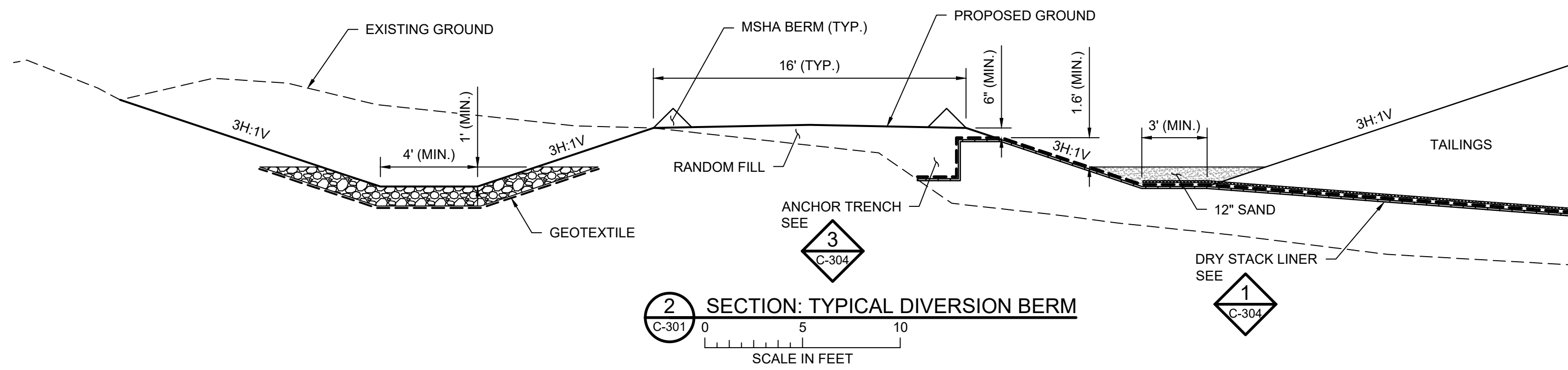
ISSUE FOR CONSTRUCTION

				CLIENT								Project Office:	AS SHOWN		TINTIC CONSOLIDATED METALS LLC. EUREKA, UTAH		TINTIC MINE EXPANSION DRY STACK TAILINGS STORAGE FACILITY		BARR PROJECT No.	
				PERMIT								BARR ENGINEERING CO. 4300 MARKETPOINTE DRIVE SUITE 200 MINNEAPOLIS, MN 55435		05/04/2023					44251029.01	
				BID								Corporate Headquarters:		Drawn		SOUTH PERIMETER DITCH PROFILES		CLIENT PROJECT No.		
				CONSTRUCTION								Minneapolis, Minnesota		AJB2				No. C-307		
				RECORD								Ph: 1-800-632-2277		Checked		REV. No.				
				RELEASED TO/FOR	A	B	C	0	1	2	3	Ph: (952) 832-2601		Designed		A				
NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION							Ph: 1-800-632-2277		Approved						
											www.barr.com		JDG							

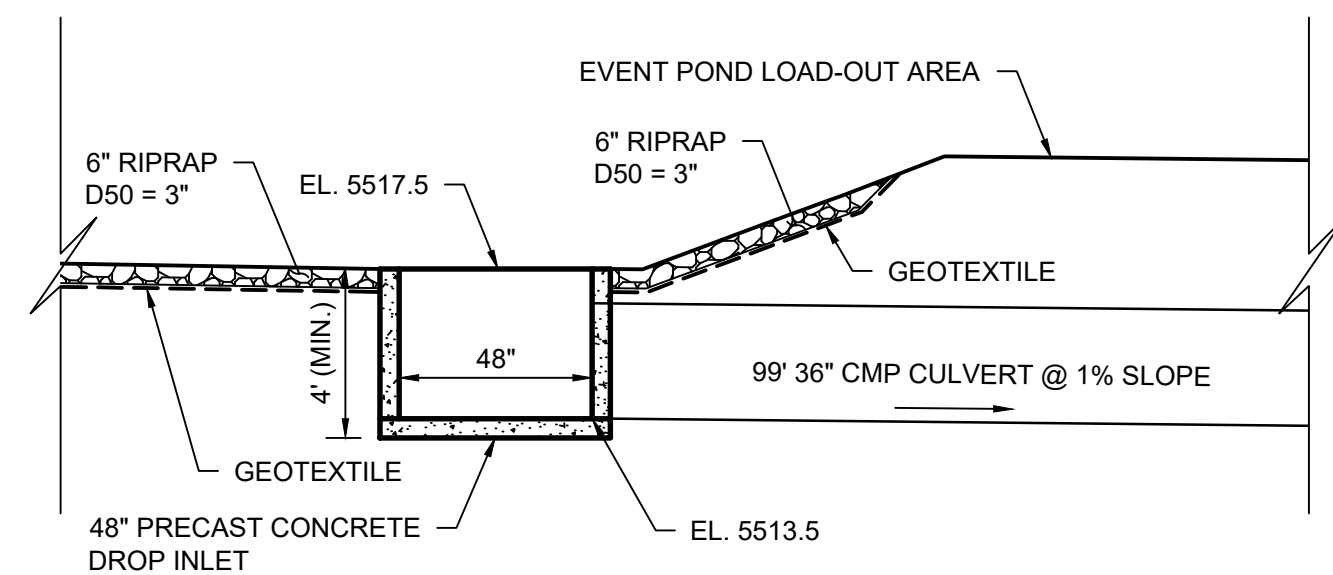
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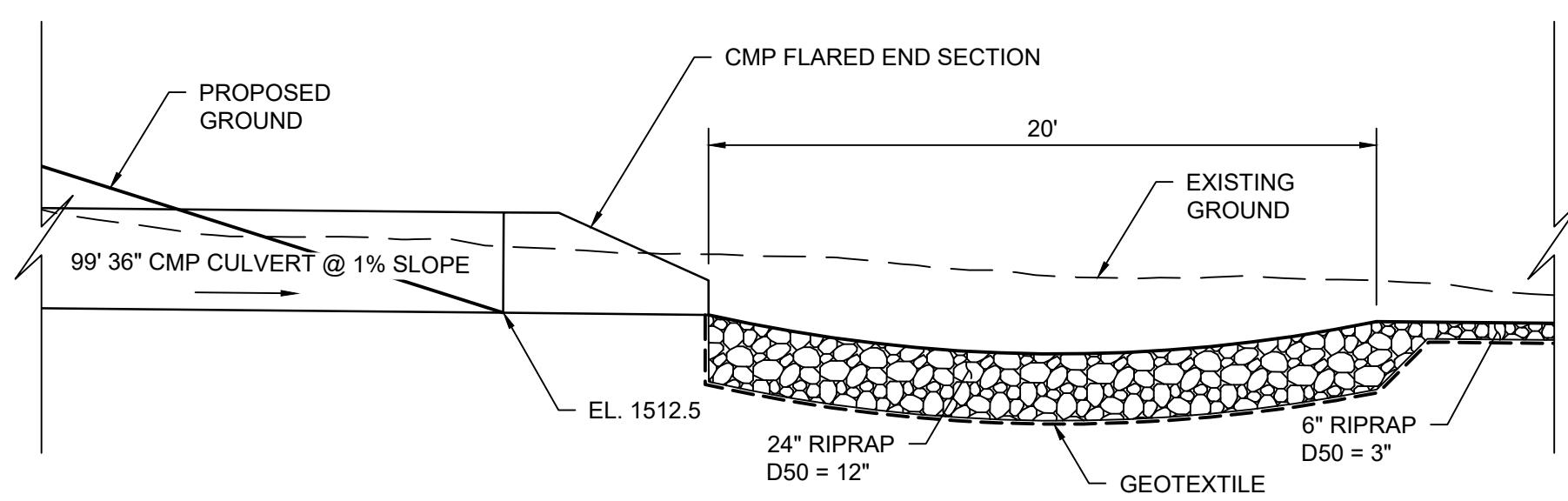
1 SECTION: TYPICAL DIVERSION BERM
SCALE IN FEET



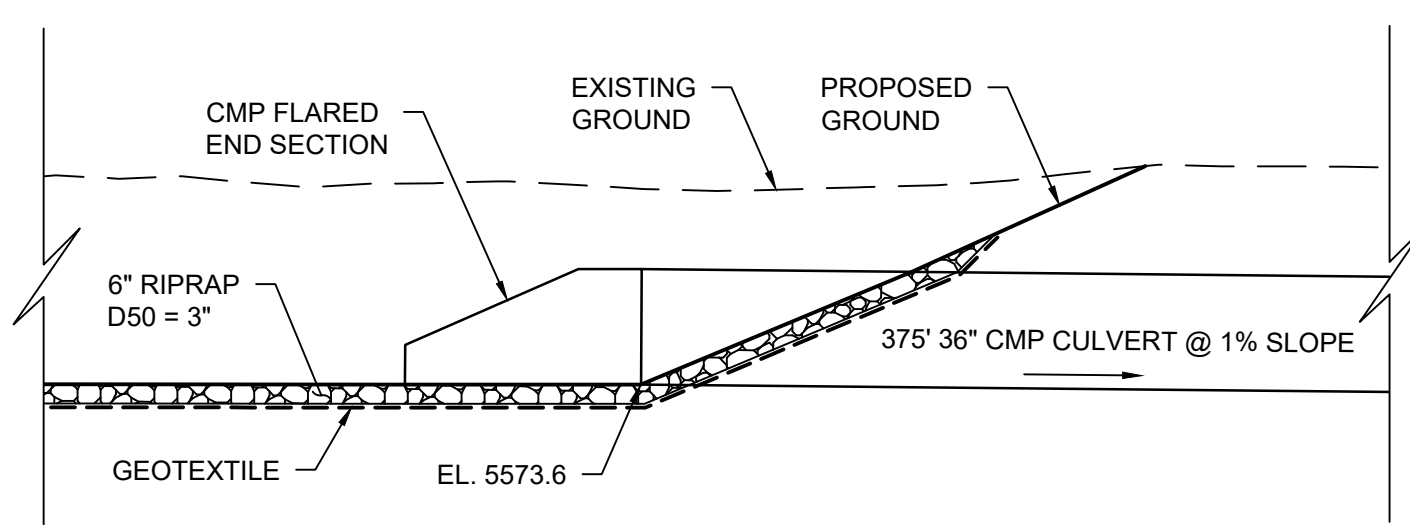
2 SECTION: TYPICAL DIVERSION BERM
SCALE IN FEET



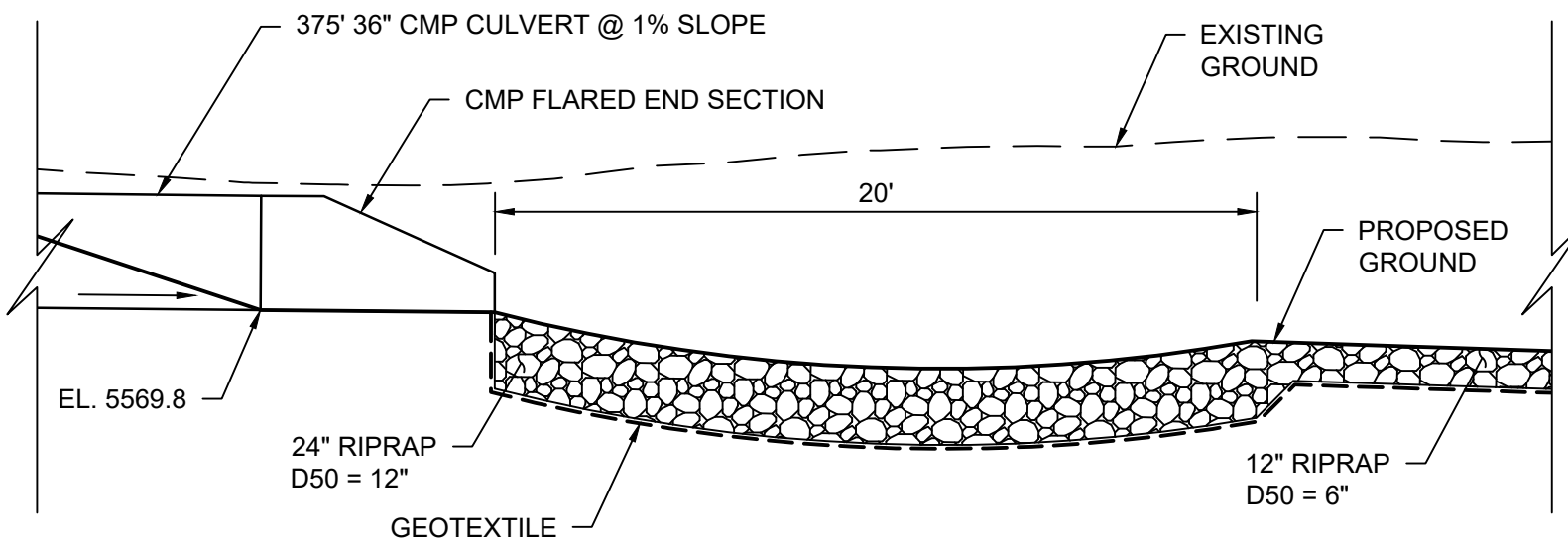
3 SECTION: SOUTH PERIMETER DITCH DROP INLET
SCALE IN FEET



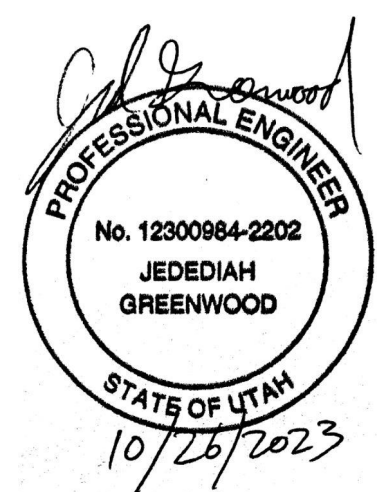
4 SECTION: SOUTH PERIMETER DITCH CULVERT OUTLET
SCALE IN FEET



5 SECTION: NORTH PERIMETER DITCH CULVERT INLET
SCALE IN FEET



6 SECTION: NORTH PERIMETER DITCH CULVERT OUTLET
SCALE IN FEET



ISSUE FOR CONSTRUCTION

NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION

CLIENT	PERMIT	BID	CONSTRUCTION	RECORD	RELEASED TO/FOR	DATE RELEASED

Project Office:
BARR ENGINEERING CO.
 4300 MARKETPOINTE DRIVE
 SUITE 200
 MINNEAPOLIS, MN 55435
 Corporate Headquarters:
 Minneapolis, Minnesota
 Ph: 1-800-632-2277
 Ph: 1-800-632-2277
 www.barr.com

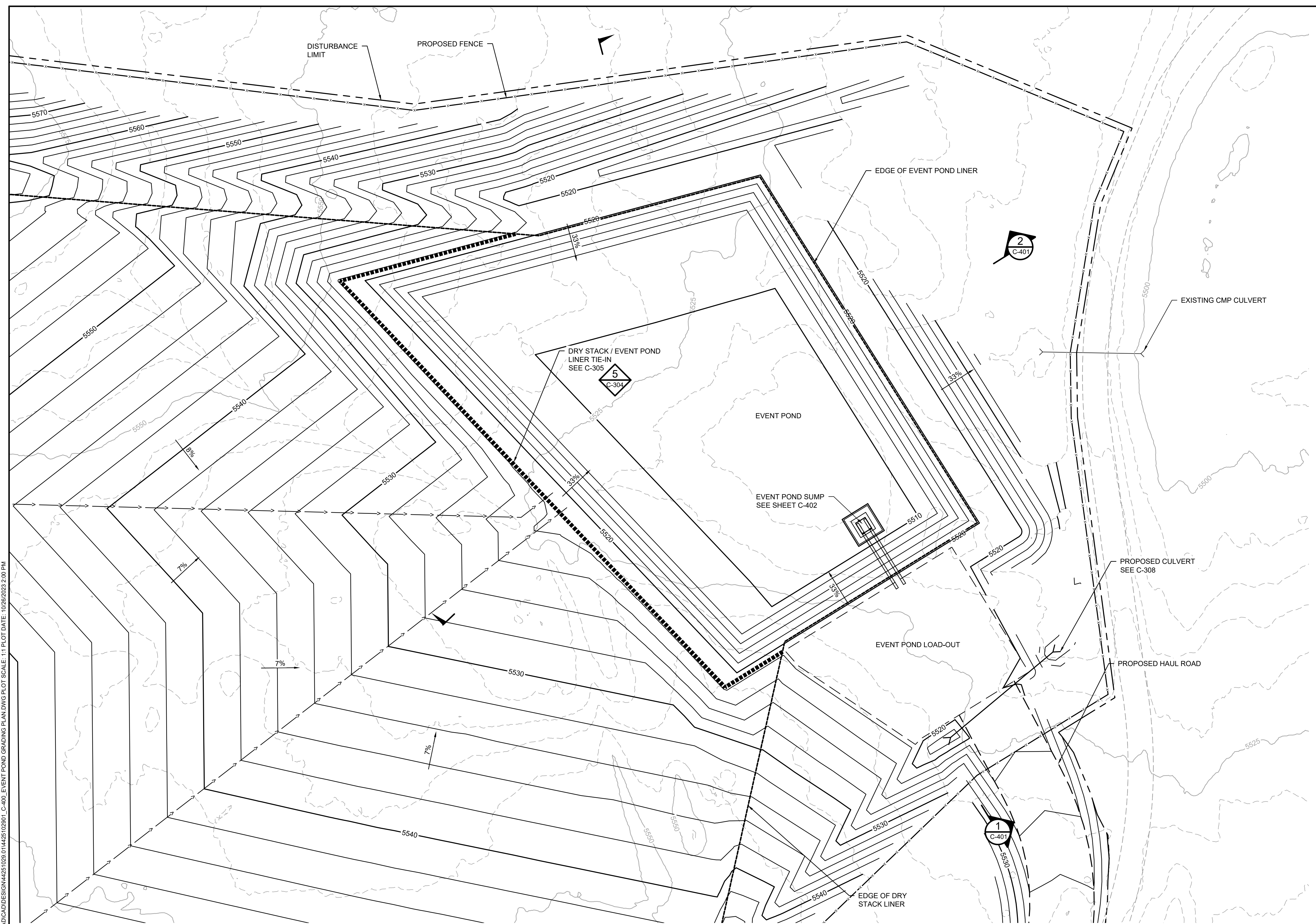
Scale	AS SHOWN
Date	02/17/2023
Drawn	ATD
Checked	JDG
Designed	ATD
Approved	JDG

TINTIC CONSOLIDATED METALS LLC.
 EUREKA, UTAH

TINTIC MINE EXPANSION
 DRY STACK TAILINGS STORAGE FACILITY
 DRY STACK PERIMETER BERM AND DITCH
 SECTIONS AND DETAILS

BARR PROJECT No. 44251029.01	
CLIENT PROJECT No.	
DWG. No. C-308	REV. No. A

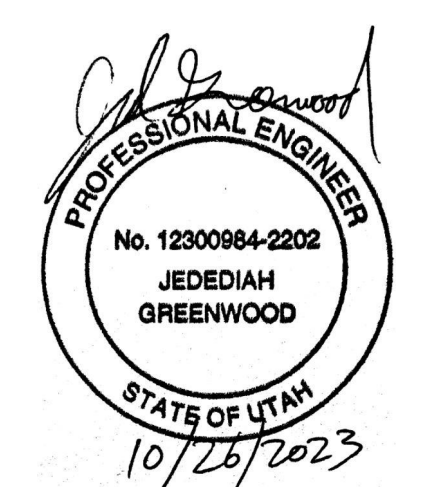
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LEGEND

	1380	EXISTING MAJOR CONTOUR
		EXISTING MINOR CONTOUR
	1380	PROPOSED MAJOR CONTOUR
		PROPOSED MINOR CONTOUR
		EXISTING OVERHEAD ELECTRIC
		PROPOSED EDGE OF LINER
		PROPOSED LEACHATE COLLECTION PIPE
		PROPOSED CULVERT
		PROPOSED FENCE

1 PLAN: FINAL COVER GRADING
 0 30 60
 SCALE IN FEET



ISSUE FOR CONSTRUCTION

NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION

CLIENT									
PERMIT									
BID									
CONSTRUCTION									
RECORD									
RELEASED TO/FOR	A	B	C	0	1	2	3		

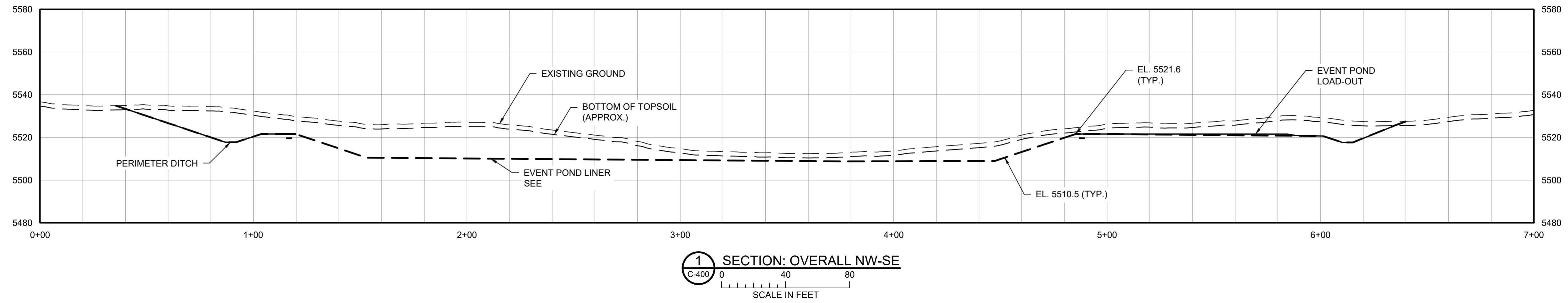
BARR
 Project Office:
 BARR ENGINEERING CO.
 4300 MARKETPOINTE DRIVE
 SUITE 200
 MINNEAPOLIS, MN 55435
 Corporate Headquarters:
 Minneapolis, Minnesota
 Ph: 1-800-632-2277
 Ph: 1-800-632-2277
 www.barr.com

Scale	AS SHOWN
Date	02/17/2023
Drawn	ATD
Checked	JDG
Designed	ATD
Approved	JDG

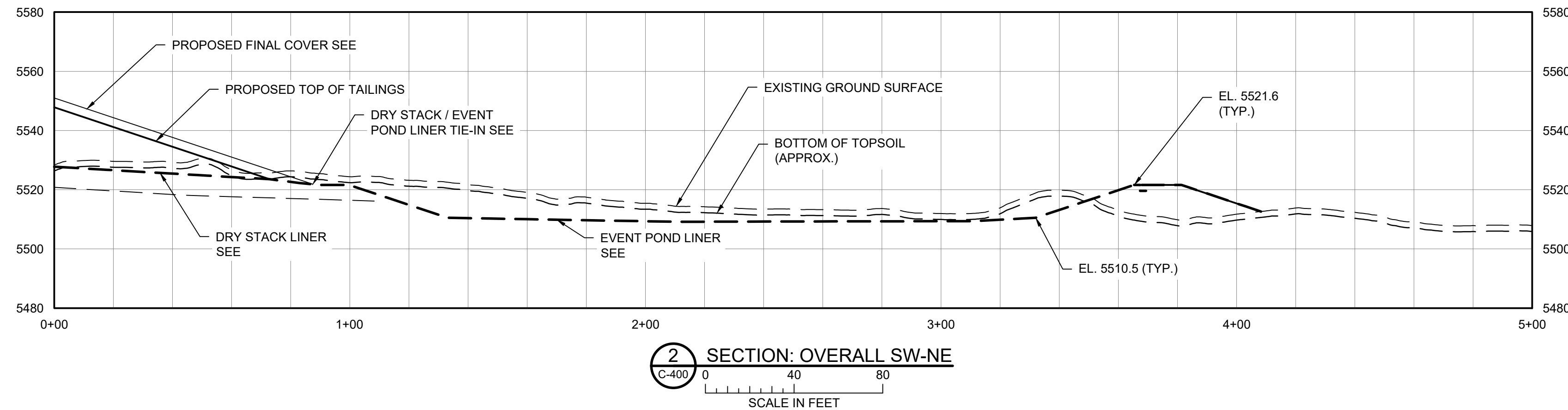
TINTIC CONSOLIDATED METALS LLC.
 EUREKA, UTAH

**TINTIC MINE EXPANSION
 DRY STACK TAILINGS STORAGE FACILITY**
 EVENT POND
 GRADING PLAN

BARR PROJECT No. 44251029.01	
CLIENT PROJECT No.	
DWG. No. C-400	REV. No. A

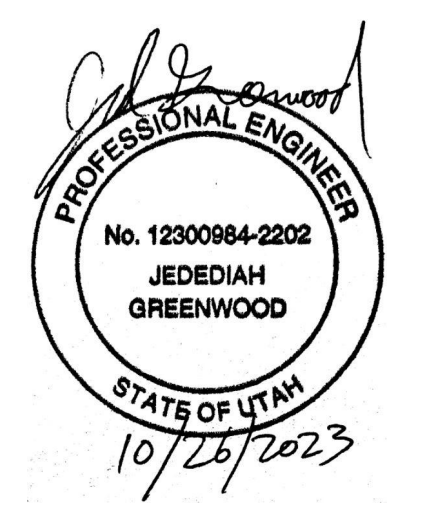


1 SECTION: OVERALL NW-SE
C-400
SCALE IN FEET



2 SECTION: OVERALL SW-NE
C-400
SCALE IN FEET

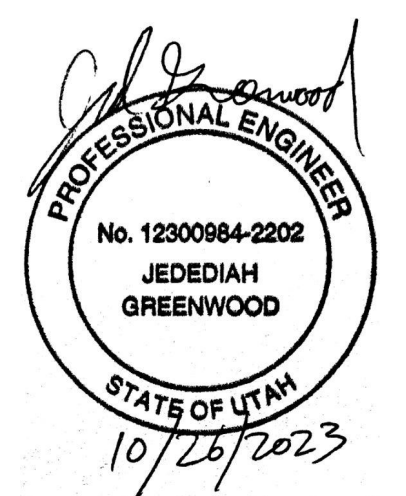
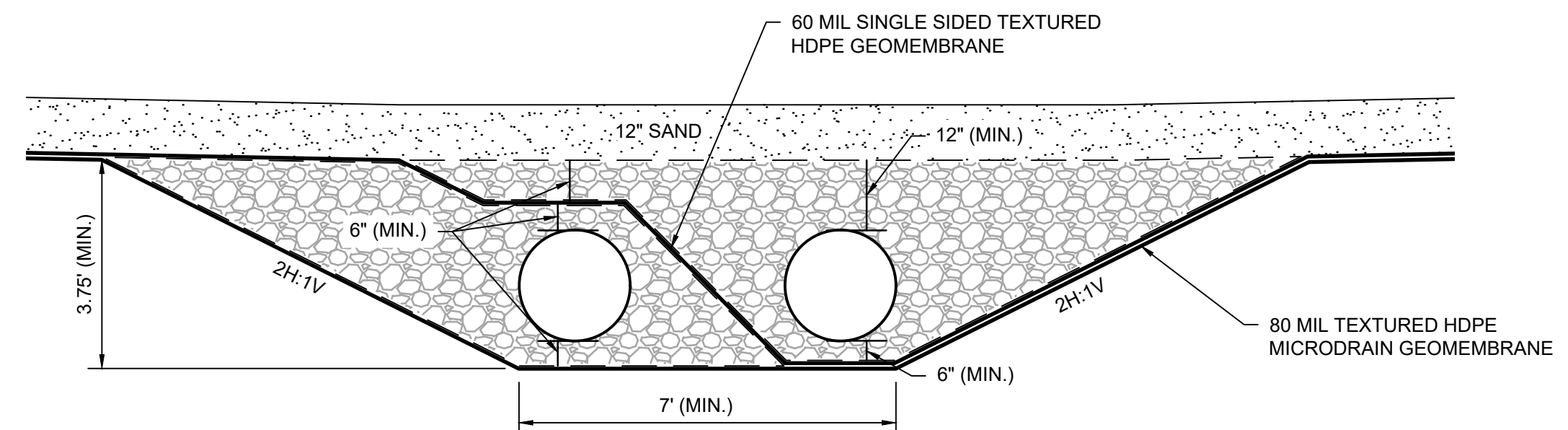
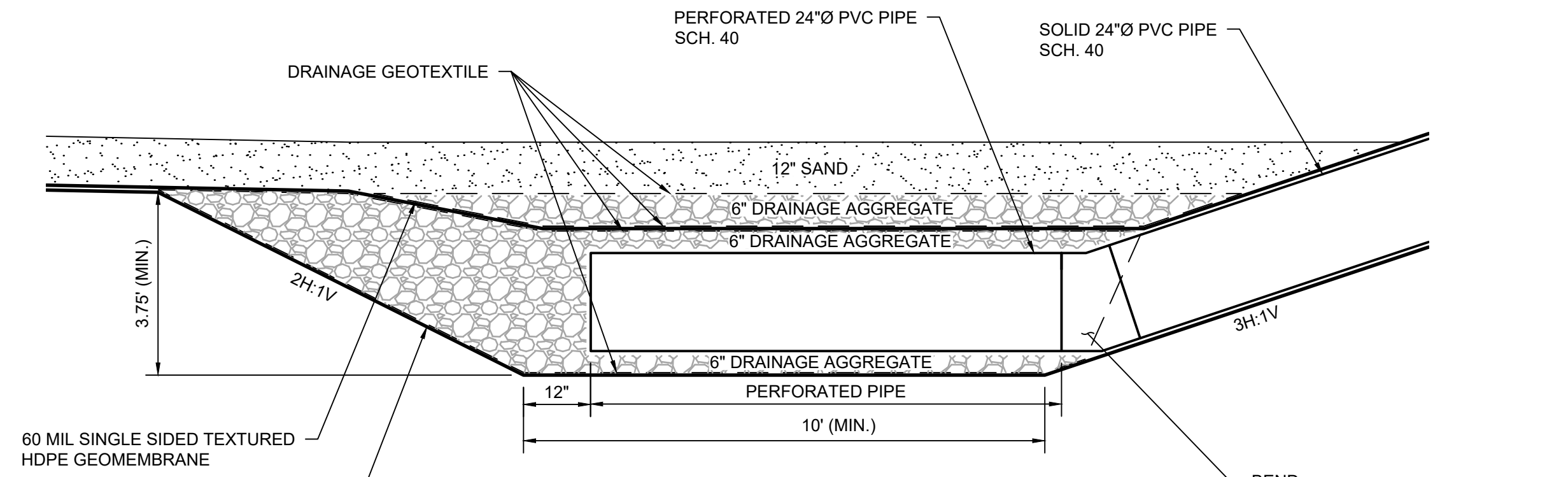
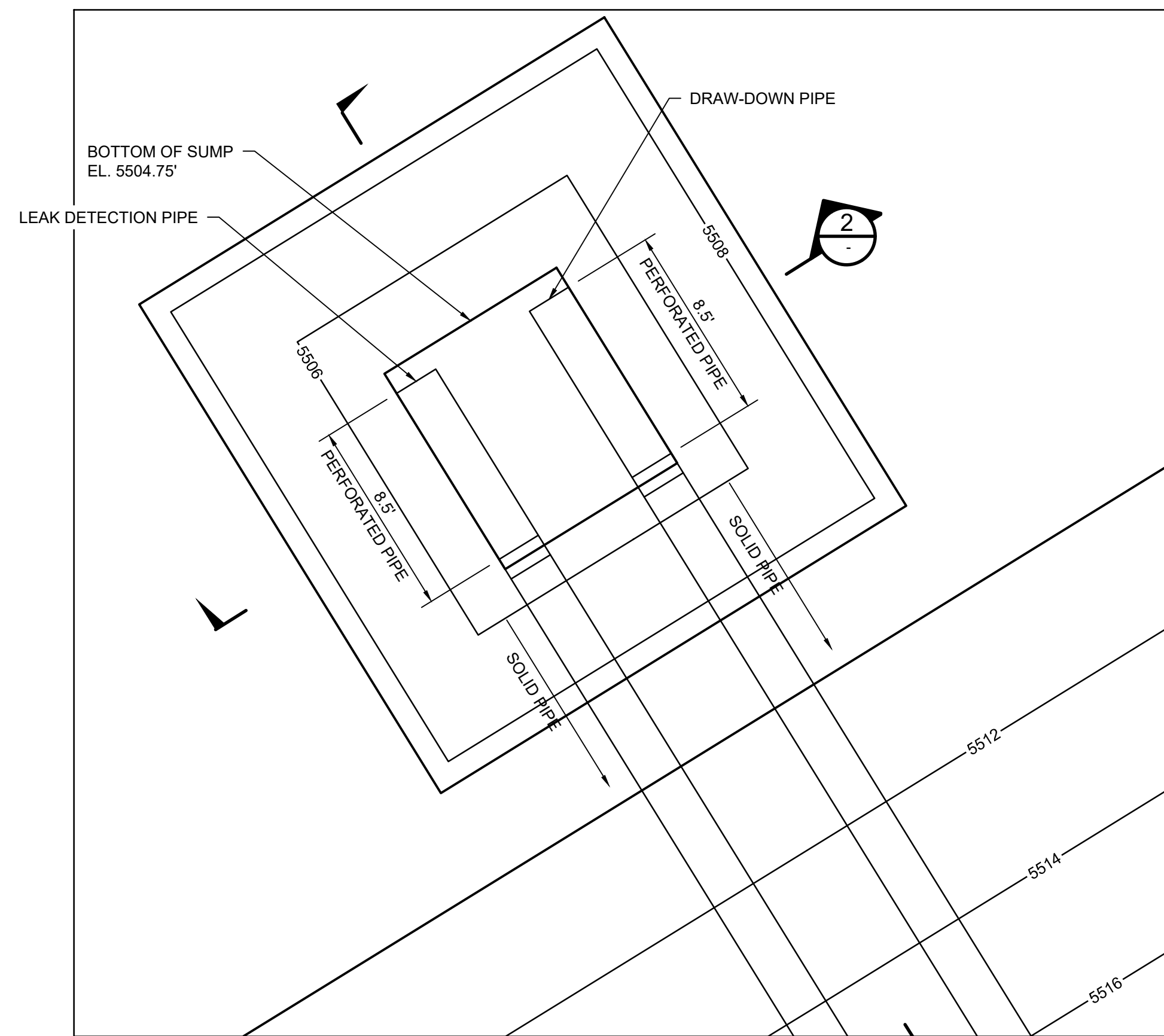
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ISSUE FOR CONSTRUCTION

				CLIENT								Project Office:	AS SHOWN		TINTIC MINE EXPANSION		BARR PROJECT No.	
				PERMIT	06/08/23							BARR ENGINEERING CO.	02/17/2023		DRY STACK TAILINGS STORAGE FACILITY		44251029.01	
				BID								4300 MARKETPOINTE DRIVE	ATD		CLIENT PROJECT No.			
				CONSTRUCTION								SUITE 200	JGD		EVENT POND		DWG. No.	
				RECORD								MINNEAPOLIS, MN 55435	ATD		OVERALL SECTIONS		C-401	
				RELEASED TO/FOR	A	B	C	0	1	2	3	Corporate Headquarters:	JGD		REV. No.		A	
NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION							MINNEAPOLIS, Minnesota						
												Ph: 1-800-632-2277						
												Ph: (952) 832-2601						
												Ph: 1-800-632-2277						
												www.barr.com						

CADD USER: LCGAN.F; MADDNEY FILE: \\EDI-CADD\CADD\DESIGN\4251028\01\4\23\02801_C-402_EVENT POND SUMP PLAN SECTIONS AND DETAILS.DWG PLOT SCALE: 1:1 PLOT DATE: 10/26/2023 2:03 PM



ISSUE FOR CONSTRUCTION

NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION

CLIENT: BARR ENGINEERING CO.
 PERMIT: 06/08/23
 BID: []
 CONSTRUCTION: []
 RECORD: []

BARR
 Corporate Headquarters:
 Minneapolis, Minnesota
 Ph: 1-800-632-2277
 Ph: 1-800-632-2277

Project Office:
 BARR ENGINEERING CO.
 4300 MARKETPOINTE DRIVE
 SUITE 200
 MINNEAPOLIS, MN 55435
 Ph: 1-800-632-2277
 Fax: (952) 832-2601
 www.barr.com

Scale	AS SHOWN
Date	02/17/2023
Drawn	ATD
Checked	JDG
Designed	ATD
Approved	JDG

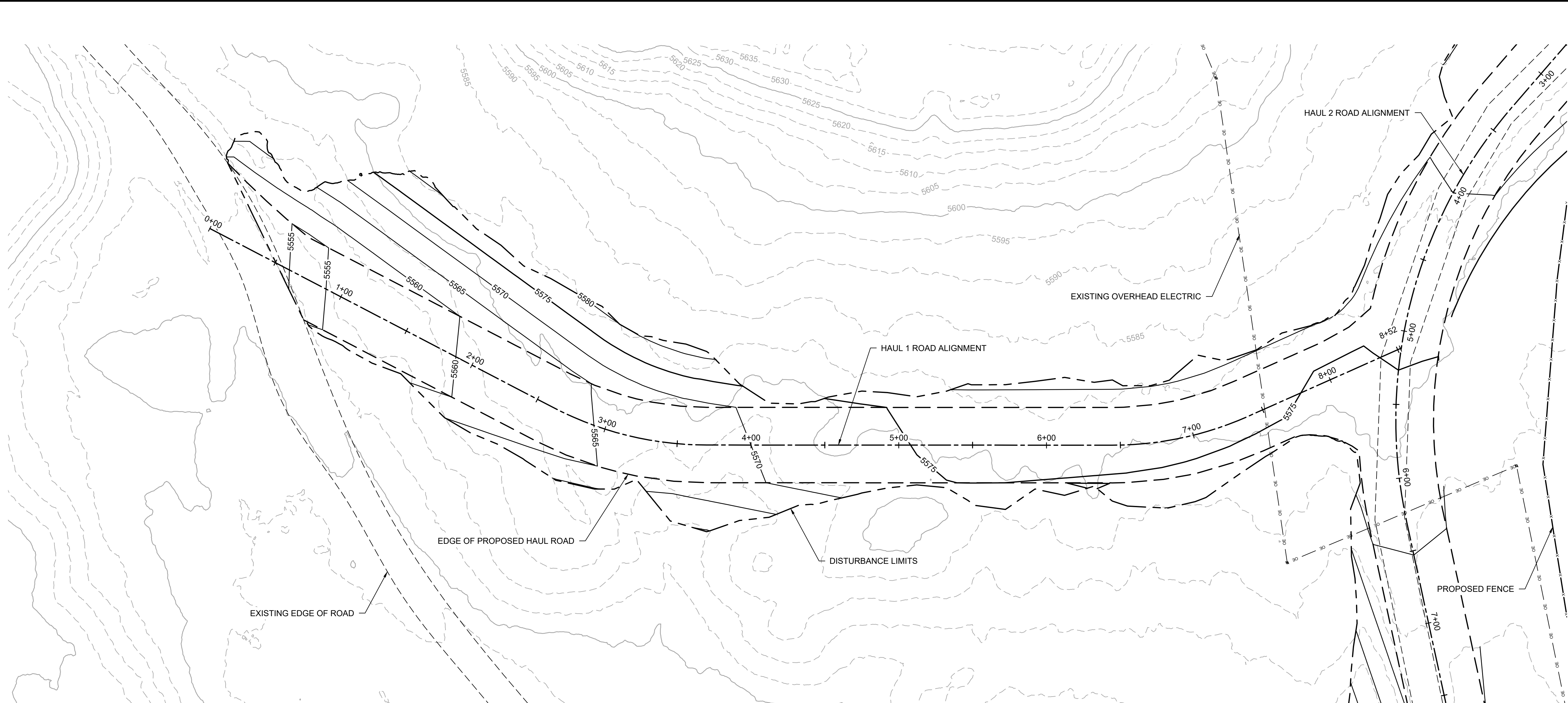
TINTIC CONSOLIDATED METALS LLC.
 EUREKA, UTAH

TINTIC MINE EXPANSION
 DRY STACK TAILINGS STORAGE FACILITY

EVENT POND SUMP
 PLAN, SECTIONS, AND DETAILS

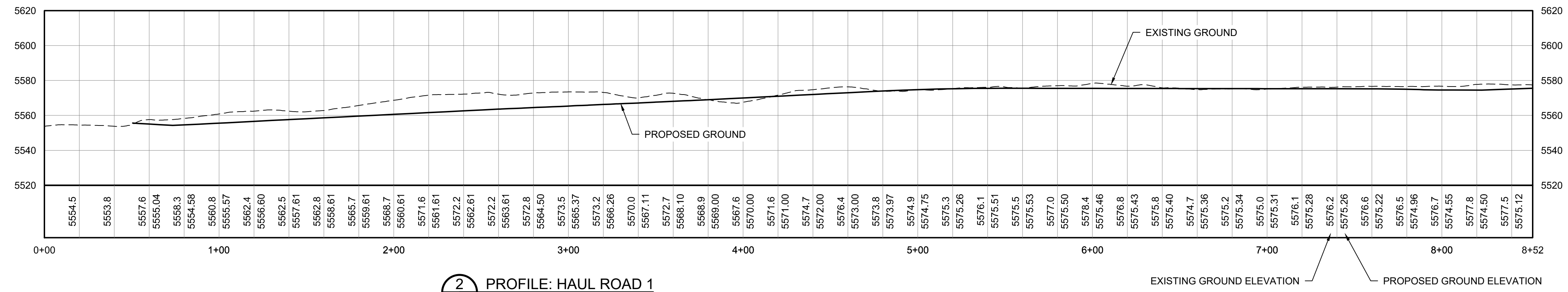
BARR PROJECT No. 44251029.01	
CLIENT PROJECT No.	
DWG. No. C-402	REV. No. A

CADD USER: LOGAN.F. MAONEY FILE: \\EDI-CADD\DESIGN\42510291_01\42510291_C-500_HAUL ROAD PLAN AND PROFILE.DWG PLOT SCALE: 1:1 PLOT DATE: 10/26/2023 2:05 PM

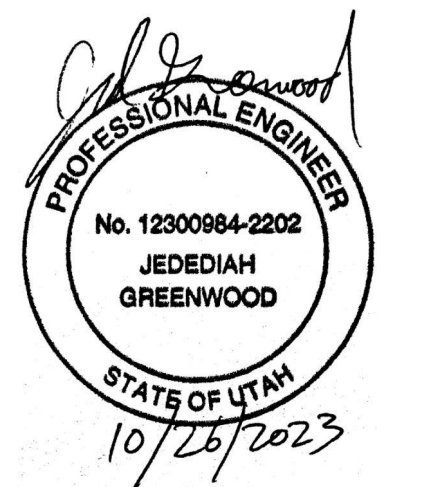


LEGEND	
	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
	PROPOSED MAJOR CONTOUR
	PROPOSED MINOR CONTOUR
	EXISTING OVERHEAD ELECTRIC
	EXISTING EDGE OF PAVED ROAD
	EXISTING EDGE OF UNPAVED ROAD
	PROPOSED EDGE OF HAUL ROAD
	PROPOSED FENCE
	DISTURBANCE LIMITS

1 PLAN: HAUL ROAD 1
0 40 80
SCALE IN FEET



2 PROFILE: HAUL ROAD 1
0 40 80
SCALE IN FEET



ISSUE FOR CONSTRUCTION

NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION

CLIENT	PERMIT	BID	CONSTRUCTION	RECORD
	06/09/23			

RELEASED TO/FOR	A	B	C	0	1	2	3

BARR Engineering Co.
4300 MARKETPOINTE DRIVE SUITE 200
MINNEAPOLIS, MN 55435
Ph: 1-800-632-2277
Fax: (952) 832-2601
www.barr.com

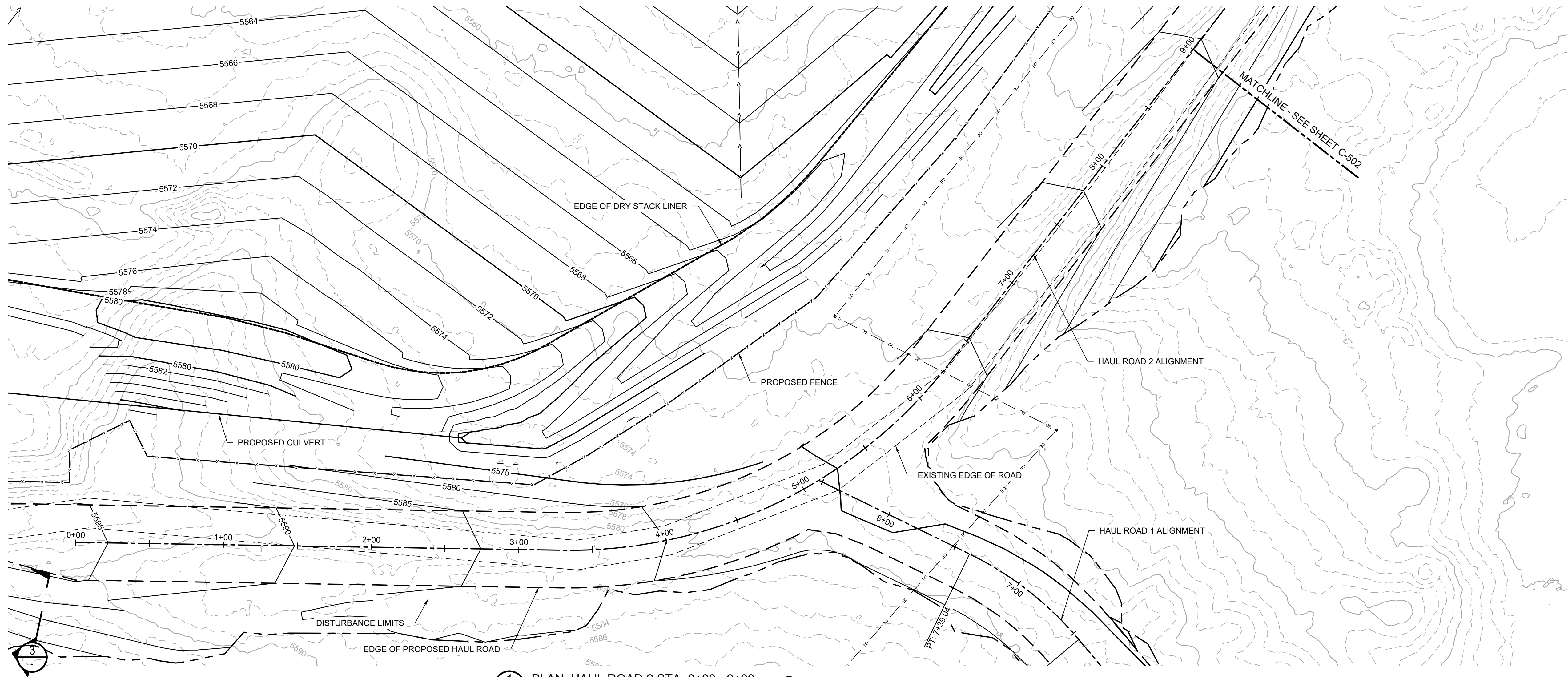
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Date	06/02/2023
Drawn	LFM
Checked	JDG
Designed	ATD
Approved	JDG

TINTIC CONSOLIDATED METALS LLC.
EUREKA, UTAH

TINTIC MINE EXPANSION
DRY STACK TAILINGS STORAGE FACILITY
HAUL ROAD 1
PLAN AND PROFILE

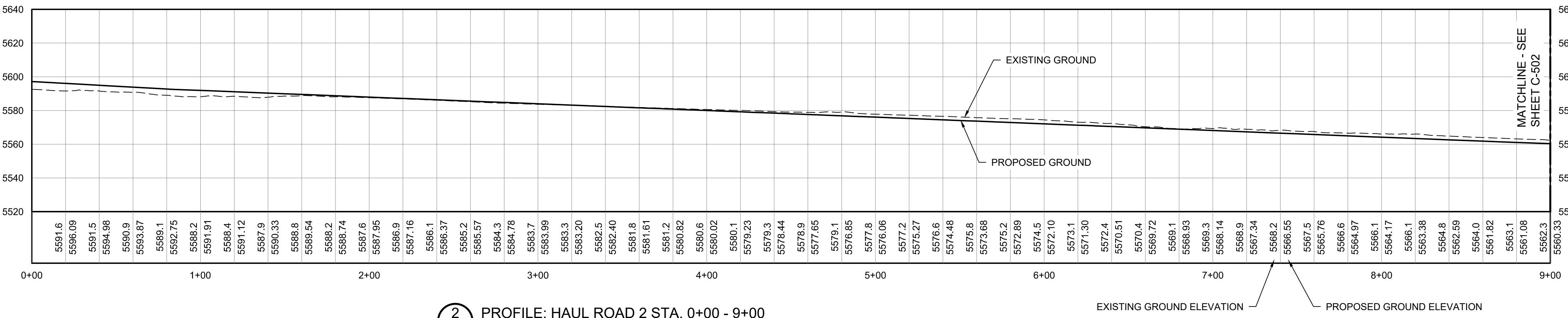
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CLIENT PROJECT No.	DWG. No. C-500

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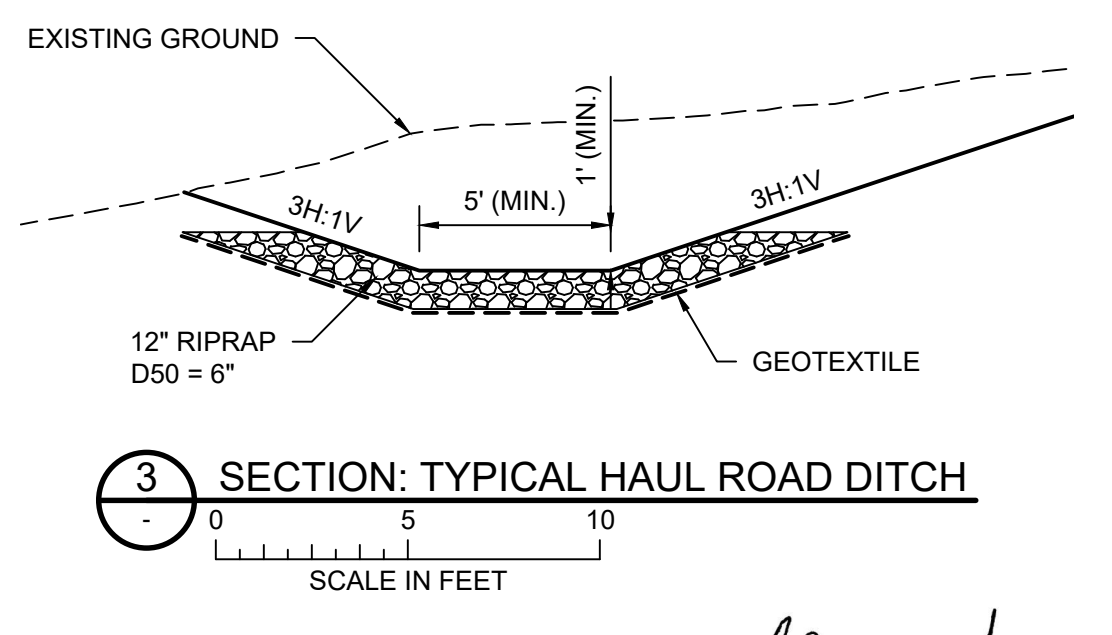


LEGEND	
	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
	PROPOSED MAJOR CONTOUR
	PROPOSED MINOR CONTOUR
	EXISTING OVERHEAD ELECTRIC
	EXISTING EDGE OF PAVED ROAD
	EXISTING EDGE OF UNPAVED ROAD
	PROPOSED EDGE OF HAUL ROAD
	PROPOSED FENCE
	DISTURBANCE LIMITS

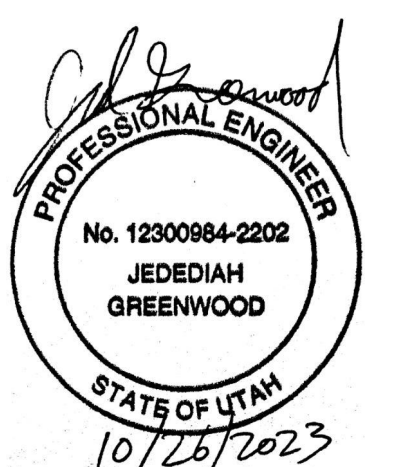
1 PLAN: HAUL ROAD 2 STA. 0+00 - 9+00
 SCALE IN FEET



2 PROFILE: HAUL ROAD 2 STA. 0+00 - 9+00
 SCALE IN FEET



3 SECTION: TYPICAL HAUL ROAD DITCH
 SCALE IN FEET



ISSUE FOR CONSTRUCTION

NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION

CLIENT	PERMIT	BID	CONSTRUCTION	RECORD
	06/08/23			

BARR ENGINEERING CO.
 4300 MARKETPOINTE DRIVE
 SUITE 200
 MINNEAPOLIS, MN 55435
 Project Office:
 BARR ENGINEERING CO.
 4300 MARKETPOINTE DRIVE
 SUITE 200
 MINNEAPOLIS, MN 55435
 Corporate Headquarters:
 Minneapolis, Minnesota
 Ph: 1-800-632-2277
 Ph: 1-800-632-2277
 www.barr.com

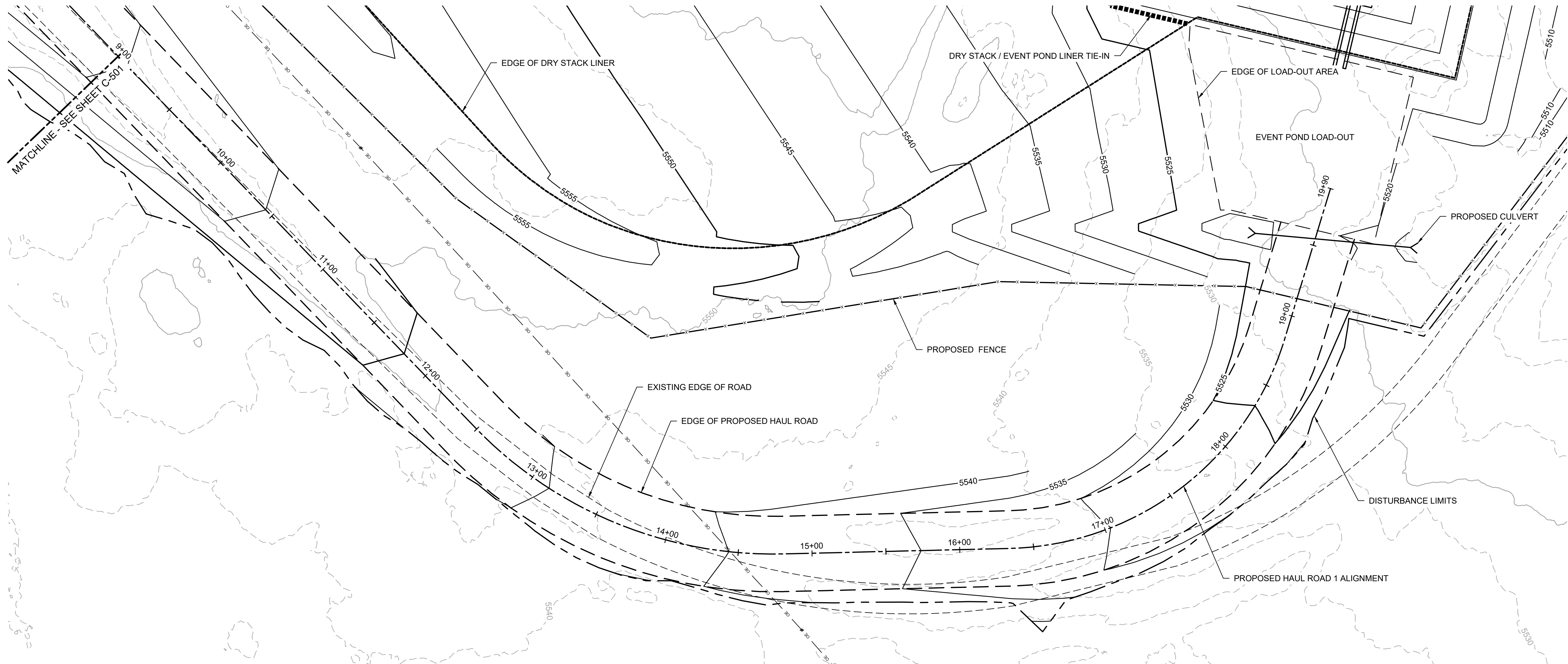
Scale	AS SHOWN
Date	05/04/2023
Drawn	AJB2
Checked	JDG
Designed	ATD
Approved	JDG

TINTIC CONSOLIDATED METALS LLC.
 EUREKA, UTAH

**TINTIC MINE EXPANSION
 DRY STACK TAILINGS STORAGE FACILITY**
 HAUL ROAD 2
 PLAN AND PROFILE

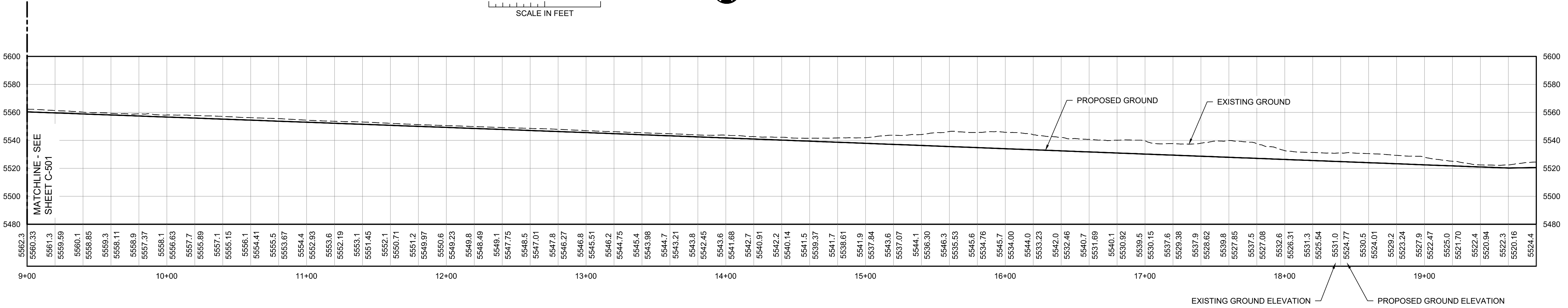
BARR PROJECT No.	44251029.01
CLIENT PROJECT No.	
DWG. No.	C-501
REV. No.	A

CADD USER: LOGAN.F. MAHONEY FILE: \\EDI-CADD\DESIGN\4251028\1\425102801_C-502_HAUL ROAD PLAN AND PROFILE.DWG PLOT SCALE: 1:1 PLOT DATE: 10/26/2023 2:11 PM

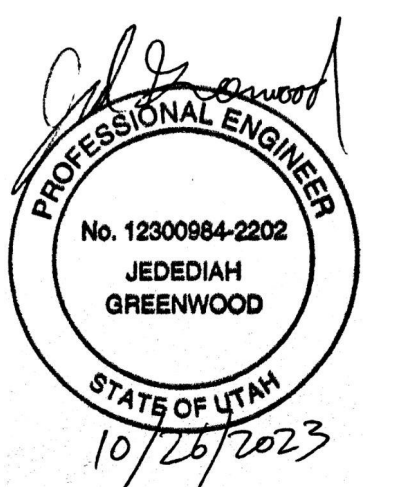


LEGEND	
	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
	PROPOSED MAJOR CONTOUR
	PROPOSED MINOR CONTOUR
	EXISTING OVERHEAD ELECTRIC
	EXISTING EDGE OF PAVED ROAD
	EXISTING EDGE OF UNPAVED ROAD
	PROPOSED EDGE OF HAUL ROAD
	PROPOSED FENCE
	DISTURBANCE LIMITS

1 PLAN: HAUL ROAD 1 STA. 9+00 - END
 0 40 80
 SCALE IN FEET



2 PROFILE: HAUL ROAD STA. 30+00 - END
 0 40 80
 SCALE IN FEET



ISSUE FOR CONSTRUCTION

NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION

CLIENT	
PERMIT	06/08/23
BID	
CONSTRUCTION	
RECORD	
RELEASED TO/FOR	A B C 0 1 2 3
DATE RELEASED	

BARR Project Office:
 BARR ENGINEERING CO.
 4300 MARKETPOINTE DRIVE
 SUITE 200
 MINNEAPOLIS, MN 55435
 Corporate Headquarters:
 Minneapolis, Minnesota
 Ph: 1-800-632-2277
 Fax: (952) 832-2601
 www.barr.com

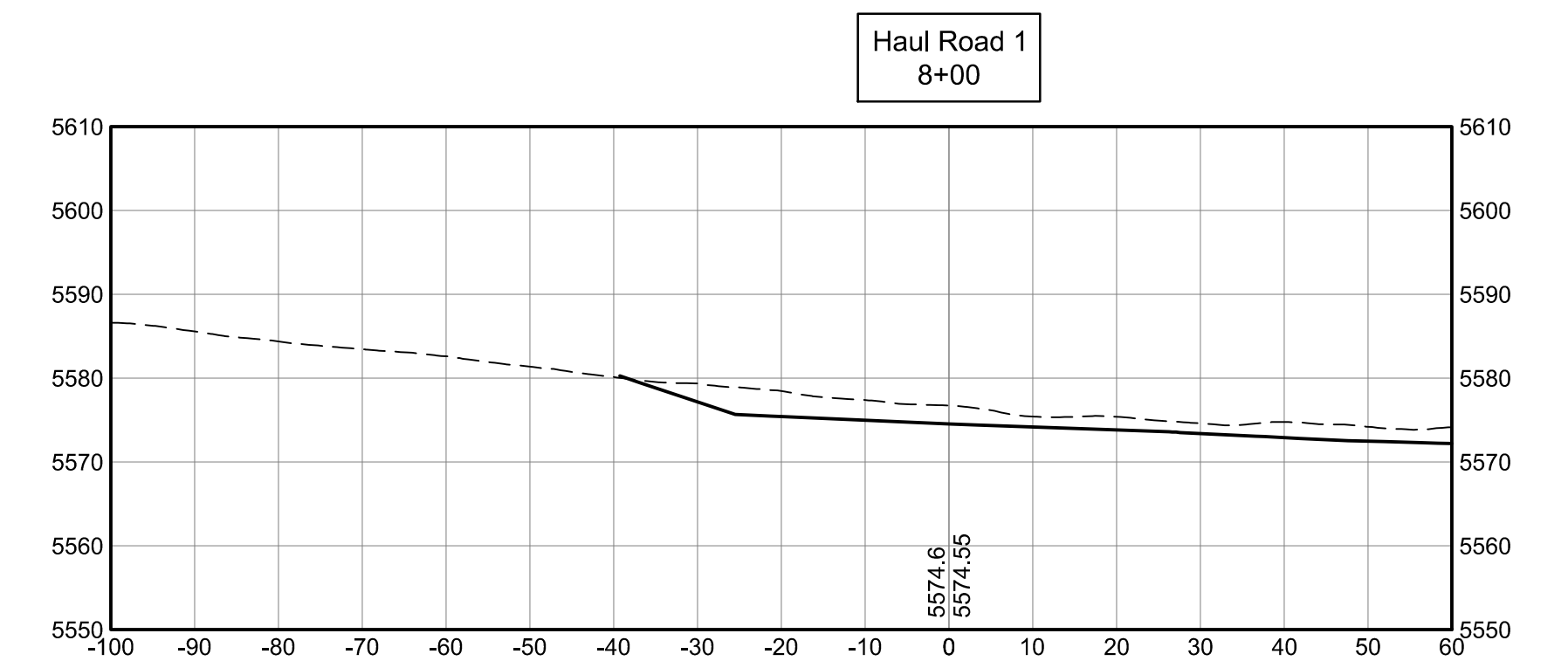
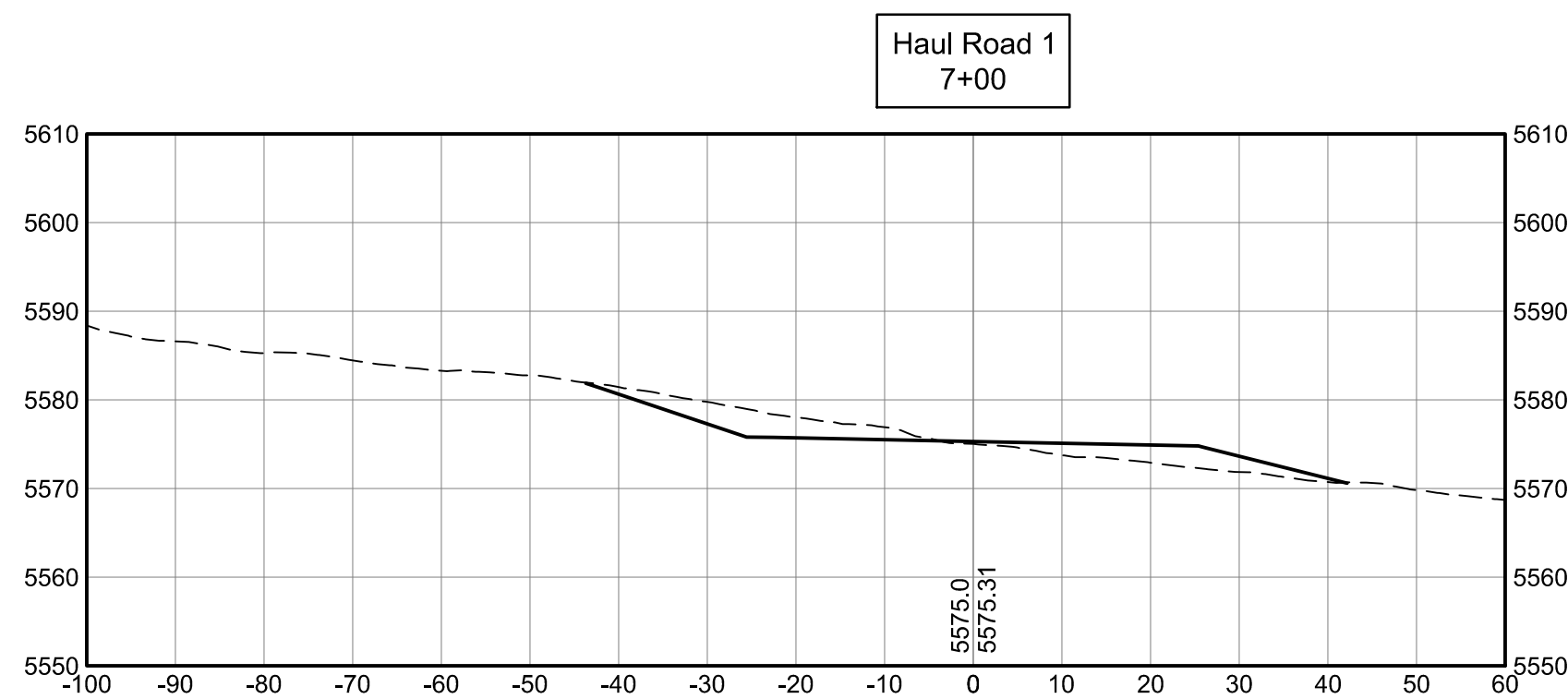
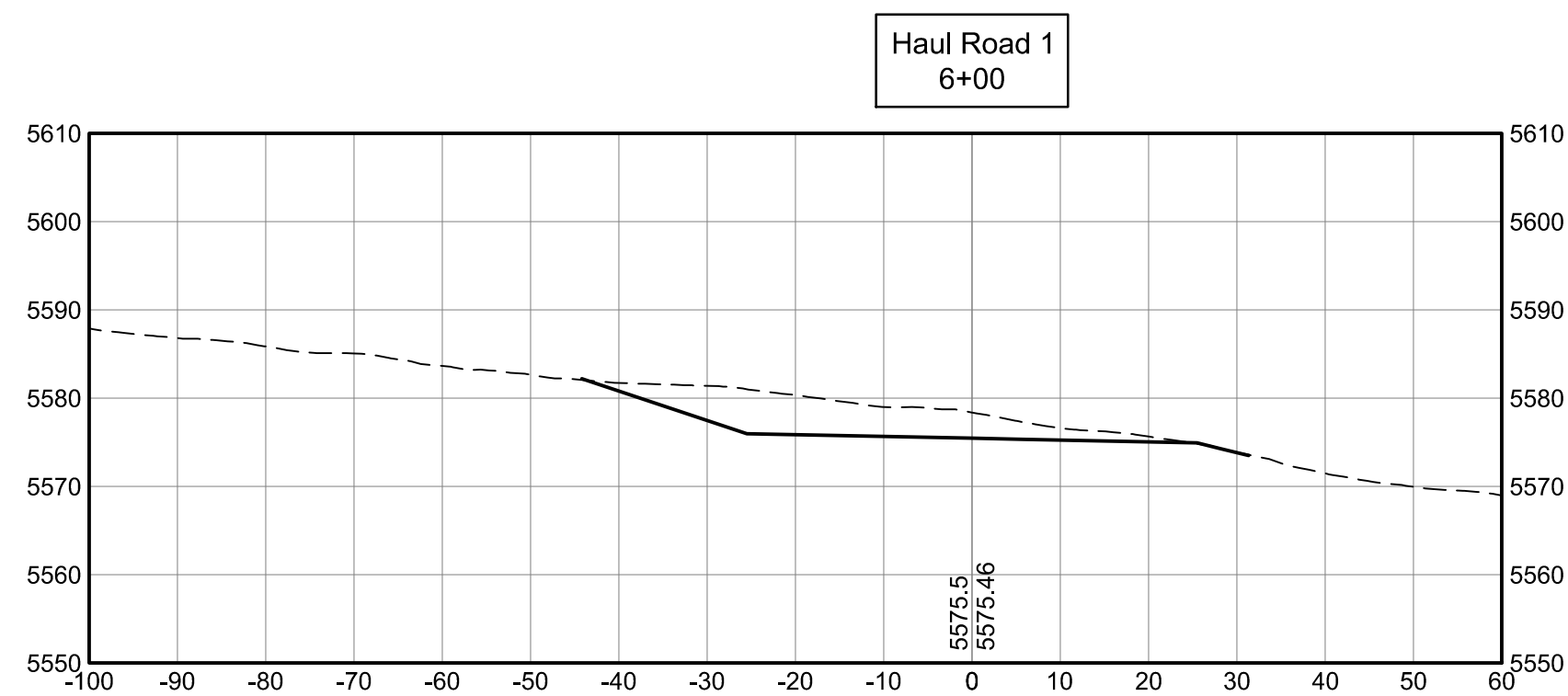
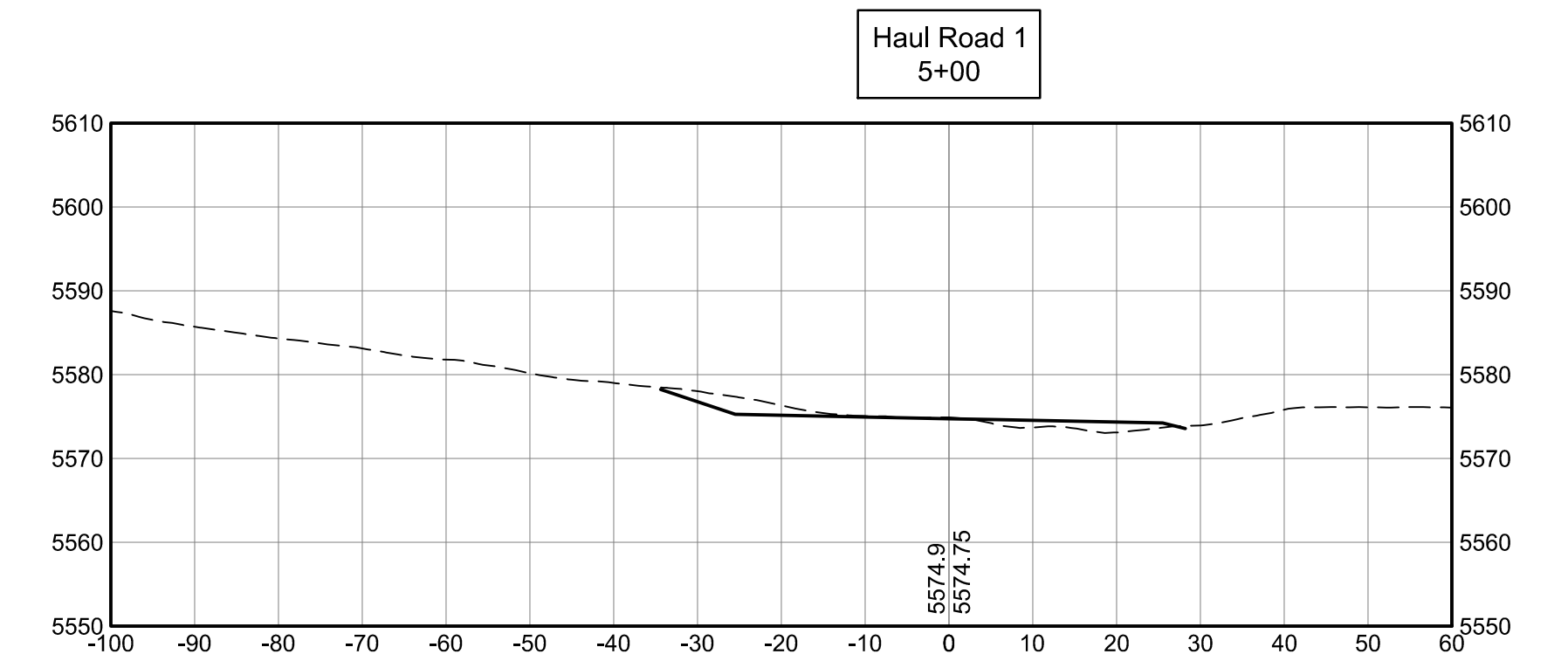
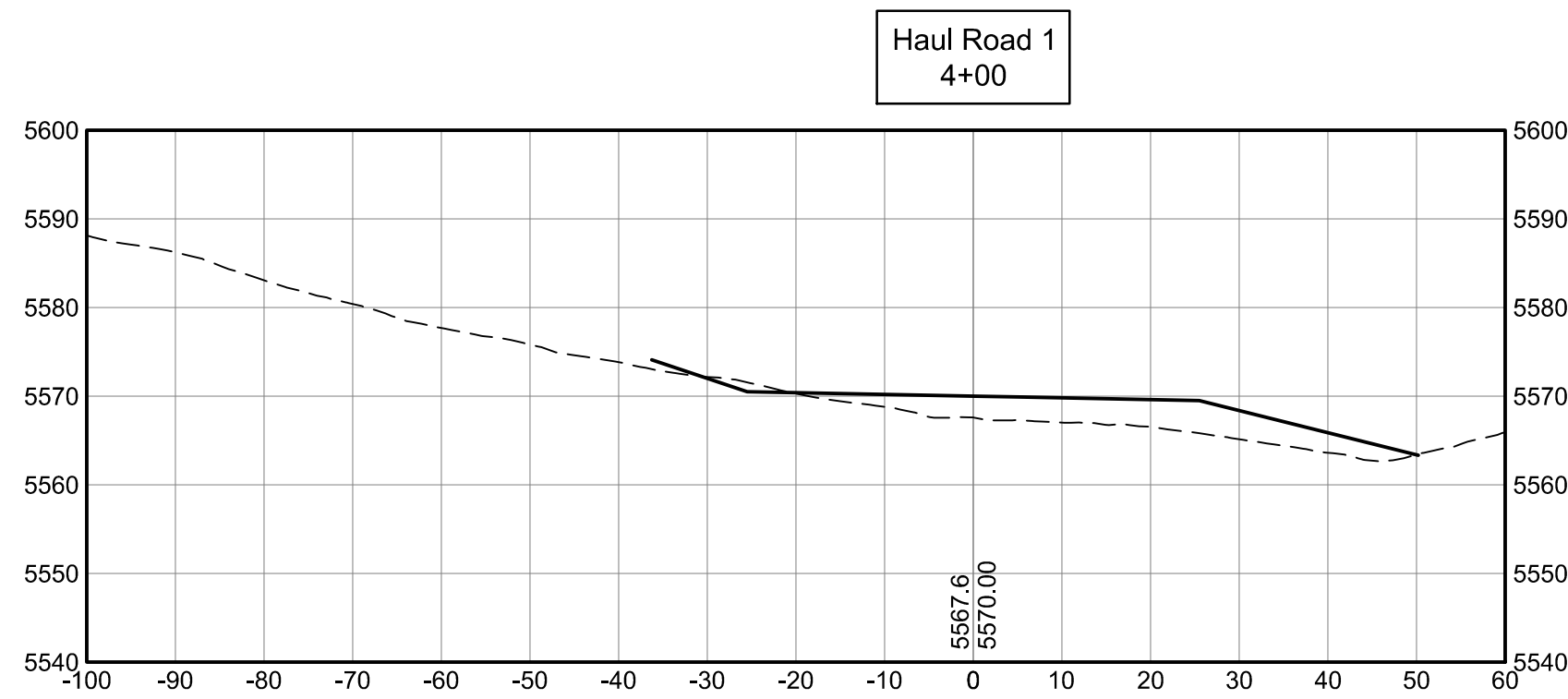
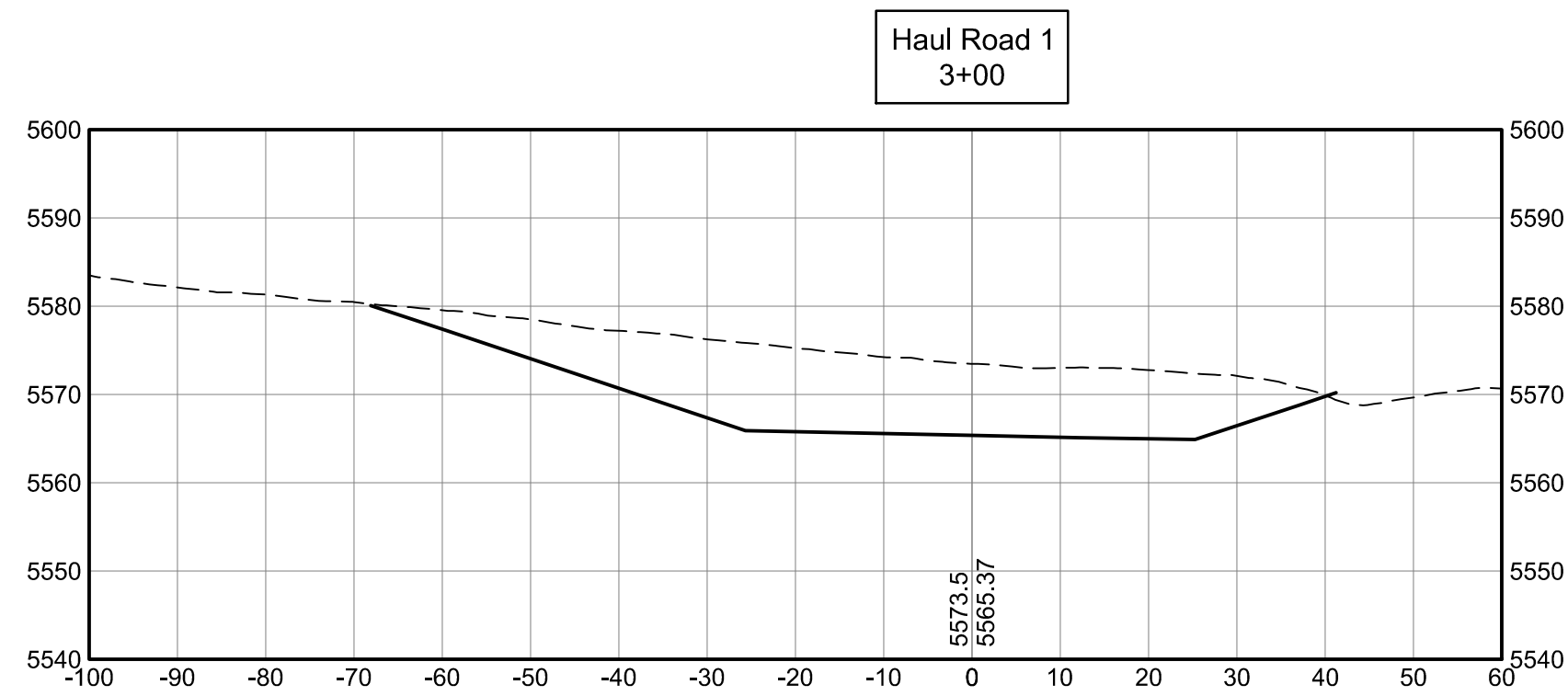
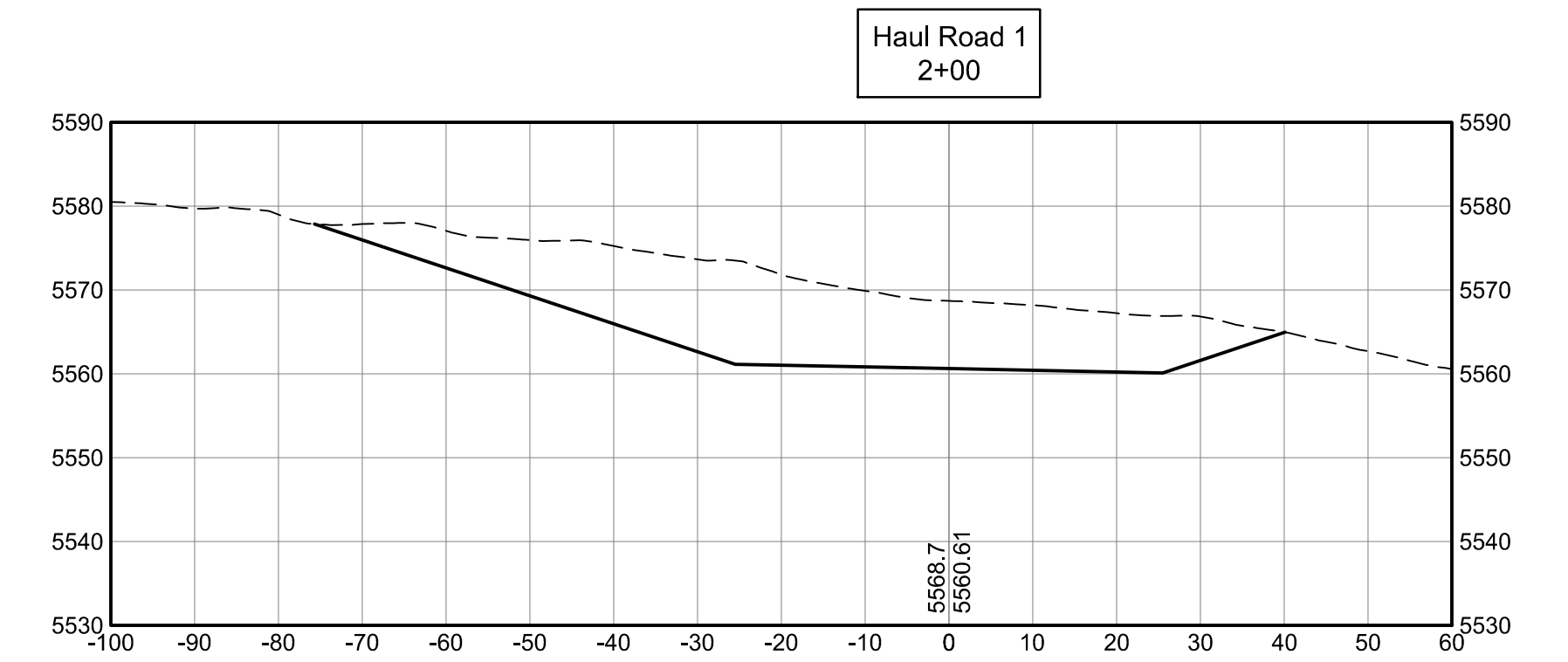
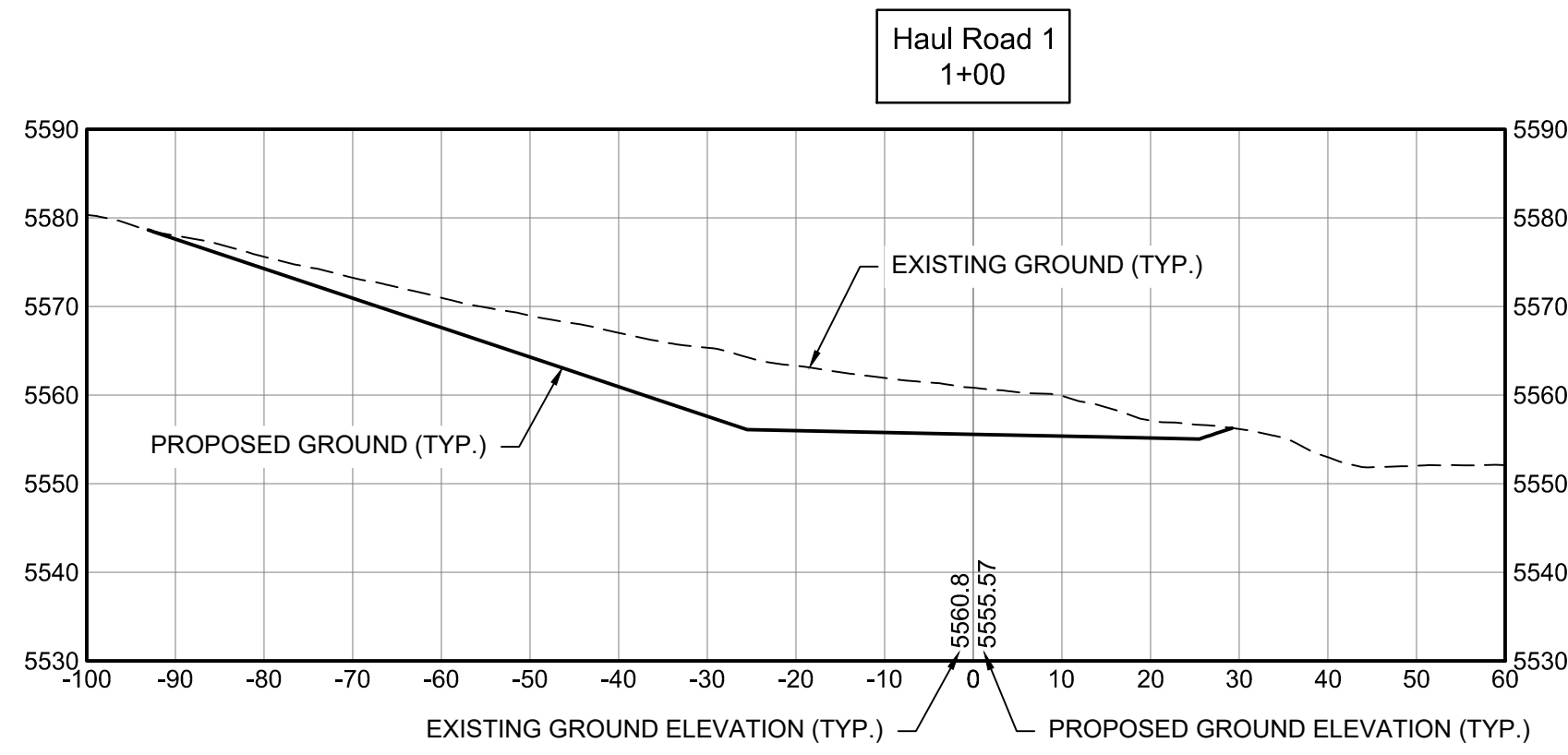
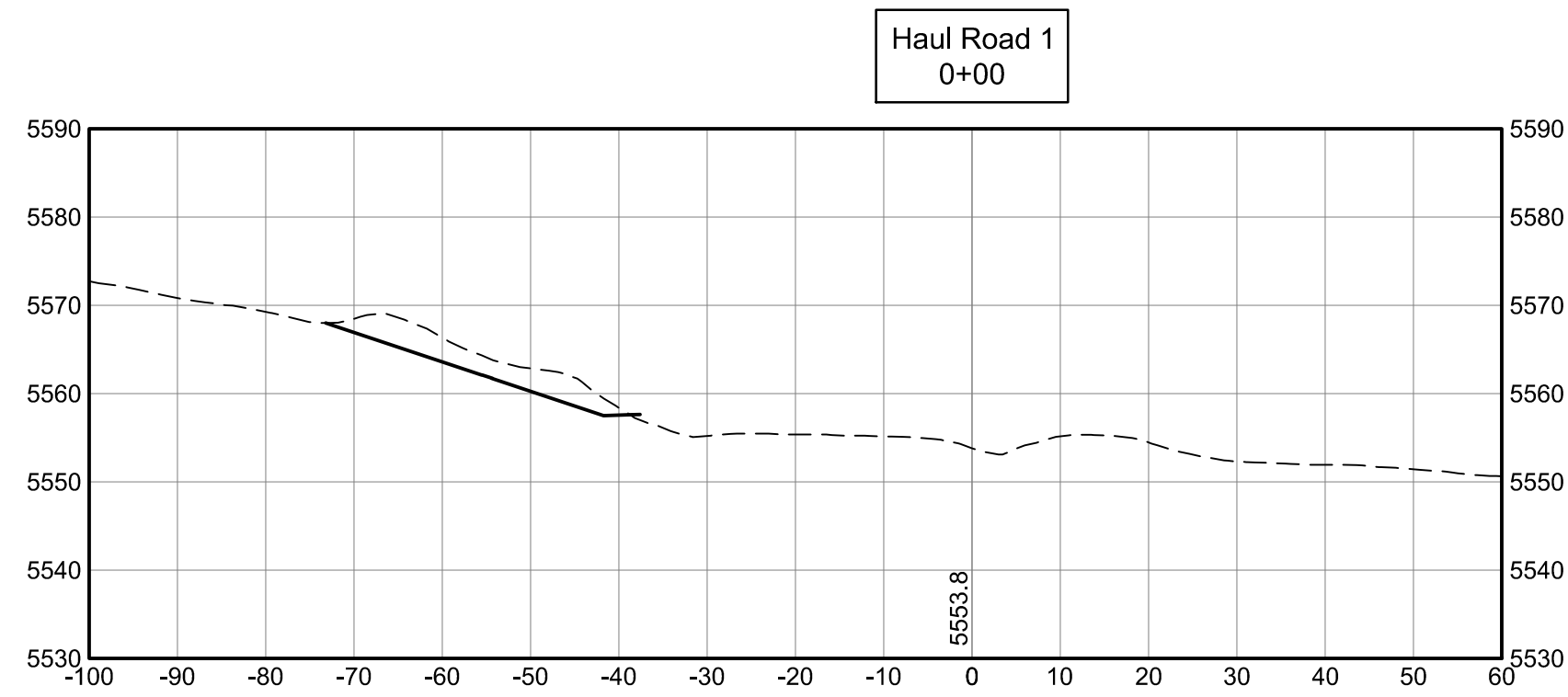
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Checked	JDG
Designed	ATD
Approved	JDG

TINTIC CONSOLIDATED METALS LLC.
 EUREKA, UTAH

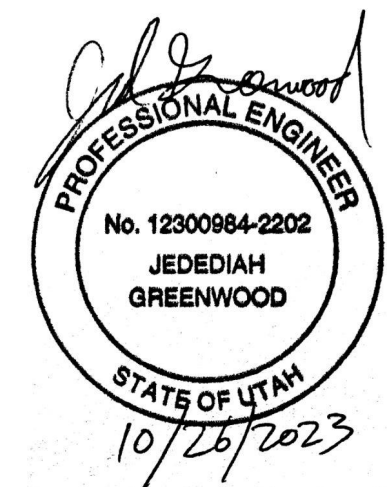
**TINTIC MINE EXPANSION
 DRY STACK TAILINGS STORAGE FACILITY**
 HAUL ROAD 1
 PLAN AND PROFILE

BARR PROJECT No.	44251029.01
CLIENT PROJECT No.	
DWG. No.	C-502
REV. No.	A

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ISSUE FOR CONSTRUCTION

NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION

CLIENT	PERMIT	BID	CONSTRUCTION	RECORD	RELEASED TO/FOR	A	B	C	0	1	2	3
	06/09/23											

BARR
 Project Office:
 BARR ENGINEERING CO.
 4300 MARKETPOINTE DRIVE
 SUITE 200
 MINNEAPOLIS, MN 55435
 Corporate Headquarters:
 Minneapolis, Minnesota
 Ph: 1-800-632-2277
 Ph: 1-800-632-2277
 www.barr.com

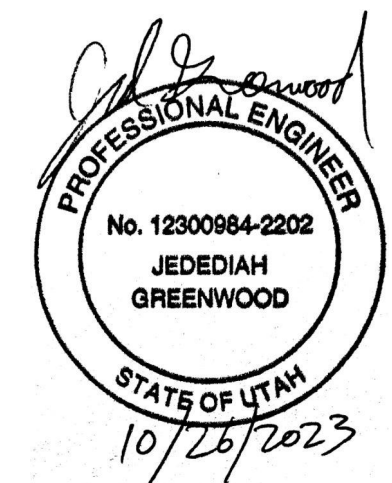
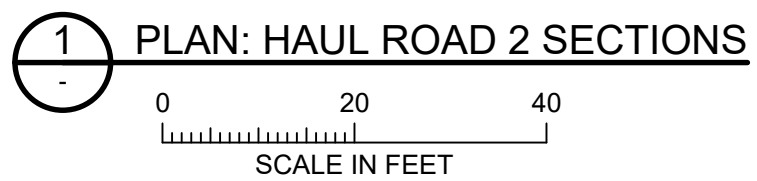
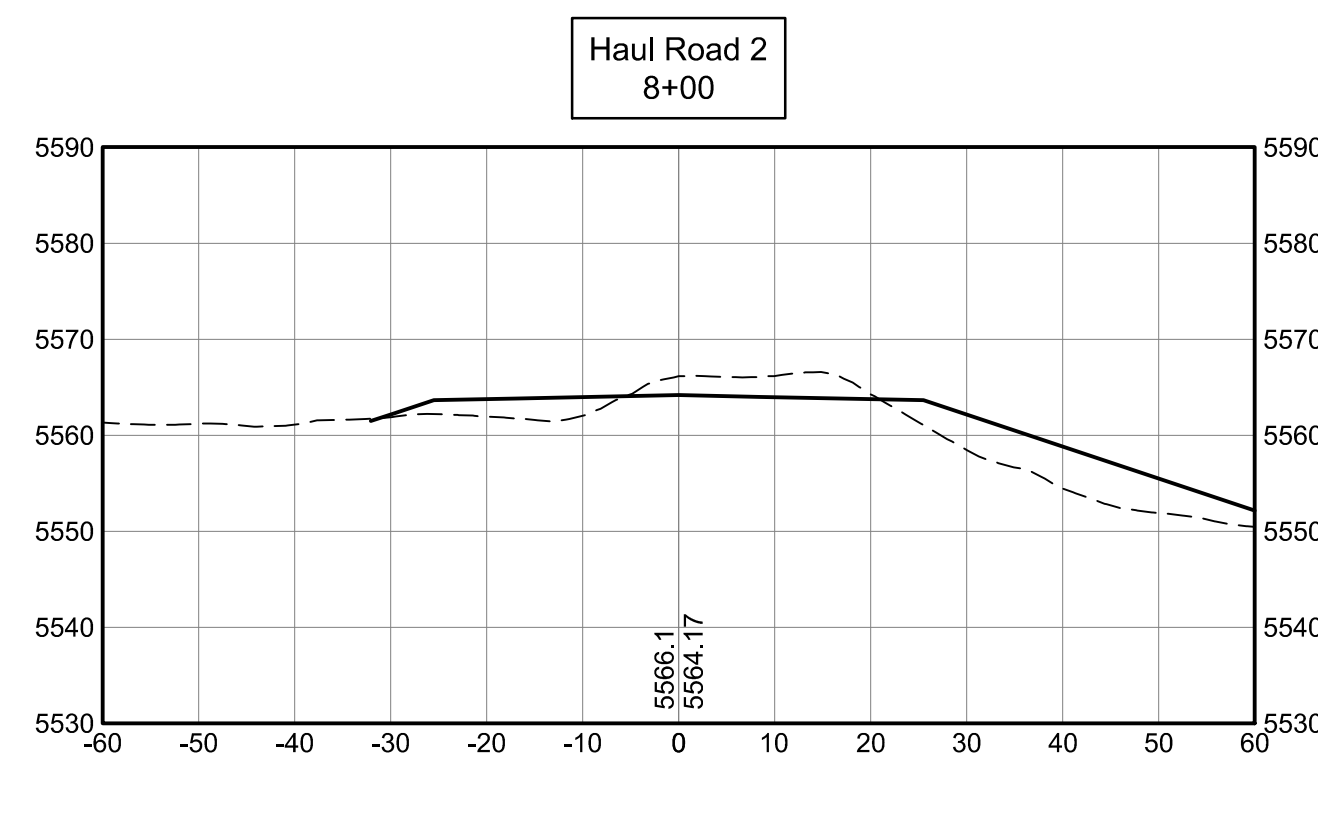
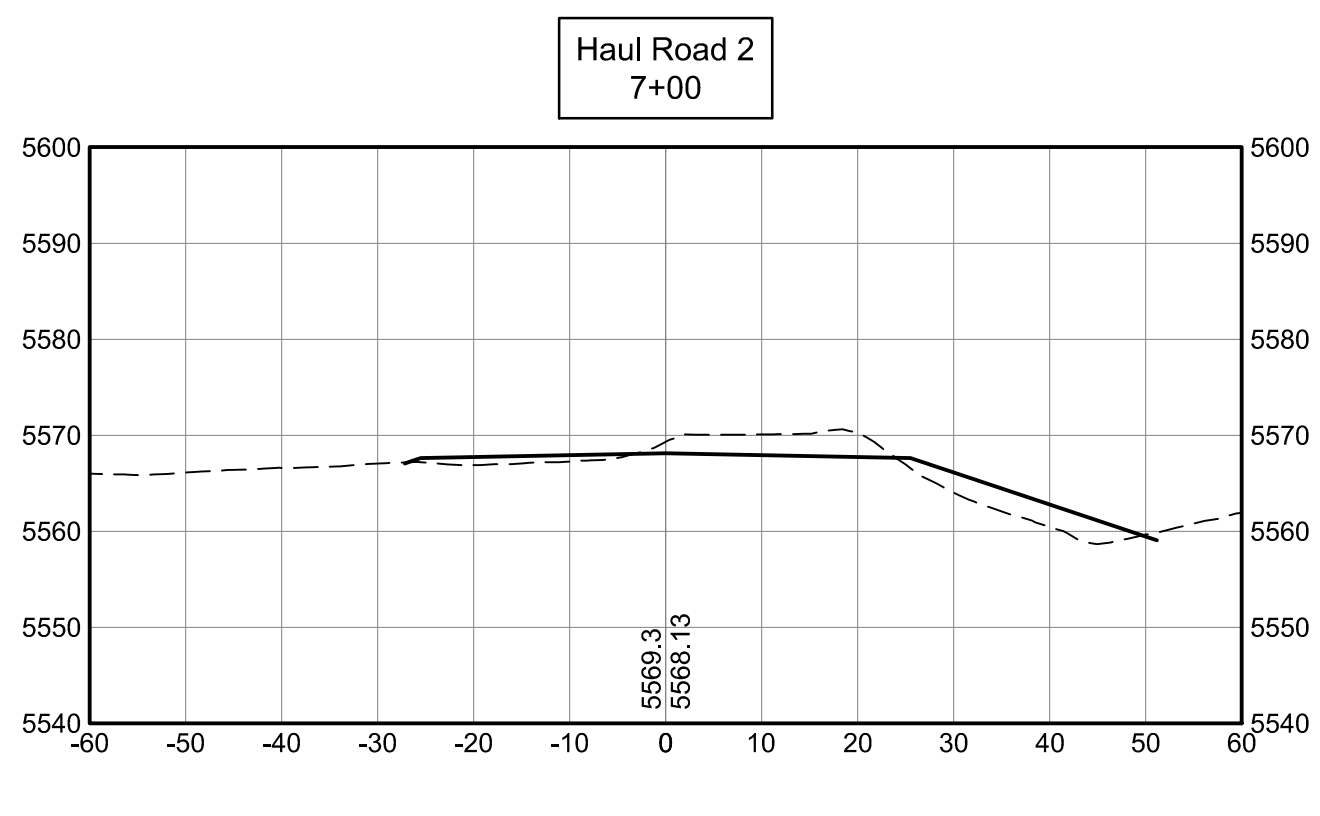
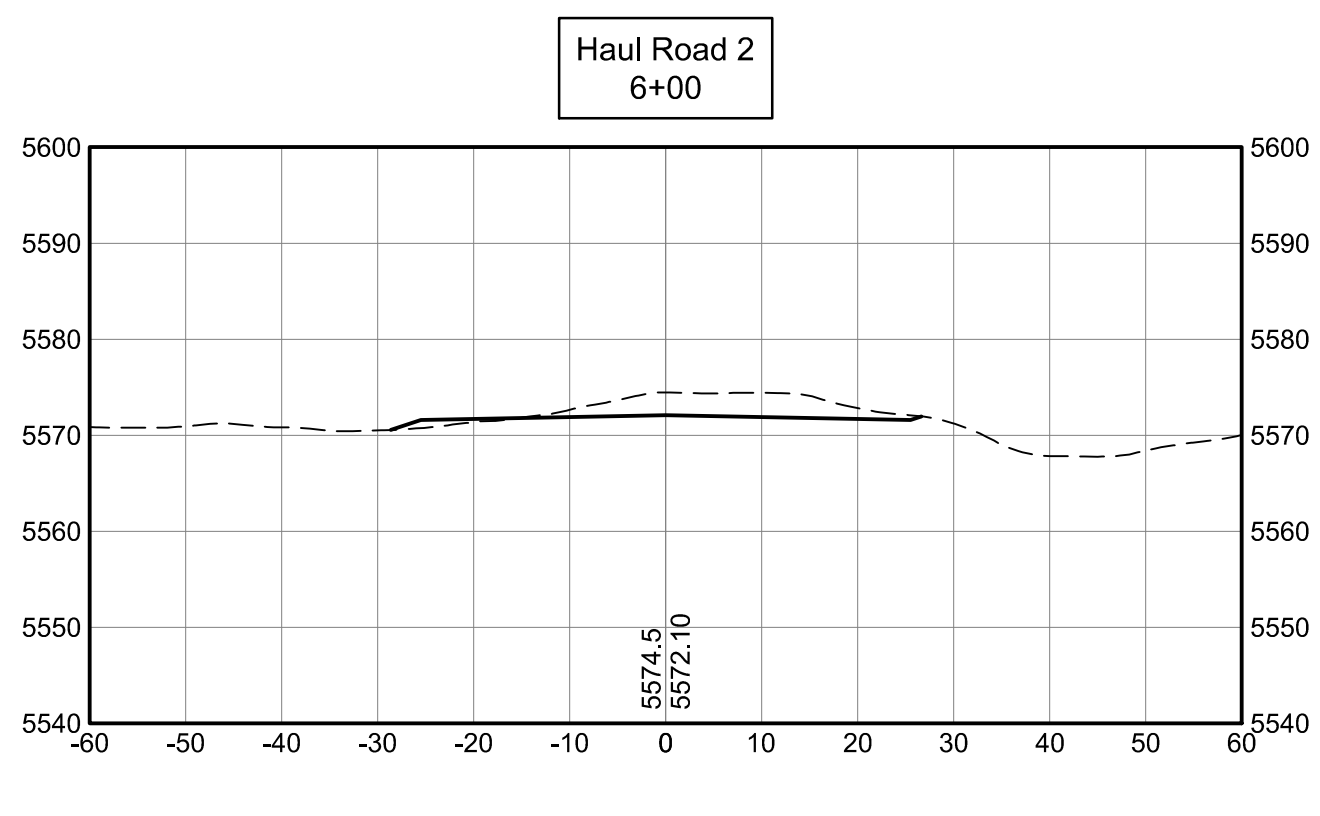
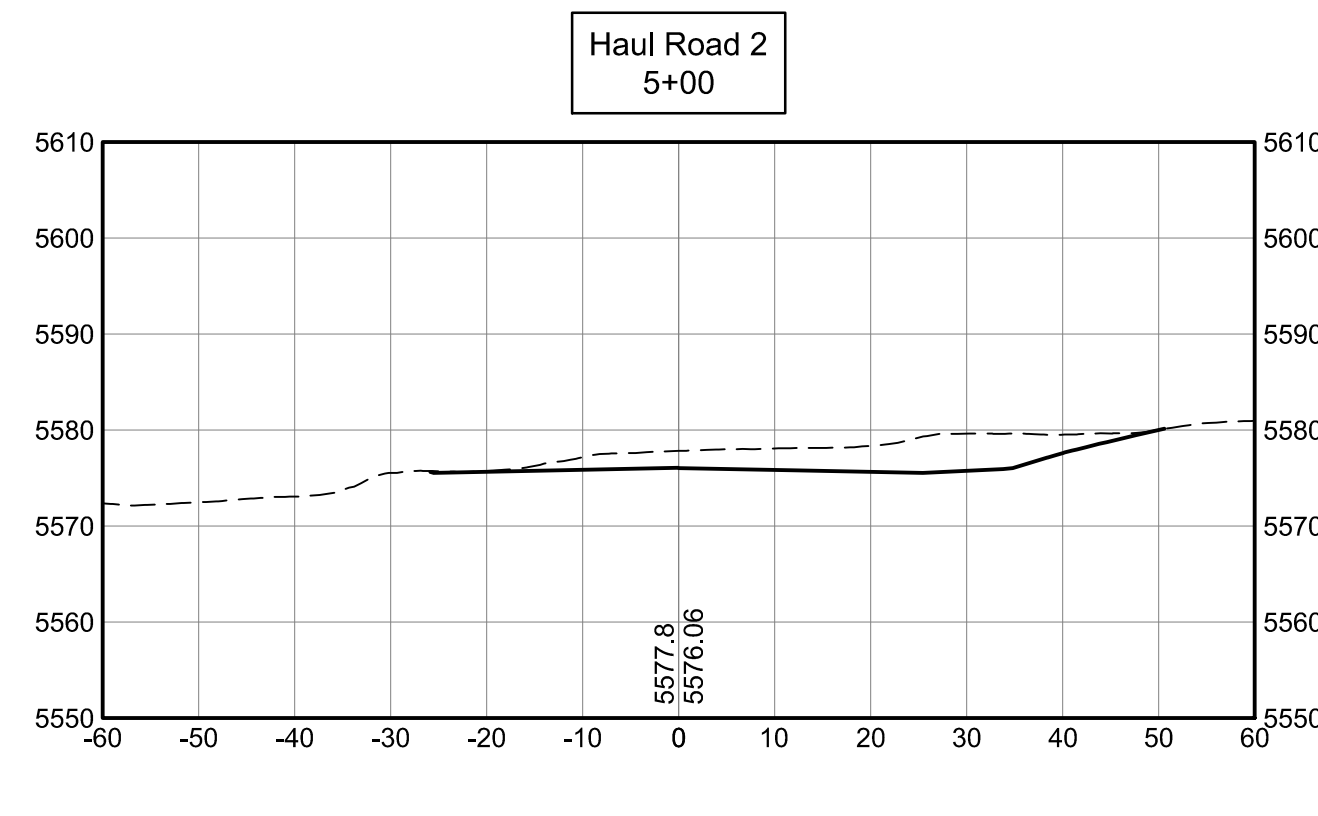
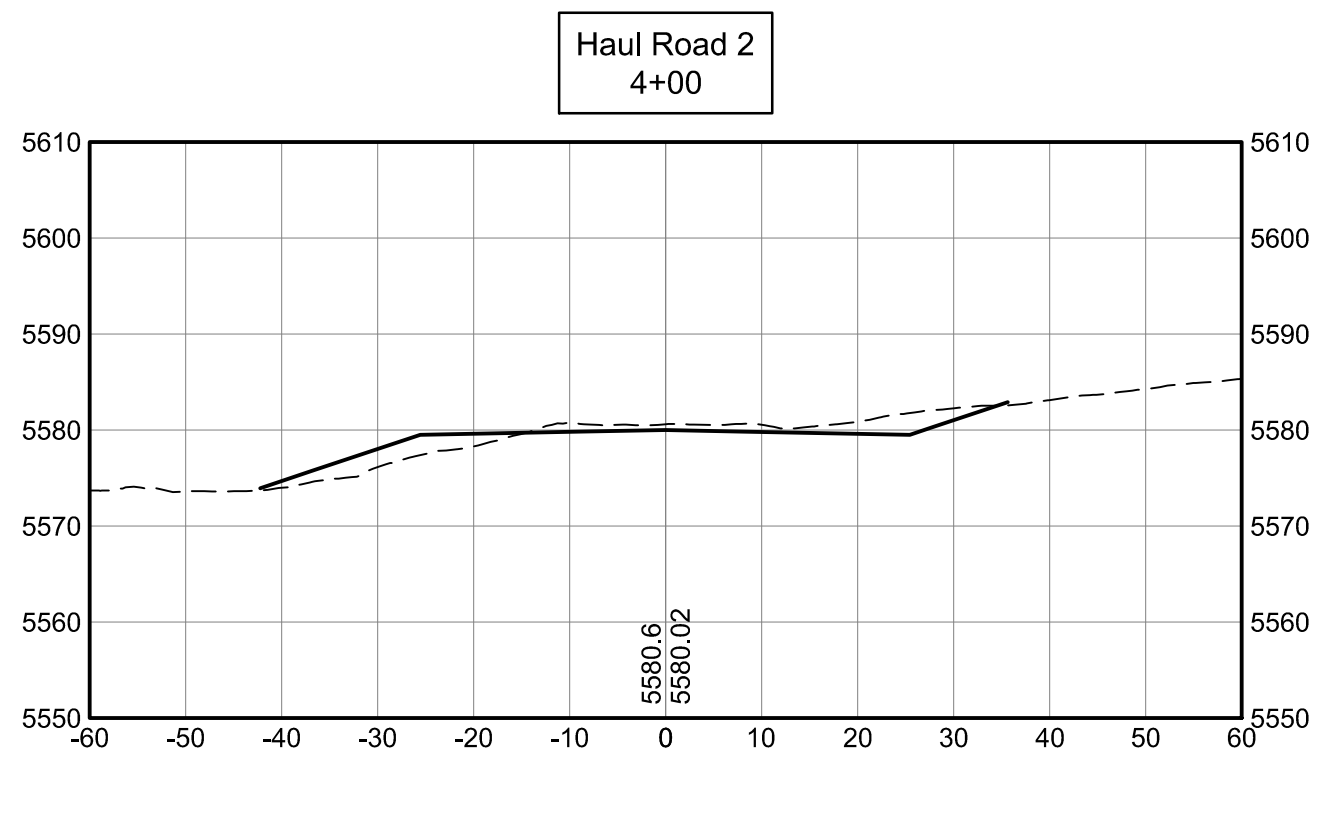
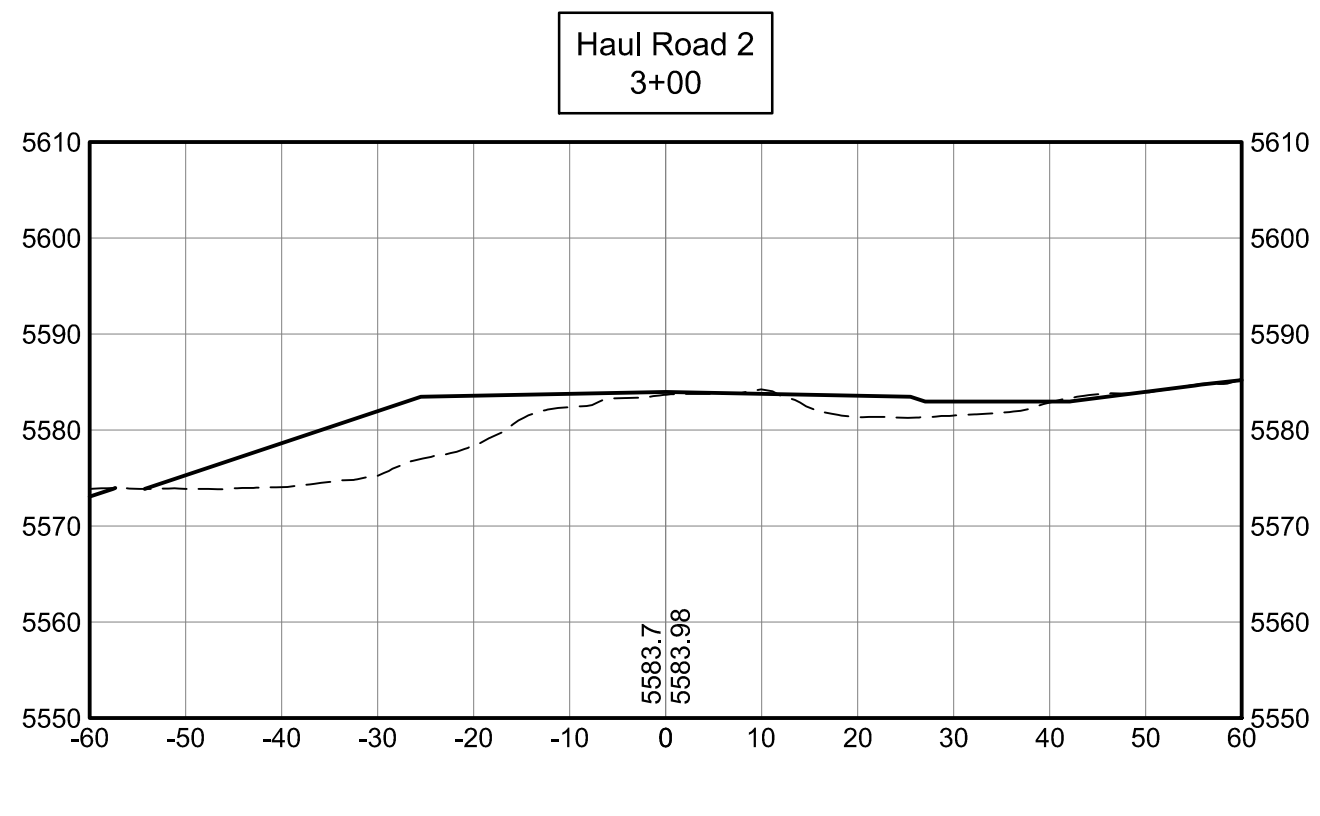
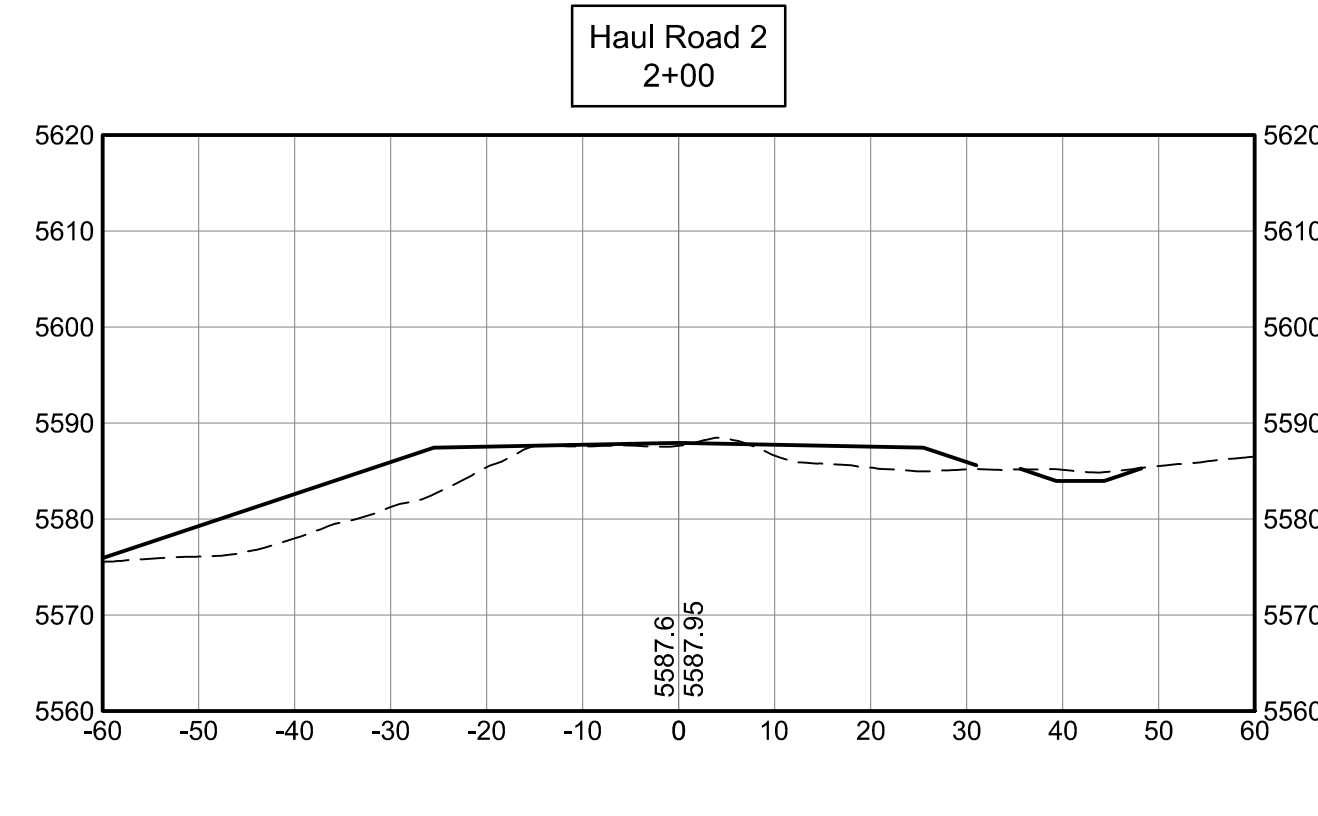
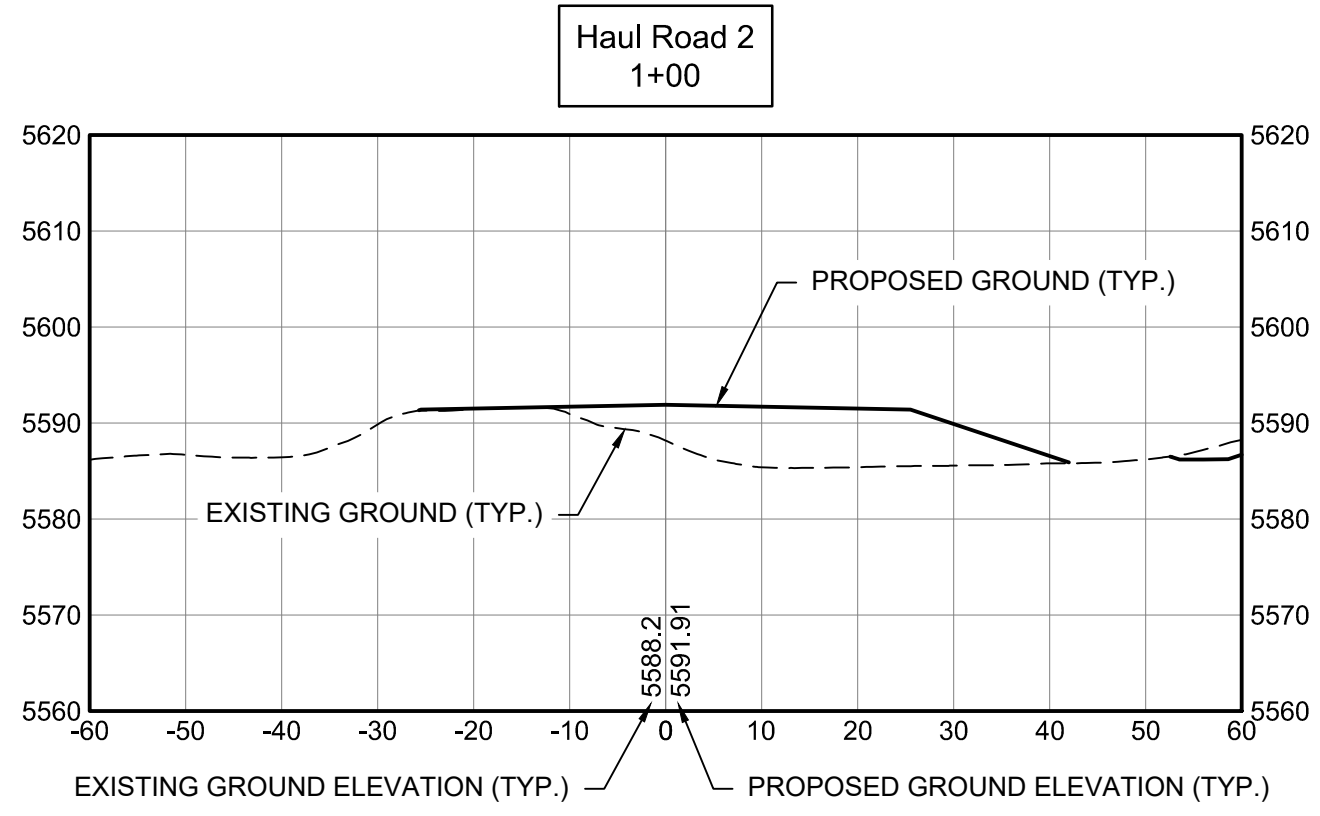
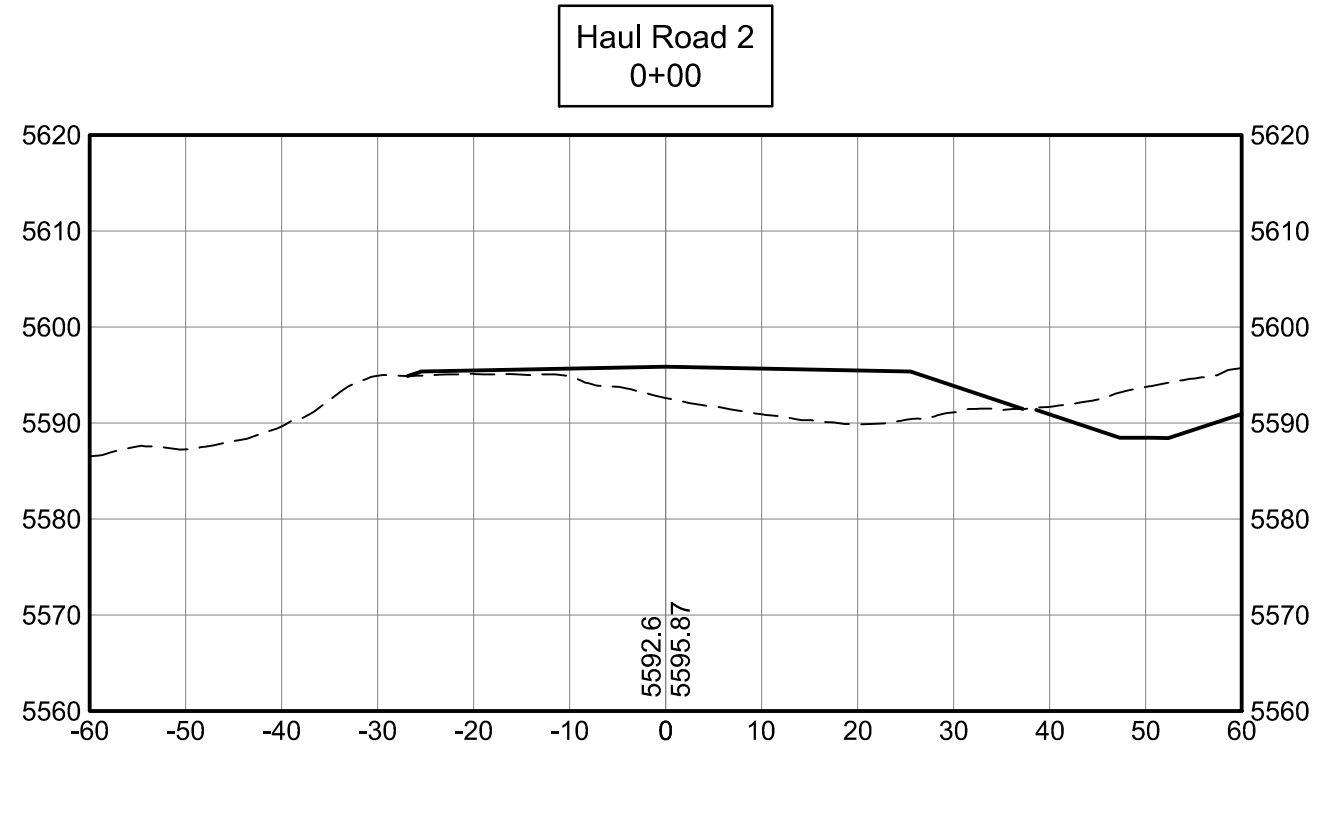
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Drawn	AJB2
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Approved	JDG

TINTIC CONSOLIDATED METALS LLC.
 EUREKA, UTAH

**TINTIC MINE EXPANSION
 DRY STACK TAILINGS STORAGE FACILITY**
 HAUL ROAD 1
 SECTIONS

BARR PROJECT No. 44251029.01	
CLIENT PROJECT No.	
DWG. No. C-503	REV. No. A

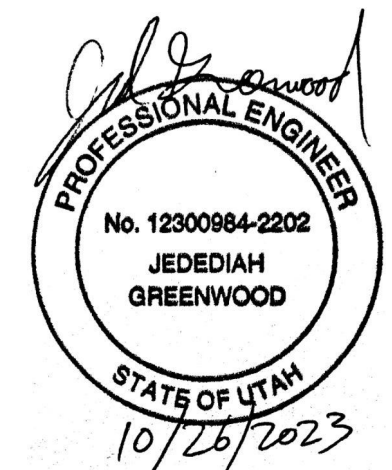
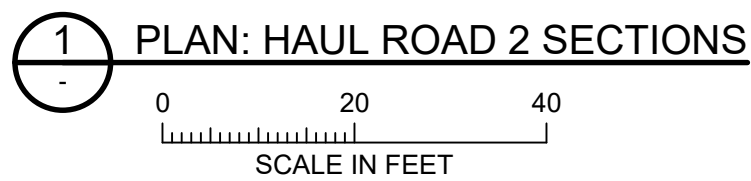
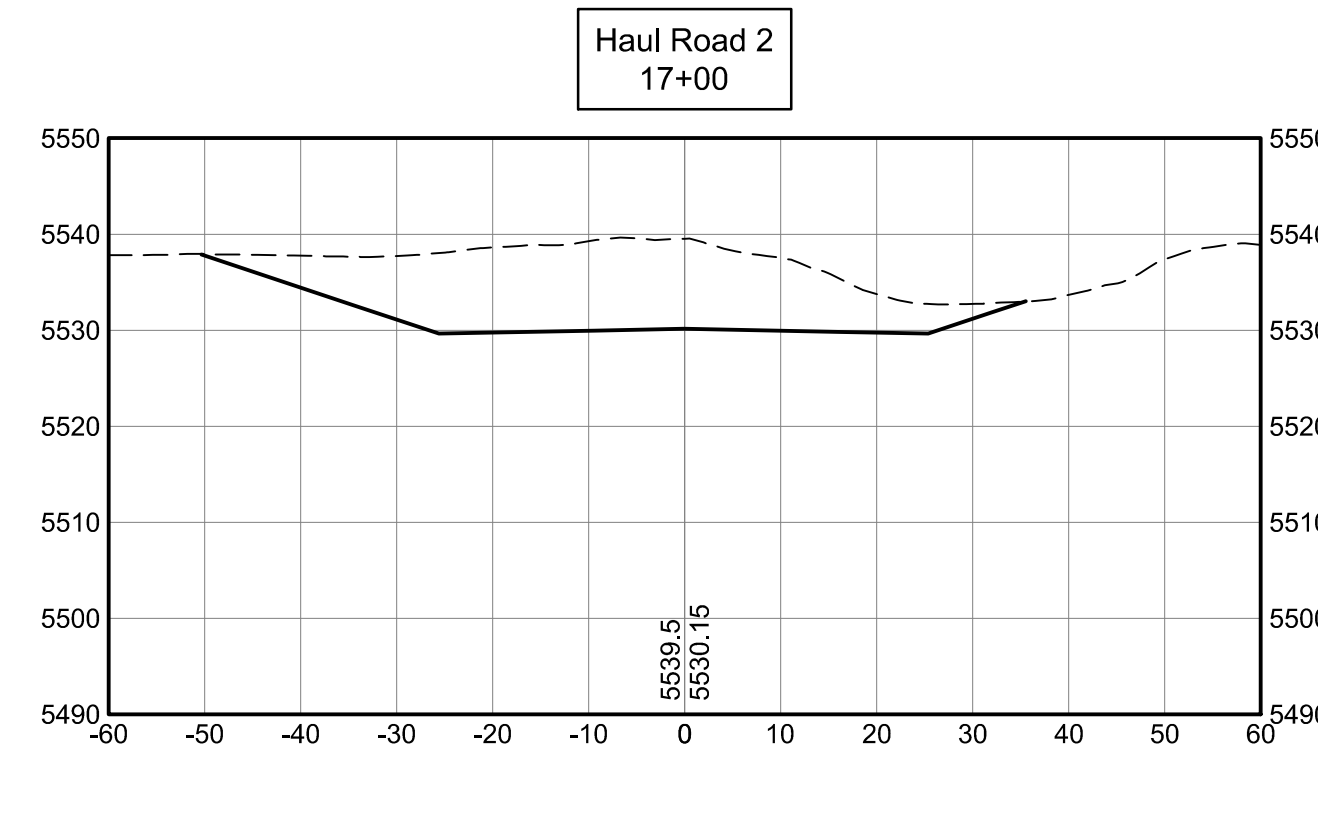
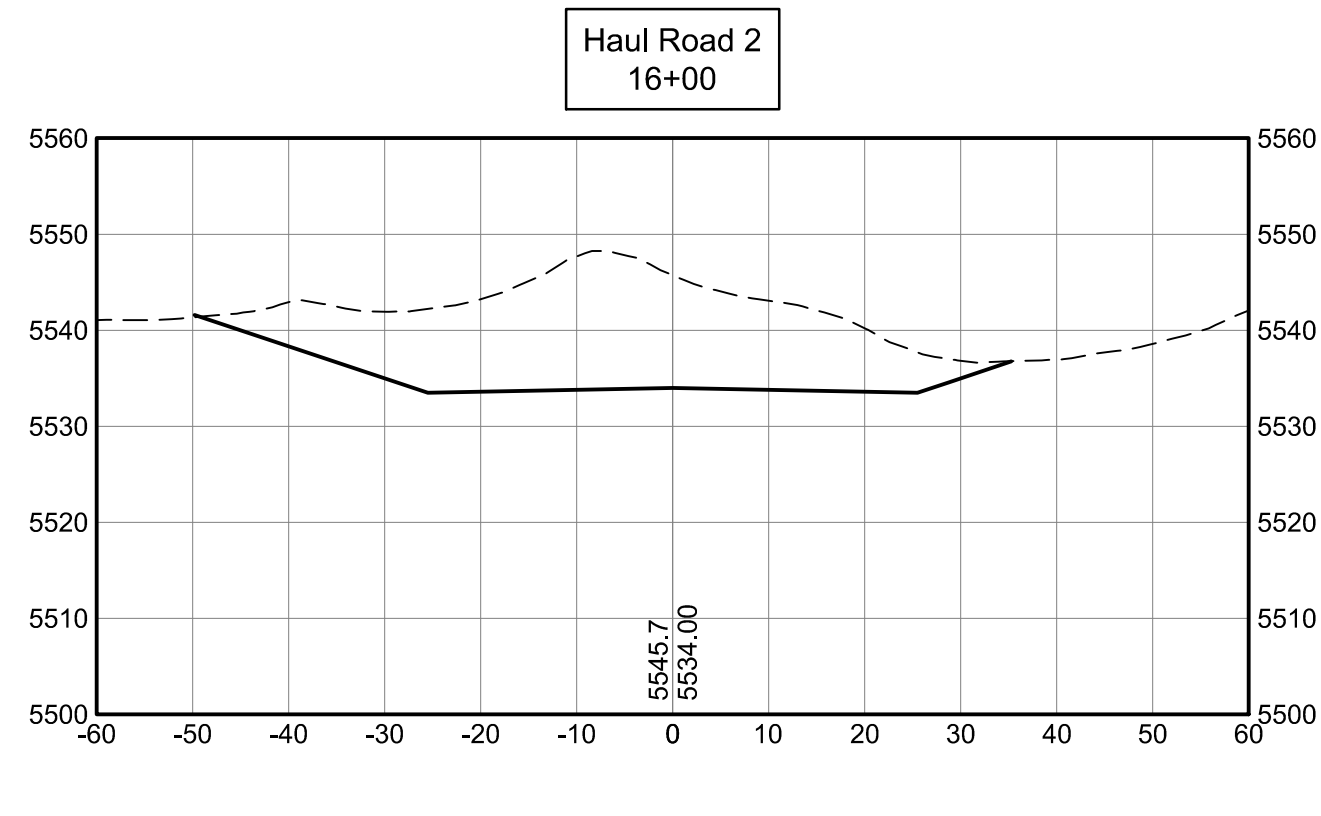
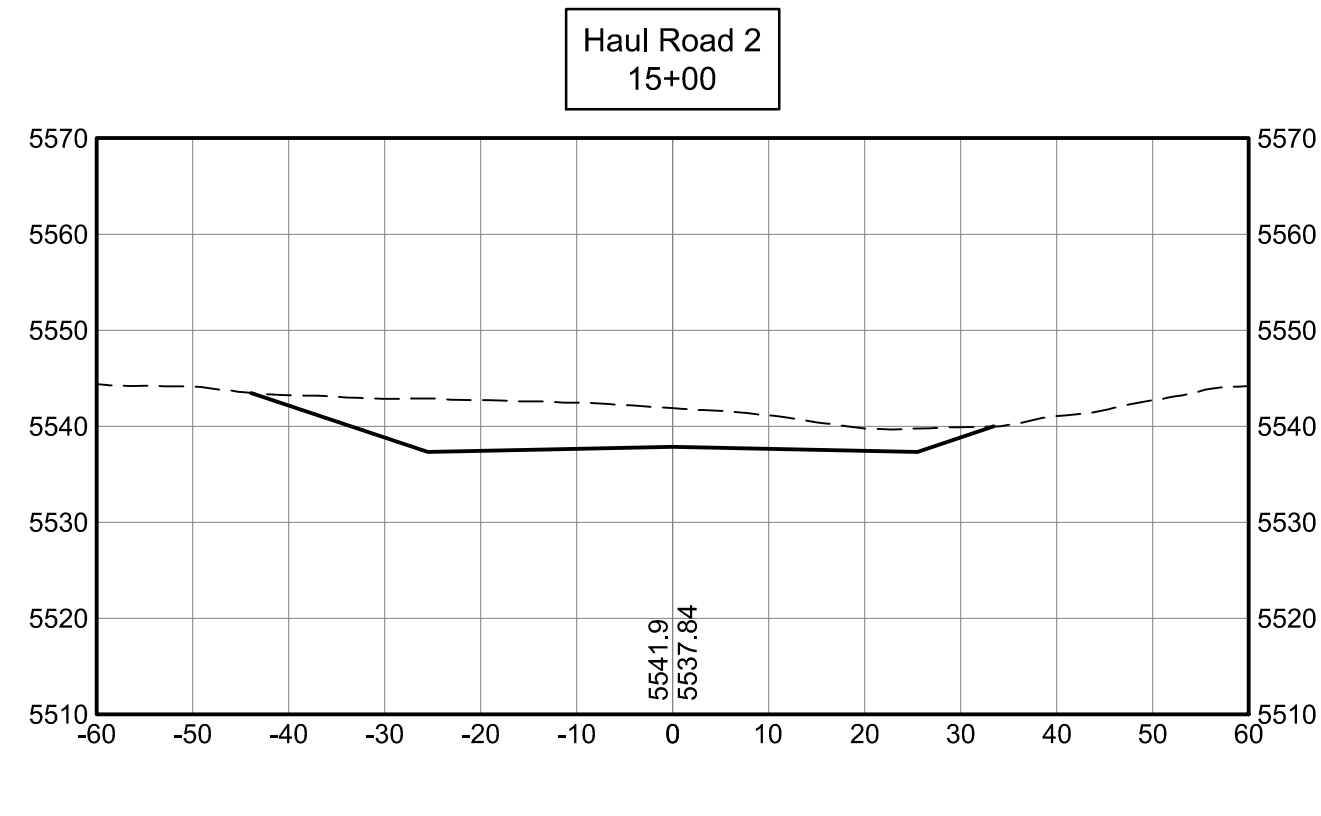
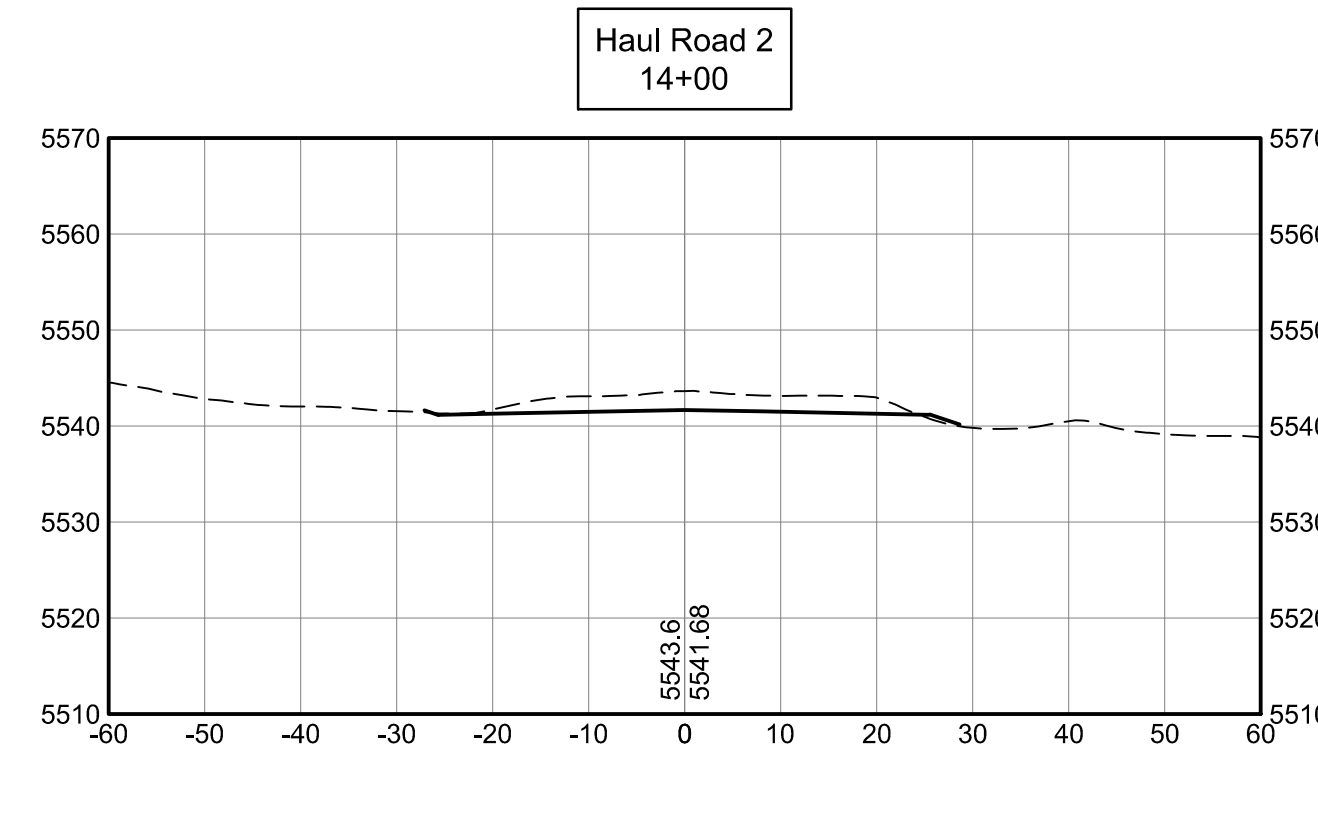
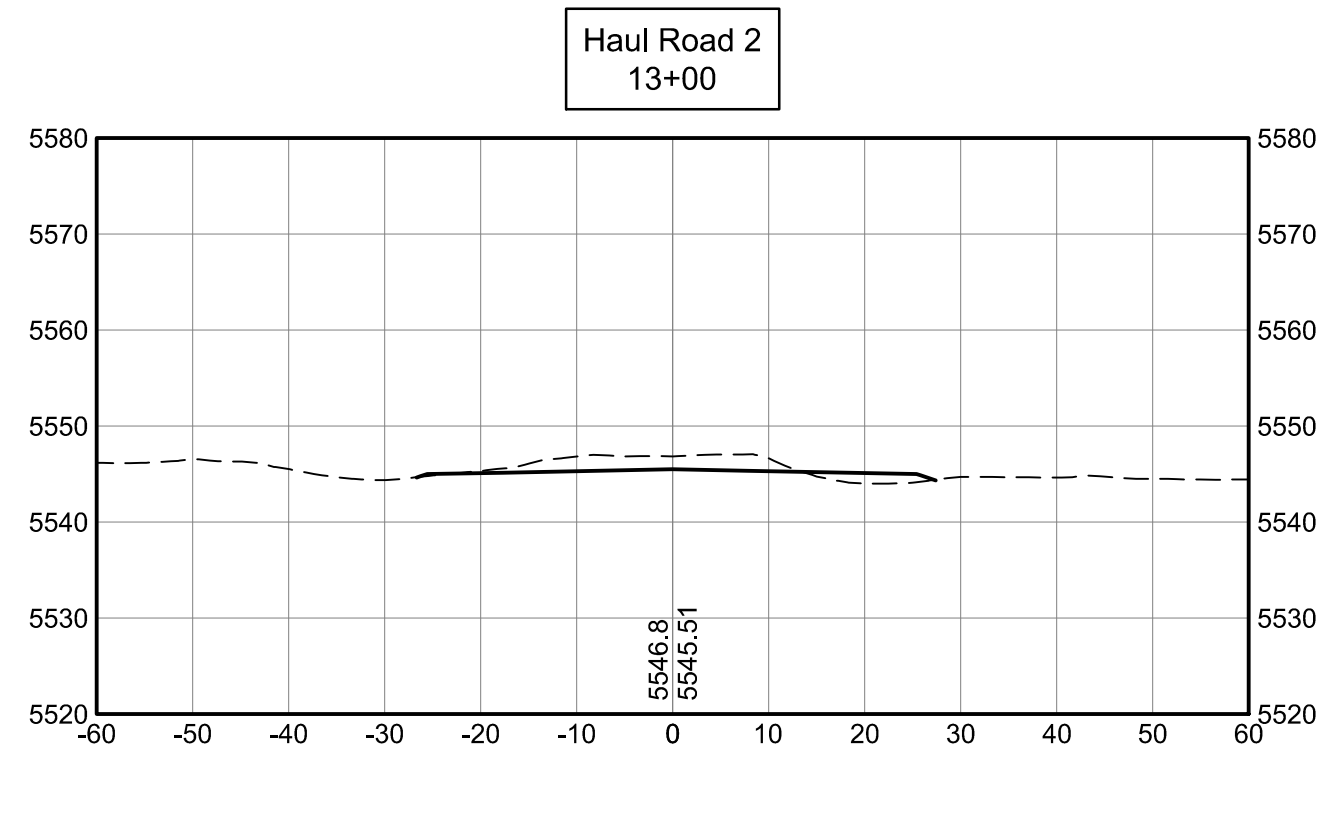
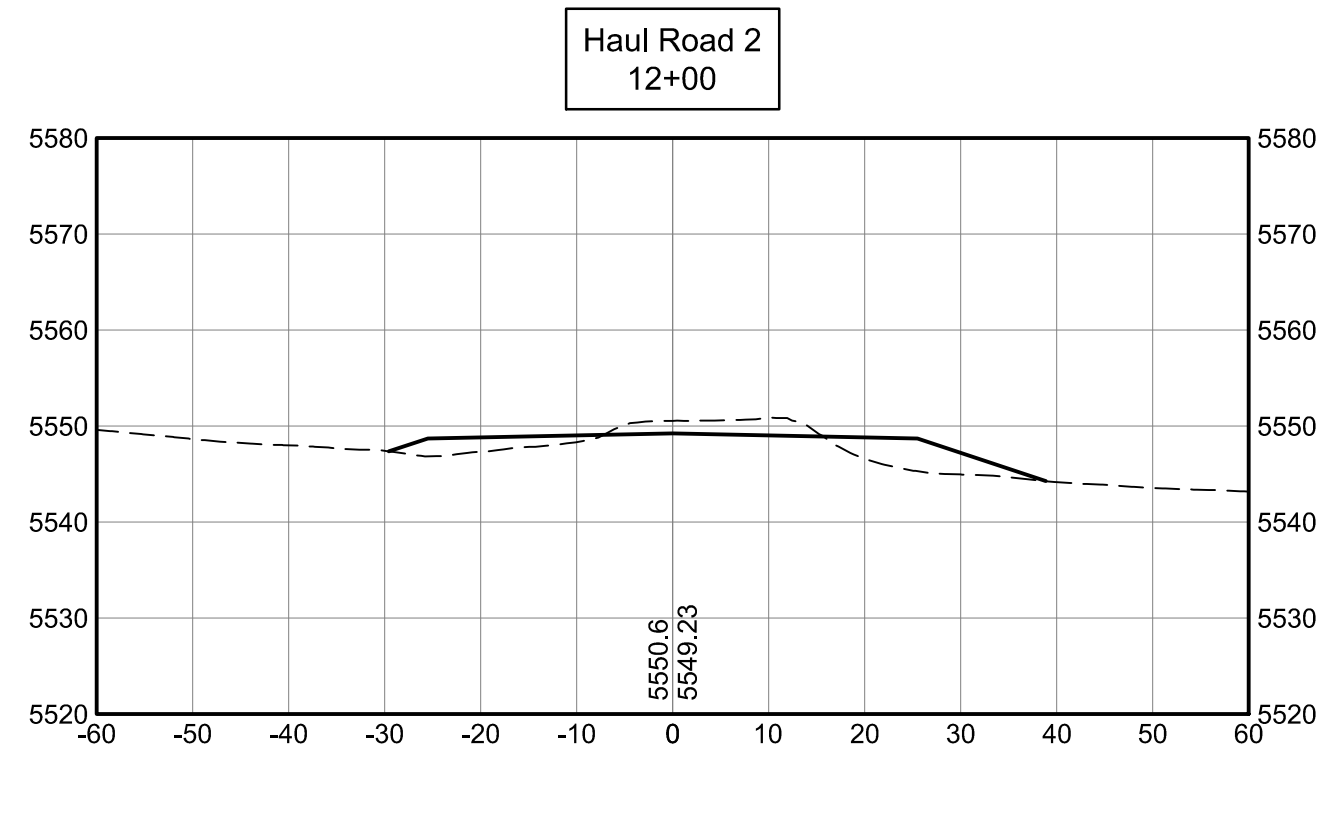
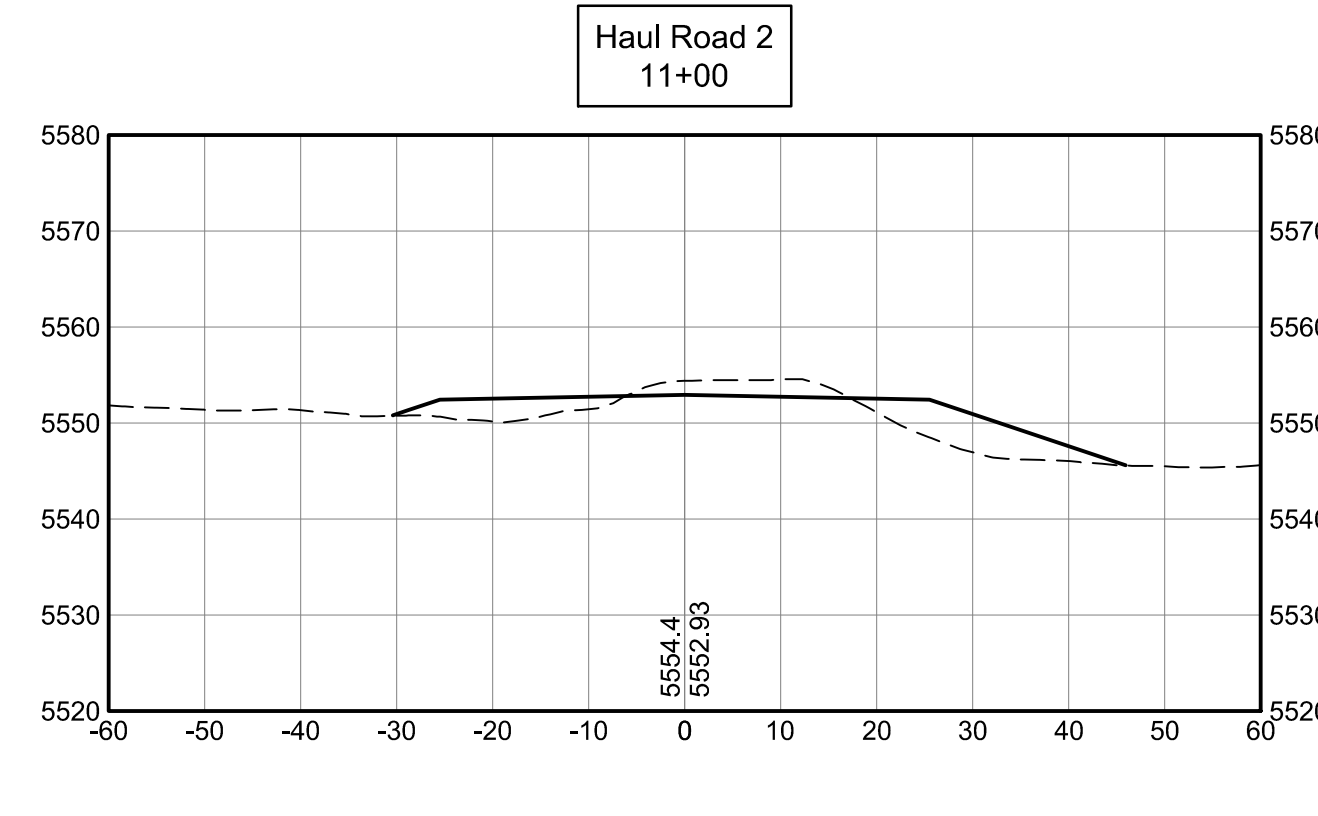
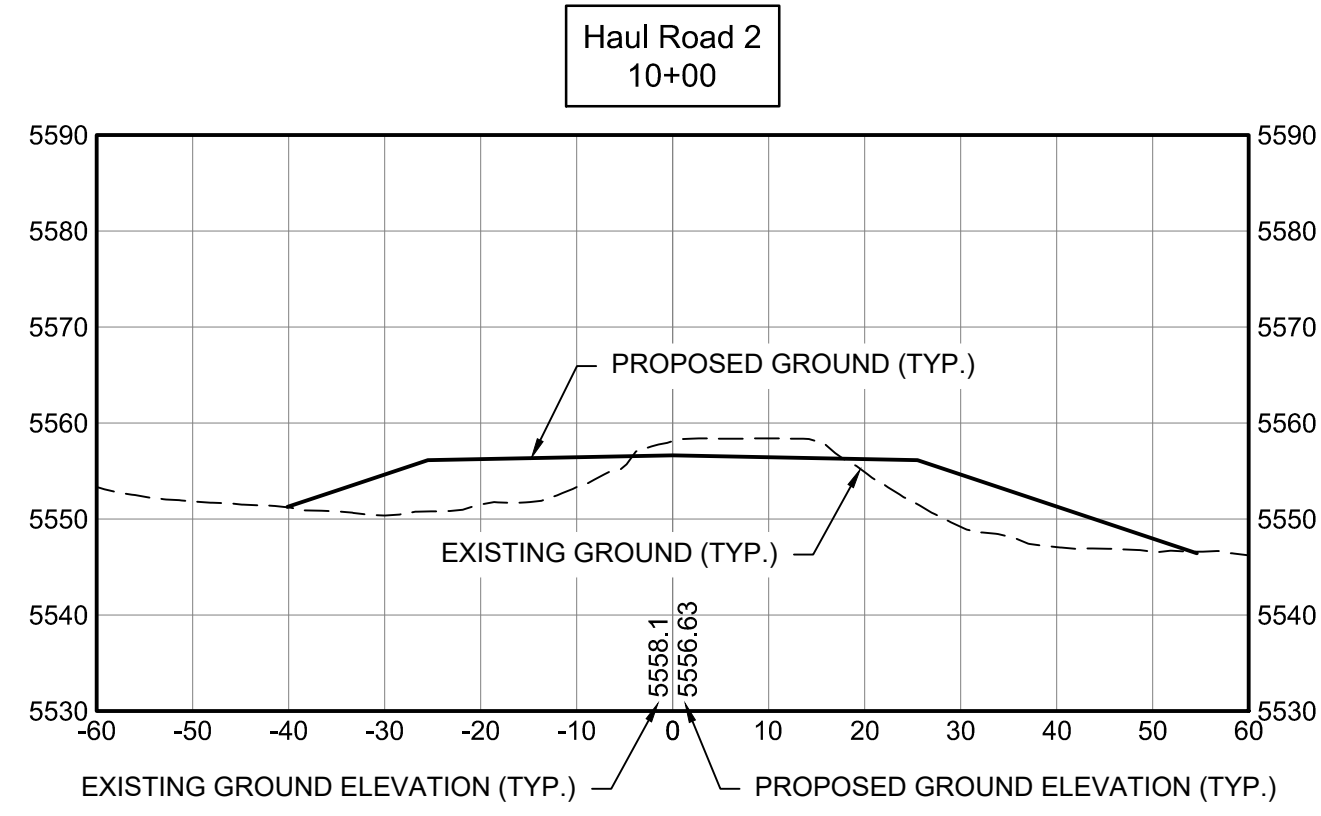
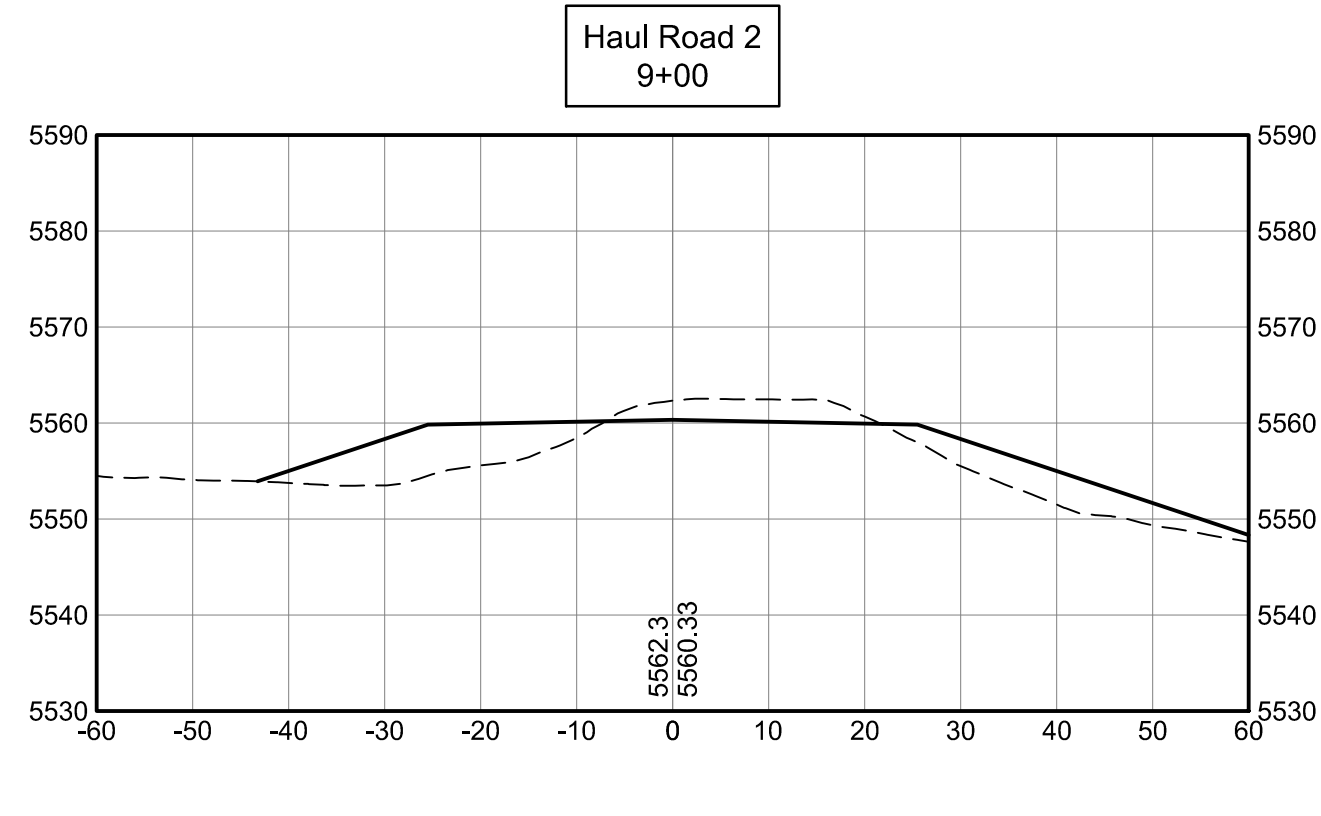
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				RELEASED TO/FOR	A	B	C	0	1	2	3	Corporate Headquarters:							
				DATE RELEASED								Minneapolis, Minnesota							
												Ph: 1-800-632-2277							
												Ph: (952) 832-2601							
												Ph: 1-800-632-2277							
												www.barr.com							
NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION														

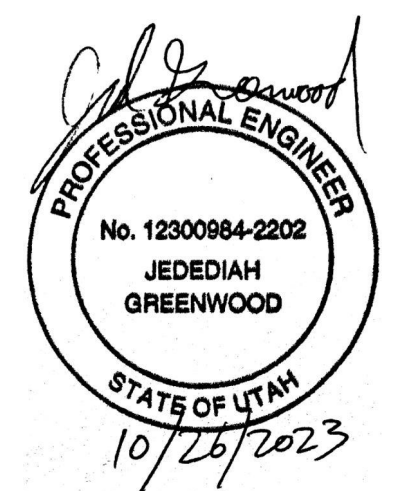
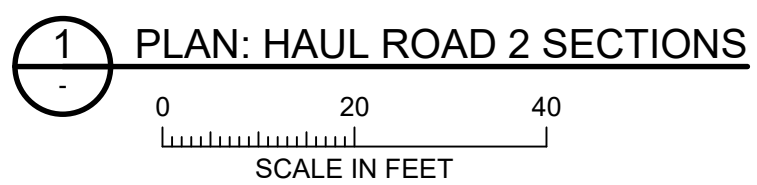
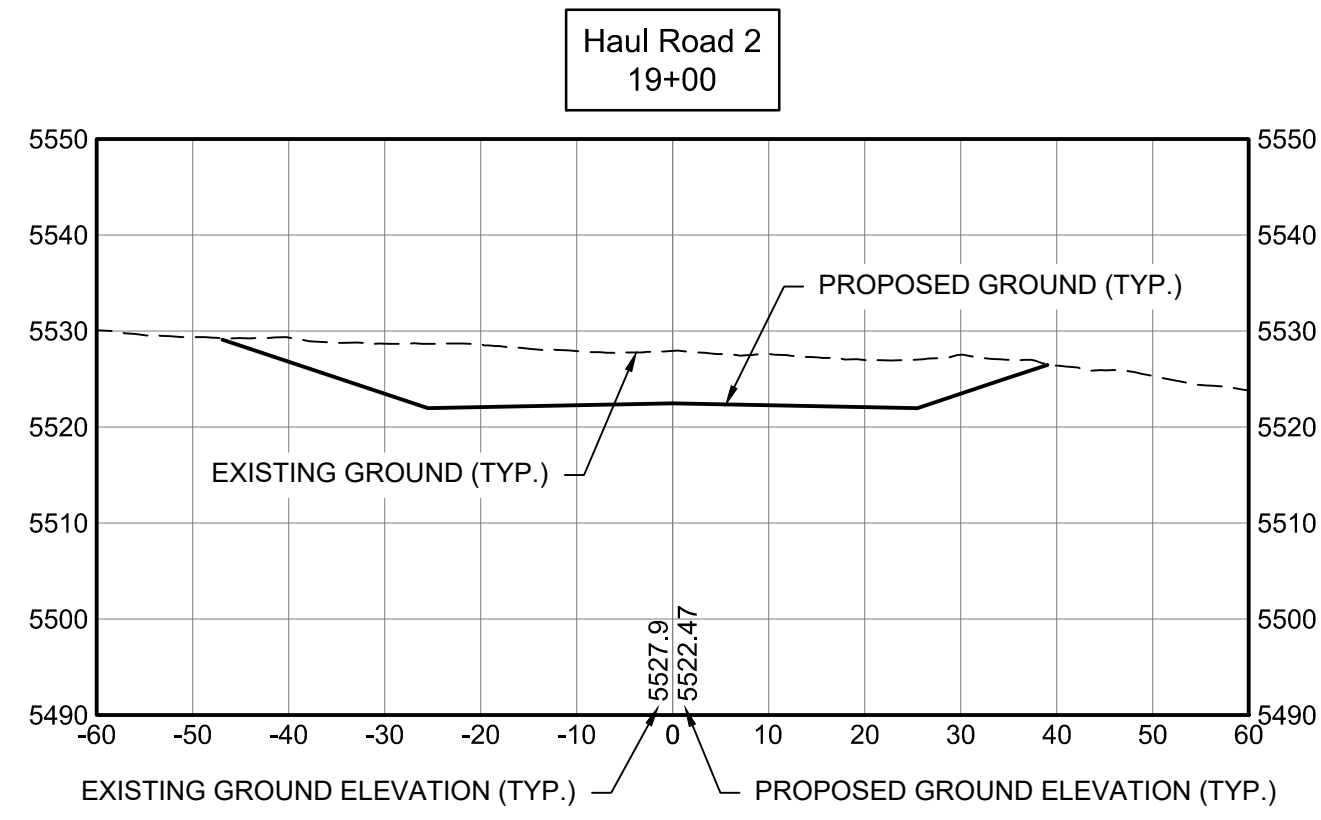
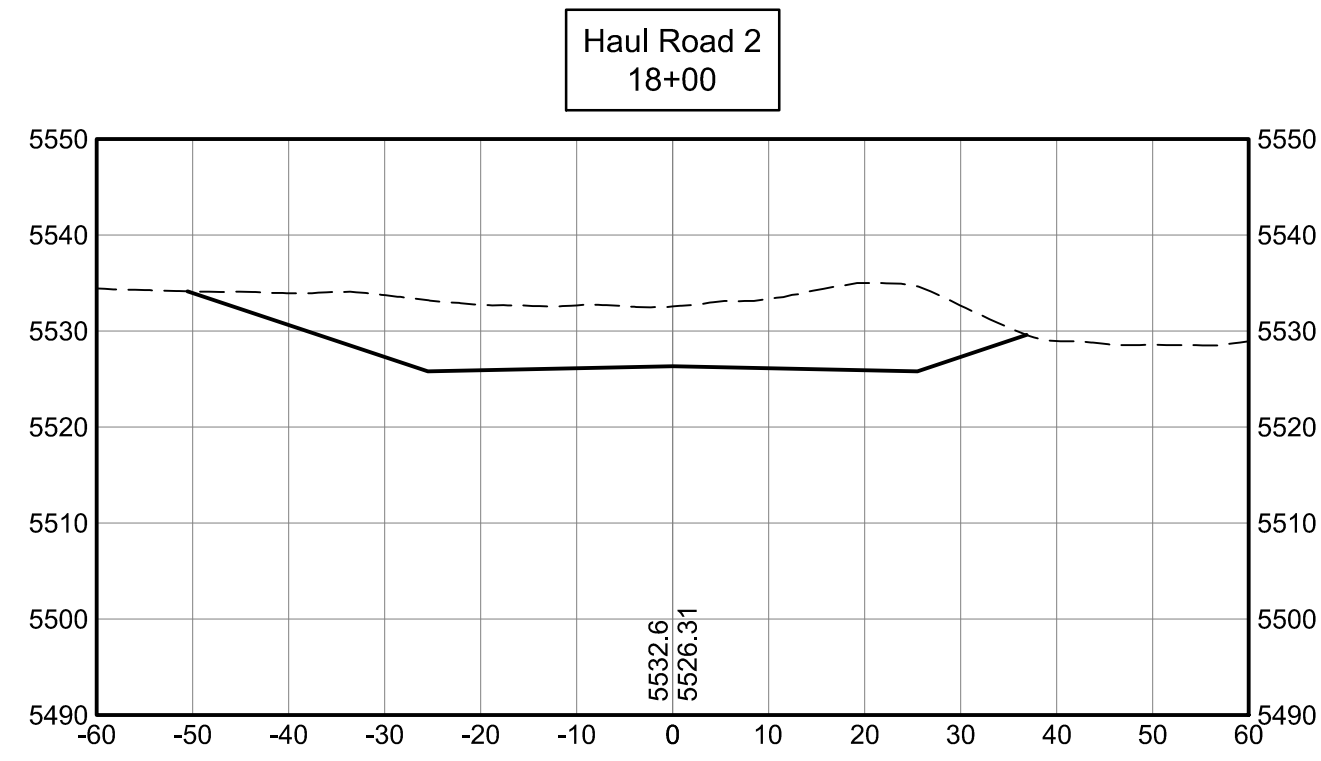
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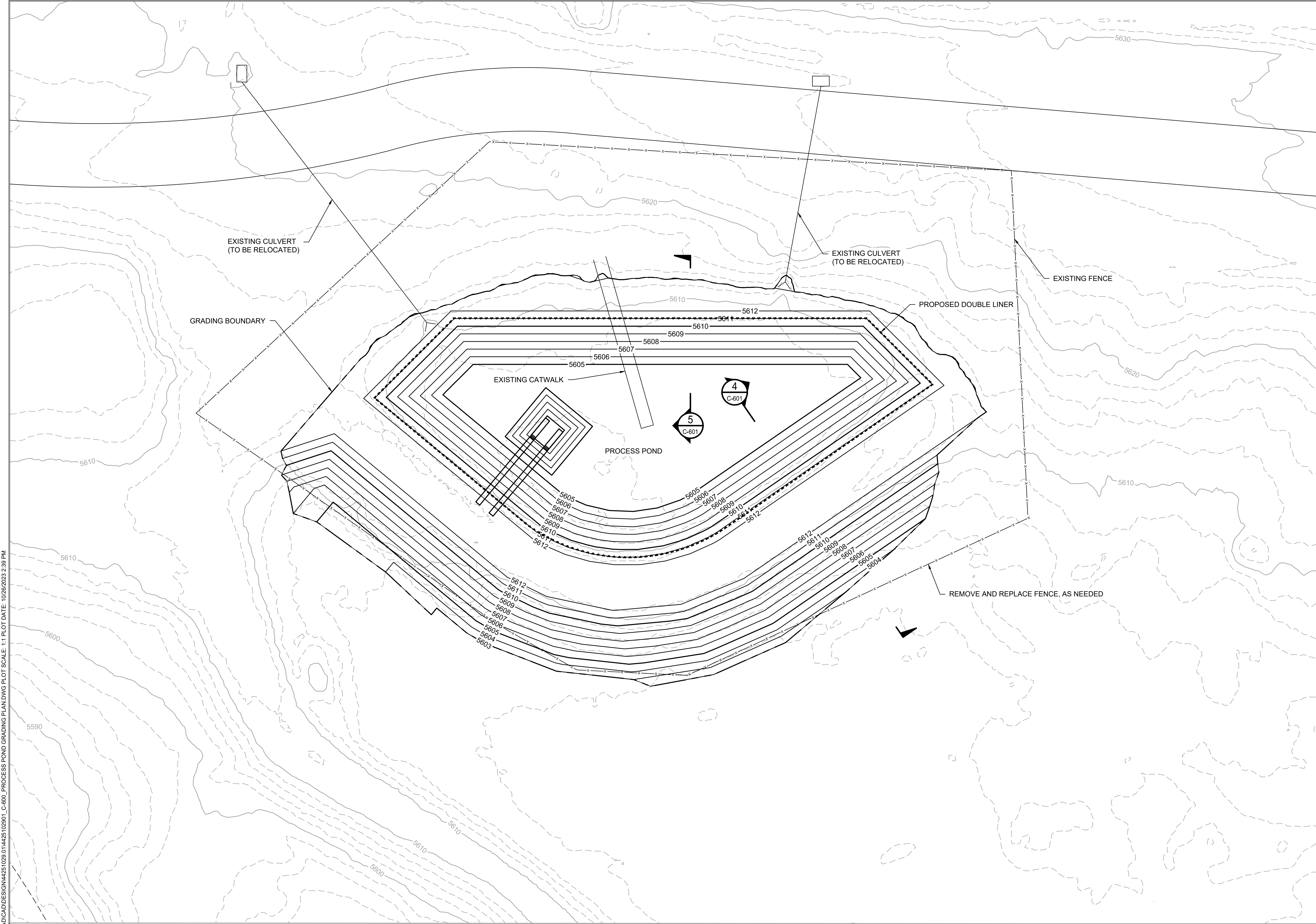
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												Ph: (952) 832-2601		JDG		A		
												www.barr.com						

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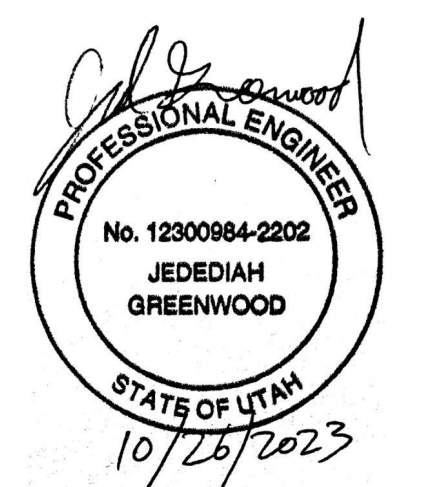


LEGEND

	1380	EXISTING MAJOR CONTOUR
		EXISTING MINOR CONTOUR
	1380	PROPOSED MAJOR CONTOUR
		PROPOSED MINOR CONTOUR
		EXISTING OVERHEAD ELECTRIC
		EXISTING EDGE OF PAVED ROAD
		EXISTING EDGE OF GRAVEL ROAD
		EXISTING FENCE
		PROPOSED DOUBLE LINER

1 PLAN: PROCESS POND GRADING PLAN

0 20 40
SCALE IN FEET



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NO.	BY	CHK	APP	DATE	REVISION DESCRIPTION

CLIENT									
PERMIT									
BID									
CONSTRUCTION									
RECORD									
RELEASED TO/FOR	A	B	C	0	1	2	3		

BARR Engineering

Project Office:
BARR ENGINEERING CO.
4300 MARKETPOINTE DRIVE
SUITE 200
MINNEAPOLIS, MN 55435

Corporate Headquarters:
Minneapolis, Minnesota
Ph: 1-800-632-2277
Ph: 1-800-632-2277
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Checked	JDG
Designed	ATD
Approved	JDG

TINTIC CONSOLIDATED METALS LLC.
EUREKA, UTAH

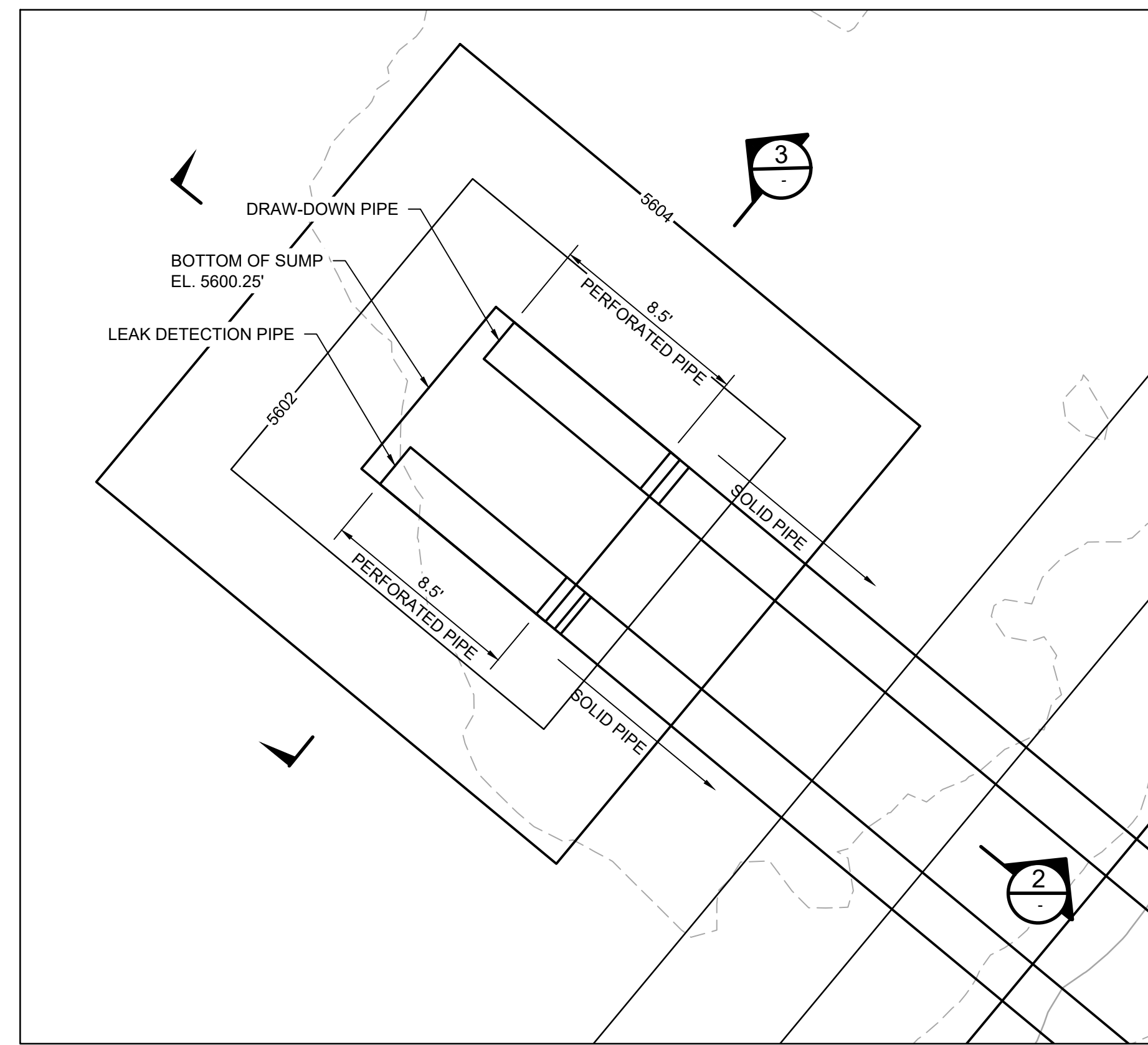
**TINTIC MINE EXPANSION
DRY STACK TAILINGS STORAGE FACILITY**

**PROCESS POND
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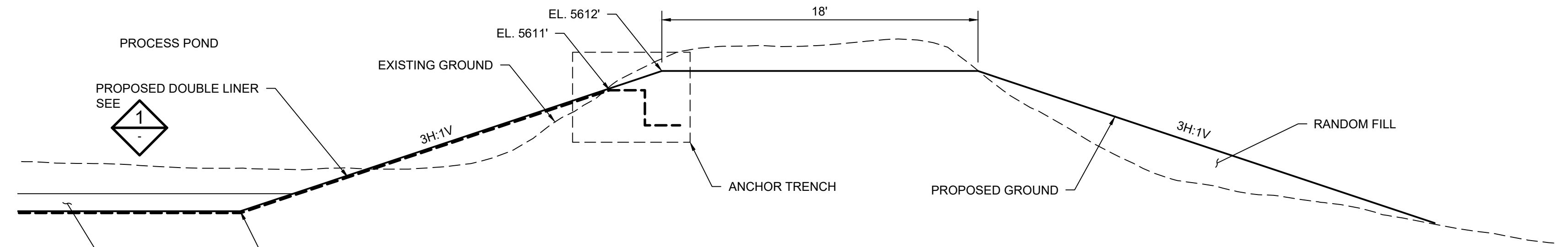
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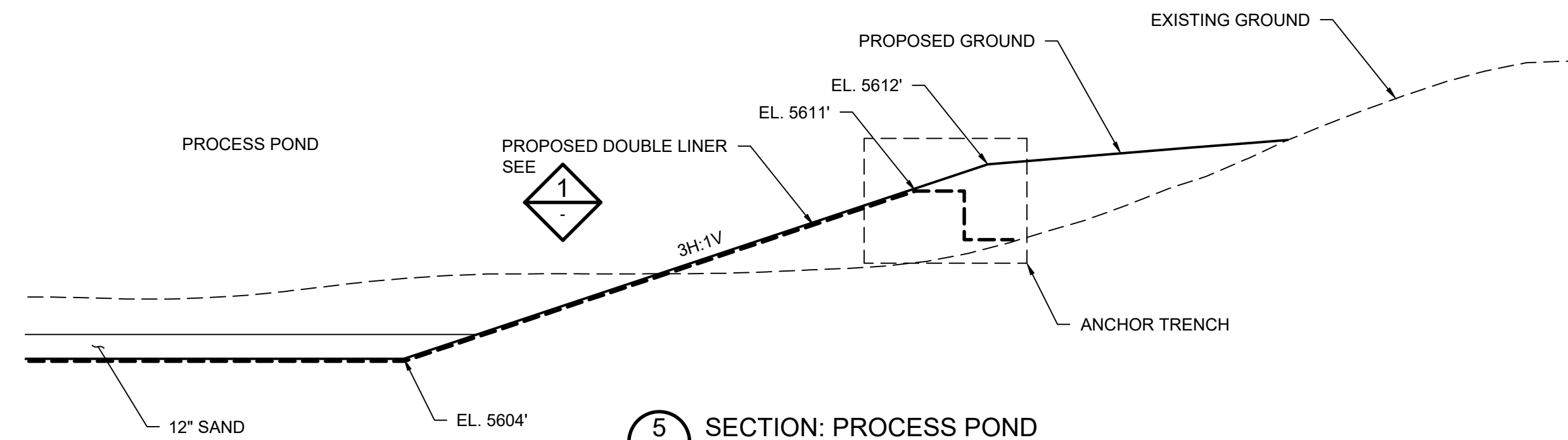
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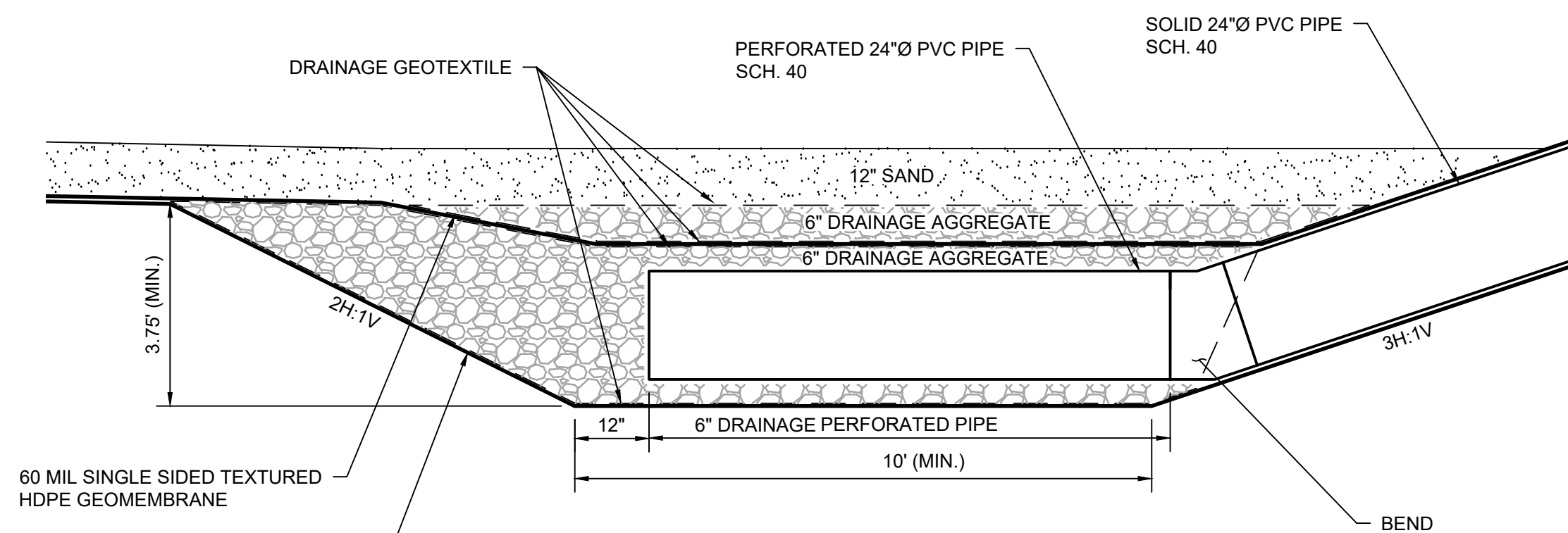
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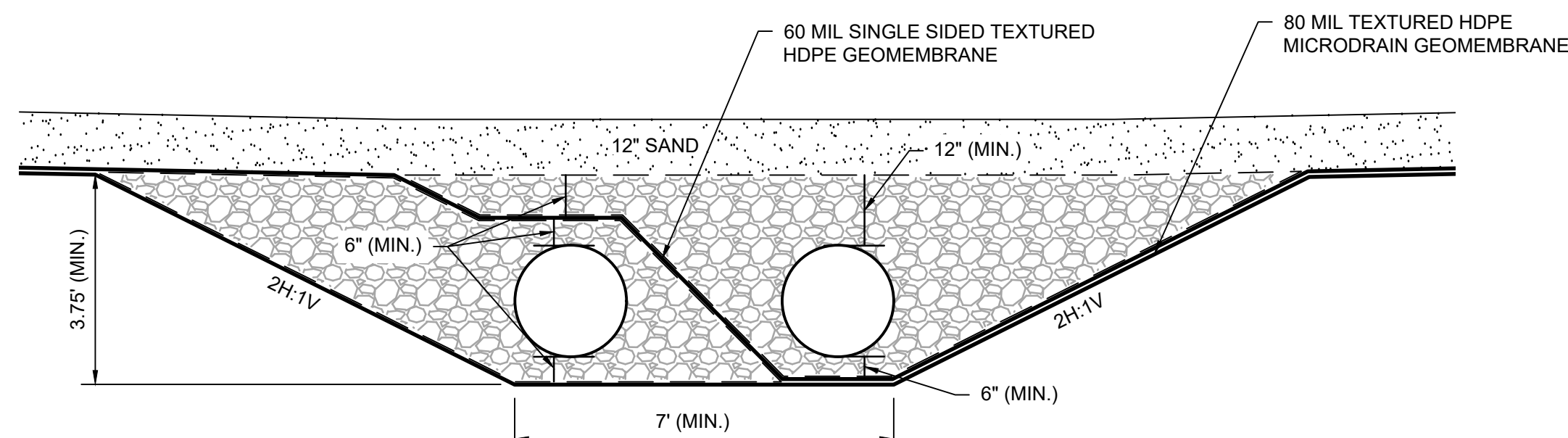
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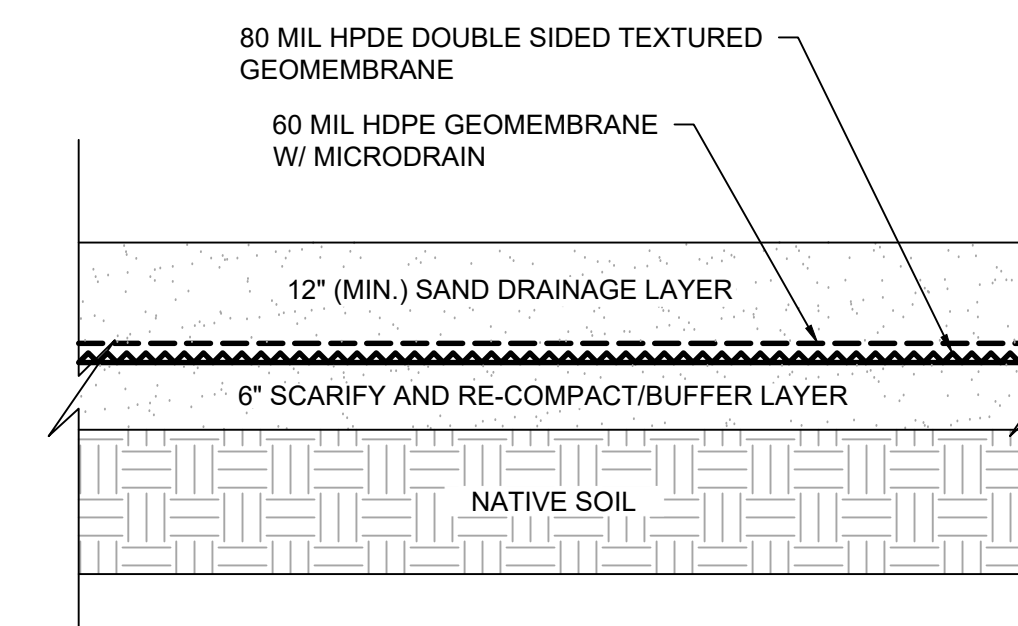
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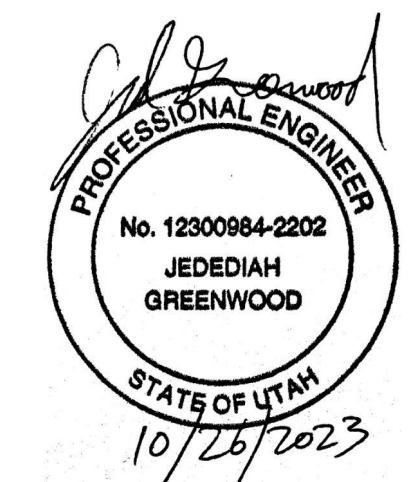
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2 SECTION: SUMP AND POND DRAW DOWN PIPING
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BARR ENGINEERING CO.	06/09/23											

BARR Project Office:
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 Ph: 1-800-632-2277
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Scale	AS SHOWN
Date	04/11/2023
Drawn	ATD
Checked	JDG
Designed	ATD
Approved	JDG

TINTIC CONSOLIDATED METALS LLC.
 EUREKA, UTAH

**TINTIC MINE EXPANSION
 DRY STACK TAILINGS STORAGE FACILITY**
 PROCESS POND
 SECTIONS AND DETAILS

BARR PROJECT No.	44251029.01
CLIENT PROJECT No.	
DWG. No.	C-601
REV. No.	A

Tintic Mine Expansion Tailings Storage Facility Technical Specifications

Prepared for
Tintic Consolidated Metals

October 2023 – Rev. B

ISSUE FOR CONSTRUCTION



Tintic Mine Expansion Tailings Storage Facility Technical Specifications

Prepared for
Tintic Consolidated Metals, LLC

October 2023 – Rev. B

ISSUE FOR CONSTRUCTION

Tintic Mine Expansion Tailings Storage Facility- Technical Specifications

Table of Contents

DIVISION 1 - GENERAL REQUIREMENTS

Section 01 11 00 – Summary of Work
Section 01 45 00 – Quality Control
Section 01 51 00 – Temporary Utilities

DIVISIONS 3, 31, 32 and 33

Section 31 00 00 – Earthwork
Section 31 01 00 – Site Preparation
Section 31 05 19.16 – Geomembranes for Earthwork
Section 31 05 19.23 – Geosynthetic Clay Liner
Section 31 10 10 – Clearing and Grubbing
Section 31 23 19 – Dewatering
Section 31 25 00 – Erosion and Sedimentation Controls
Section 31 37 00 – Riprap
Section 32 05 19.13 – Geotextiles
Section 32 31 13 – Chain Link Fences and Gates
Section 32 90 00 – Planting
Section 32 92 00 – Site Restoration
Section 33 90 00 – Landfill Site Piping

I hereby certify that this specification was prepared by me or under my direct supervision, and that I am a duly registered Professional Engineer under the laws of the State of Utah.

Date: October 26, 2023

DRAFT FOR PERMIT NOT FOR
CONSTRUCTION (10/26/2023)

12300984-2202

Jed Greenwood, P.E.

State Registration No.

SECTION 01 11 00
SUMMARY OF WORK

PART 1: GENERAL

1.01 CONTRACT DOCUMENTS

- A. The format of these Specifications is based upon the CSI MASTERFORMAT (2016 Edition); however, differences in format and subject matter location do exist. It is Contractor's sole responsibility to thoroughly read and understand these Specifications and request written clarification of those portions that are unclear.
 - 1. The term "provide" or "provided" shall mean "furnish and install complete in-place".
- B. Division of the Work as made in these Contract Documents is for the purpose of specifying and describing work, which is to be completed. There has been no attempt to make a classification according to trade or agreements which may exist between Contractor, subcontractors, or trade unions or other organizations. Such division and classification of the Work shall be Contractor's sole responsibility.

1.02 DEFINITIONS

- A. Contract Documents – As defined in the Instructions to Bidders and the Agreement.
- B. Drawings – Contract Drawings.
- C. Specifications – Division 01, 03, 31, 32 and 33 of the Technical Specifications.
- D. Owner – Tintic Consolidated Metals.
- E. Engineer – Barr Engineering Co. and engineer of record as stated on the Drawings and these Specifications.
- F. Owner's Representative - Owner's employee assigned authority to direct the Work, or employee of Engineer as designated by Owner.

1.03 EXISTING SITE CONDITIONS

- A. The site of the work is located at Tintic Consolidated Metals located at 15988 Silver Pass Road, Eureka, Utah.
- B. The site of the proposed dry stack tailings storage facility is located to the northeast of the processing facility as shown on the Drawings.
- C. The site of the proposed process pond is located to the immediate east of the process facility as shown on the Drawings.
- D. Access into the construction area shall be coordinated with Owner.

1.04 PROJECT DESCRIPTION

- A. Work under this Contract comprises of the construction of a dry stack tailings storage facility and a process pond at Tintic Consolidated Metals LLC operating under DOGM Minerals Program (Permit No. C/049/0062)
- B. Work specifically included in this Contract is the following:
 - a. Locating, identifying, and protecting existing utilities.
 - b. Clearing, grubbing, and rock removal.
 - c. Subgrade preparation.
 - d. Installing geosynthetic clay liner.



- e. Installing HDPE geomembrane liner.
 - f. Installing geotextile.
 - g. Installing drainage collection pipes and pump access piping.
 - h. Constructing event pond, including pond embankments and liner.
 - i. Installing stormwater culverts, including riprap inlets and outlets.
 - j. Excavating and grading berms and ditches.
 - k. Installing surface water control features and other features as shown on the Drawings.
 - l. Restoring and landscaping.
 - m. Constructing process pond, including pond embankments and liner.
- C. It is the intent of the Contract Documents to cover all aspects of the Project. Should there be some item or items not shown on the Contract Drawings or not described in these Specifications which are required to complete the Work, those items and the furnishing of all labor, supervision, coordination, management, materials, and equipment shall be considered incidental to the Work and no additional compensation will be provided.
- D. The Work includes the furnishing of all labor, supervision, coordination, management, equipment, tools, machinery, materials, and other items required for the construction of a complete project as specified. Equipment furnished shall be in safe operating condition and of adequate size, capacity, and condition for the performance of the Work. Contractor shall obtain all measurements necessary for the Work and shall be responsible for establishing all dimensions, levels, and layout of the Work.
- E. Contractor is solely responsible for the coordination of its activities with regard to the Project and the activities of subcontractors and Owner.
- F. Provide all construction surveying and staking and certification surveying. Contractor shall be responsible for the maintenance of all survey points. Contractor shall conduct operations so as to preserve control points, benchmarks, survey reference points and stakes existing or established for construction. Repair or replacement of survey markers damaged as a result of Contractor's activities will be done so at the expense of the Contractor. Contractor shall be responsible for errors in the Work or lost time that may result due to damage or destruction of survey markers due to Contractor's operations.

1.05 SURVEY CONTROL

- A. Survey control point information will be established prior to construction.

1.06 CONTRACTOR'S USE OF PREMISES

- A. Confine operations to areas within Contract limits as indicated and/or as approved by Owner. Portions of site beyond areas in which construction operations are indicated and/or approved by Owner are not to be disturbed.
- B. Hours of Operation: Contractor's operations shall be limited to the hours of operation identified by the Owner at the time of construction.
- C. Coordinate use of premises under direction of Owner.
- D. Assume full responsibility for protection and safekeeping of materials and equipment under this Contract.
- E. Coordinate provision of temporary utilities with Owner.
- F. Contractor to be liable for environmental impacts of Contractor's activities.



1.07 WORK BY OTHERS

A. None anticipated.

1.08 PROJECT CONTACTS

A. Owner – Project/Construction Manager

Brandon Ott
Chief Metallurgist
15988 Silver Pass Road
Eureka, UT 84628
O: 435-433-2260
M: 303-552-6918
Email: bott@tinticmetals.com

B. Engineer – Design/Certifying

Jed Greenwood, P.E.
Senior Geotechnical Engineer, Vice President
Barr Engineering Co.
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C. Owner’s Representative – To Be Determined (TBD)

D. Contractor – TBD

PART 2: PRODUCTS [NOT USED]

PART 3: EXECUTION [NOT USED]

END OF SECTION 01 11 00



SECTION 01 45 00
QUALITY CONTROL

PART 1: GENERAL

1.01 SUMMARY

- A. Section includes Contractor's field quality control responsibilities.
- B. Section includes Owner's field quality control responsibilities.

1.02 REFERENCES

- A. American Society for Testing and Materials International, Current Edition, hereafter referred to as ASTM.

1.03 CONTRACTOR'S FIELD QUALITY CONTROL RESPONSIBILITIES

- A. Contractor shall provide construction survey staking based on primary survey control as shown on the Drawings to establish line and grade of the Work.
- B. Visually inspect lines between survey points to verify uniform slopes. Irregularities which would cause concentration of runoff, impede sheet flow of runoff, or would otherwise make the slope more susceptible to erosion, as determined by Engineer or Owner's Representative, shall be corrected as directed by Engineer or Owner's Representative.
- C. Contractor shall retain an independent land surveyor for performing certification surveys for the Dry Stack Tailings Facility. Contractor shall be responsible to conduct certification surveys of features identified below and as shown on the Drawings before work is covered. Certification surveys shall be conducted on a 100foot by 100 foot maximum grid with survey points at all major breaks in slope. Contractor shall notify Engineer or Owner's Representative prior to completing the certification surveys to allow on-site review. Contractor's independent surveyor shall conduct certification surveys for the following features:
 - 1. All pipelines (survey shot every 25 feet along pipe alignment including all inverts)
 - 2. Top of geosynthetic clay liner and geomembrane liner
 - 3. Edge of geomembrane
 - 4. Edge of road
 - 5. Top of finished grade
 - 6. Rooting zone layer finished surface
 - 7. Topsoil layer finished surface
 - 8. Topographic survey of the completed site including perimeter road tie-ins and ditches
- D. Contractor shall not cover work on which survey or measurements are required until Engineer and Owner's Representative have approved the Work. Contractor's independent land surveyor shall meet with the Owner's Representative at the end of each day that certification survey data is collected and recorded, via handwriting, every survey shot collected that day. All certification survey shots shall be checked for Specification compliance including adequate shot frequency by the independent land surveyor and Owner's Representative at the end of each day. Engineer shall be immediately notified if a certification shot is found to be out of compliance.

- E. Contractor shall be responsible for the cost of additional surveys for any work that does not meet specified grade or thickness tolerances at the time the initial certification survey is conducted on any area.
- F. It is Contractor's sole responsibility to perform testing deemed necessary to ensure that materials proposed for use in construction satisfies the requirements of these Specifications prior to delivery of materials to the Site. Contractor shall conduct the minimum test types and quantities established in Table 1. Material sources producing marginal test results may require additional testing, at Engineer's direction, to demonstrate that the proposed source is suitable for materials to be used in the Work. Materials that do not meet the requirements of these Specifications shall be removed from the Site by Contractor.
- G. Soil tests shall be performed by Owner during construction as stated in paragraph 1.04. Required tests, locations, and frequencies are listed in Table 1 for reference. Tested work shall not be covered by Contractor until notified by the Owner or Owner's Representative that test results have been approved.
- H. Work failing to meet specifications as outlined herein and as may be identified as a result of the field quality control program shall be repaired at Contractor's expense. Owner will perform additional testing after repairs are completed to demonstrate the finished work meets specifications. Contractor shall take such measures as are necessary (rework, replacement of materials, etc.) to bring the Work to meet specifications.
- I. Contractor shall provide access to the construction area for testing by Owner, Owner's Representative, or Owner's soil testing technician throughout construction.

1.04 OWNER'S FIELD QUALITY CONTROL RESPONSIBILITIES

- A. Soil samples shall be collected by Owner, Owner's Representative, or Owner's soil testing technician. Required tests, locations, and frequencies are listed in Table 1. Tested work shall not be covered by Contractor until notified by the Owner or Owner's Representative that test results have been approved.
- B. The Owner or Owner's Representative will be responsible to collect and send out the geomembrane seam destructive test samples for the Independent Third-Party laboratory testing. The Owner will be responsible for all costs associated with the Third-Party laboratory testing. The Contractor shall provide destructive samples of geomembrane seams as required in Section 31 05 19.16 – Geomembranes for Earthwork.
- C. The Owner's Representative and Contractor's geomembrane installer shall perform all other field quality assurance requirements for geomembrane installation as described in these Specifications.
- D. Refer to Technical Specifications 31 05 19.16 for Geosynthetic Clay Liner quality control requirements.

1.05 SUBMITTALS

- A. Submit for review results from borrow source evaluation testing. Submit one copy each to Engineer and to Owner's Construction Manager a minimum of 10 days prior to delivery of material to the site.
- B. The Owner's Representative and the Contractor's independent land surveyor shall review and record daily all certification shots taken for that day as described in paragraph 1.03.
- C. Submit for review within 24 hours of receipt all certification survey results. Engineer will respond within 24 hours. The submittal must be approved by Engineer before placement of overlying materials.

- D. Submit for record a tabulation of all results of certification survey work performed. The tabulation shall contain the following information for each survey location:
1. A unique identification number.
 2. Project coordinates.
 3. Elevation of finished surface (liner subgrade, top of pipe, edge of road, etc.)
 4. Thickness (if necessary) of each material.
- E. Submit for record certification survey record drawings containing the unique identification numbers and material thicknesses for each survey point. The drawings shall use a scale of 1 inch = 50 feet and shall be submitted in reproducible paper and electronic (AutoCAD) format. At a minimum, the following plan views shall be submitted:
1. Top of geosynthetic clay liner and geomembrane subgrade
 2. Top and edge of road
 3. Top of pipe
 4. Top of drainage outlet pipe and inverts
 5. Top of culverts and inverts
 6. Top of rooting zone layer
 7. Top of topsoil layer
 8. Topographic survey of completed site

PART 2: PRODUCTS [NOT USED]

PART 3: EXECUTION [NOT USED]

END OF SECTION 01 45 00

SECTION 01 51 00
TEMPORARY UTILITIES

PART 1: GENERAL

1.01 SUMMARY

- A. Section includes information on temporary utilities (electrical, sanitary sewer and water) for use during the Project.

1.02 CONTRACTOR REQUIREMENTS

A. Electrical

- 1. Provide temporary power for construction activities. Power is available at the mine and may be available for Contractor use. Coordinate with Owner prior to hookup and use.

B. Water

- 1. Provide potable water for Contractor's personnel use at site.
- 2. Obtain and supply water for usage at site. Coordinate with Owner for access to non-potable water for on-site moisture conditioning of soils and dust control as needed.

C. Sanitary

- 1. Provide portable sanitary facilities for personnel at the site. Maintain clean sanitary condition at all times.

1.03 COORDINATION

- A. Coordinate any required utility connections with Owner and utilities companies.

PART 2: PRODUCTS [NOT USED]

PART 3: EXECUTION

- 3.01 Examine and verify site acceptability to receive and construct temporary utilities.
- 3.02 Provide and maintain power and water required for construction-related project Work.
- 3.03 Provide and maintain required sanitary facilities for personnel use.
- 3.04 Disconnect any temporary power and water supply upon project completion and remove personnel sanitary facilities upon project completion.

END OF SECTION 01 51 00

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1: GENERAL

1.01 SUMMARY

- A. Material and Equipment incorporated into Work:
 - 1. Conform to applicable specifications and standards.
 - 2. Comply with size, make, type, and quality specified, or as specifically approved.
- B. Manufactured and Fabricated Materials and Equipment:
 - 1. Design, fabricate, and assemble in accordance with engineering and shop practices standard with industry.
 - 2. Material and equipment shall be suitable for service conditions.
- C. Do not use material or equipment for purpose other than for which it is designed or specified.

1.02 MANUFACTURER'S INSTRUCTIONS

- A. Installation of materials shall comply with manufacturer's instructions. Obtain and distribute printed copies of such instructions to parties involved in installation, including two copies to Owner's Representative.
 - 1. Maintain one set of complete instructions at job site during installation until completion of entire Project.
- B. Handle, store, install, connect, clean, condition, and adjust materials in accordance with manufacturer's written instructions and in conformance with Specifications.
 - 1. If job conditions or specified requirements conflict with manufacturer's instructions, consult Engineer for further instructions.
 - 2. Do not proceed with Work without written instructions.

PART 2: PRODUCTS [NOT USED]

PART 3: EXECUTION [NOT USED]

END OF SECTION 01 60 00

SECTION 31 01 00

SITE PREPARATION

PART 1: GENERAL

1.01 SUMMARY

- A. Section includes providing all materials, equipment, and labor to prepare the Site for construction, including, but not limited to:
 - 1. Removal of all trash, debris, rocks, and foreign materials necessary to access the work area and perform the work.
 - 2. Relocation or protection of all existing utilities and coordination with utility companies relocating any electrical, gas or communications lines.
 - 3. Coordination with utilities companies for all removals, relocations, or replacements of existing utilities.
 - 4. Coordination with other contractors working within or near project areas.

1.02 RELATED SECTIONS

- A. Section 31 10 00 Clearing and Grubbing.
- B. Section 31 25 00 Erosion and Sediment Control.

1.03 SUBMITTALS

- A. No submittals are required from this Section.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION

1.04 GENERAL

- A. Take necessary measures to prepare the Site access and Site conditions necessary to perform the Work, all in accordance with the Drawings and these Specifications.
- B. Take necessary measures to secure the Project Site from public access to protect Contractor's materials and equipment, and Project Work areas.
- C. Take necessary measures to protect Work areas from public access that may pose danger or hazard to the public.

1.05 UTILITY LOCATIONS

- A. Locate all utilities and resolve any utility conflicts with utility company prior to any excavation work. Coordination between Contractor and utility companies shall be incidental to the Work.

END OF SECTION 31 01 00

SECTION 31 05 19.16

GEOMEMBRANES FOR EARTHWORK

PART 1: GENERAL

1.01 SUMMARY

- A. Work under this section includes installation of the high density polyethylene (HDPE) textured and MicroDrain geomembrane liner for the Dry Stack facility, Event Pond, and Process Pond.
- B. This specification covers the technical requirements for the Manufacturing and Installation of the geomembrane. All materials shall meet or exceed the requirements of this specification, and all work shall be performed in accordance with the procedures provided in these project specifications.

1.02 REFERENCES

- A. American Society for Testing and Materials International, Current Edition, hereafter referred to as ASTM.
 - 1. D792 Method B, Density and Specific Gravity of Plastics by Displacement
 - 2. D1004 Initial Tear Resistance of Plastic Film and Sheeting
 - 3. D1238 Flow Rates of Thermoplastics by Extrusion Plastometer
 - 4. D3895 Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
 - 5. D4218 Determination of Carbon Black in Polyethylene Compounds
 - 6. D4833 Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
 - 7. D5199 Measuring Nominal Thickness of Geotextiles and Geomembranes
 - 8. D5397 Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
 - 9. D5596 Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
 - 10. D5994 Measuring Core Thickness of Textured Geomembranes
 - 11. D6392 Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
 - 12. D6693 Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
 - 13. D7466 Measuring Asperity Height of Textured Geomembranes
- B. Geosynthetic Research Institute (GRI)
 - 1. GRI GM 13 Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
 - 2. GRI GM19 Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes.

1.03 DEFINITIONS

- A. Lot - A quantity of resin (usually the capacity of one rail car) used in the manufacture of geomembranes. Finished rolls shall be identified by a roll number traceable to the resin lot used.



- B. Geomembrane Manufacturer (Manufacturer) - The party responsible for manufacturing the geomembrane rolls.
- C. Construction Quality Assurance Consultant (Consultant) - Party, independent from Manufacturer and Installer that is responsible for observing and documenting activities related to quality assurance during the lining system construction.
- D. Engineer - Individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.
- E. Geosynthetic Quality Assurance Laboratory (Testing Laboratory) - Party, independent from the Owner, Owner's Representative, Manufacturer, and Installer, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the Owner's Representative.
- F. Installer - Party responsible for field handling, transporting, storing, deploying, seaming, and testing of the geomembrane seams.
- G. Panel - Unit area of a geomembrane that will be seamed in the field that is larger than 100 square feet.
- H. Patch - Unit area of a geomembrane that will be seamed in the field that is less than 100 square feet.
- I. Subgrade Surface - Soil layer surface which immediately underlies the geosynthetic material(s).

1.04 SUBMITTALS

- A. For geomembrane manufacturers and installers, submit for review documentation of qualifications per paragraph 1.05.
- B. Submit for record the following product data prior to installation of the geomembrane material:
 - 1. Resin Data shall include the following:
 - a. Certification stating that the resin meets the specification requirements (Table 1).
 - b. Production date(s) of resin.
 - 2. Geomembrane Roll
 - a. Statement certifying no recycled polymer and no more than 10 percent (%) rework of the same type of material is added to the resin (product run may be recycled).
 - 3. Roll Identification - provide geomembrane in rolls tagged with the following information:
 - a. Manufacturer's name, address, and telephone number.
 - b. Product identification.
 - c. Lot number.
 - d. Roll number.
 - e. Roll dimensions.
 - f. Material thickness.
 - 4. Provide instructions on special handling during hauling and storage to ensure product is not damaged.

5. Copy of quality control certificates for each roll indicating compliance with the requirements per paragraph 2.03.
- C. Submit for record fabrication certificates (if applicable):
1. Copy of quality control certificates indicating compliance with requirements of these Specifications.
- D. The Installer, via Contractor, shall submit for review the following information prior to installation:
1. Proposed panel layout drawings.
 - a. Installation layout identifying placement patterns, field seams, and fabricated seams (if applicable), as well as variance or additional details deviating from Drawings. Layout shall be approved by Engineer. Layout shall be adequate for use as construction plan and include information such as dimensions and details.
 - b. Layout must be approved prior to installing the geomembrane. Approved layout shall be followed during construction except as otherwise approved by the Engineer.
 - c. Actual panel placement will be governed by site conditions.
 2. Installer's Geosynthetic Field Installation Quality Assurance Plan.
- E. Submit for record geomembrane subgrade acceptance form(s) prior to geomembrane installation.
- F. Submit for record tensiometer calibration certificate prior to geomembrane installation.
- G. Each day (at the end of each working day), the Installer shall provide to the Owner's Representative a signed report and sketch of Work complete on that day. Owner's Representative shall review and sign report acknowledging receipt of report. Report and sketch shall include but not be limited to the following information:
1. Panel placement and roll identification.
 2. Trial weld test logs.
 3. Seam locations, lengths and type.
 4. Seam testing and results.
 5. Destructive testing and results.
 6. Repair locations and log.
- H. The Installer shall, via Contractor, within 15 working days of Installer's final demobilization from the Site, submit for record the following:
1. All field testing results.
 2. Certificate stating the geomembrane has been installed in accordance with the Contract Documents.
 3. Material and installation warranties.
 4. As-built drawings showing:
 - a. Actual geomembrane panel placement, dimensions and seams.
 - b. Destructive testing locations.
 - c. Repair locations.

d. Typical anchor trench detail.

1.05 QUALIFICATIONS

A. Manufacturer:

1. The following geomembrane manufacturers are approved for this Project:
 - a. AGRU America, Inc.
2. Contractor requests for approval of alternate manufacturers (if any) must be submitted to Owner and Engineer not less than 7 days prior to Bid opening. Contractor must obtain from Owner or Engineer written approval of alternate manufacturer in order to include alternate in Bid.
3. Qualifications:
 - a. Manufacturer shall have minimum ten years of continuous experience in manufacture of HDPE geomembrane rolls or experience totaling 50,000,000 square feet of manufactured geomembrane rolls for a minimum of 20 completed facilities.
 - b. Manufacturer shall have manufactured a minimum of 20,000,000 square feet of polyethylene geomembrane during the last year.

B. Installer:

1. Contractor shall submit qualifications and experience of proposed Installer. Owner's written approval of Installer is required prior Installer mobilization to the site.
2. Qualifications:
 - a. Installer shall have installed a minimum of 50,000,000 square feet of polyethylene geomembrane for a minimum of 10 completed facilities.
 - b. Installer shall have worked in a similar capacity on at least 10 projects similar in complexity to the project described in the Contract Documents.
 - c. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.
 - d. The Installer shall provide a minimum of one Master Seamer for work on the project.
 - 1) Master Seamer must have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for use on this Project.

C. Fabricator (if applicable):

1. Fabricator shall have minimum five years continuous experience in fabrication of geomembrane or experience totaling 10,000,000 square feet of fabricated geomembrane for minimum of 10 completed facilities.

1.06 MATERIAL LABELING, DELIVERY, STORAGE, AND HANDLING

A. Labeling – Each roll of geomembrane delivered to the site shall be labeled by the Manufacturer. The label will identify:

1. Manufacturer's name
2. Product type

3. Thickness
 4. Length
 5. Width
 6. Roll number
- B. Delivery – Rolls of geomembrane shall be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading. Handle geomembrane rolls by appropriate means to prevent damage. Protect geomembrane rolls with impermeable and opaque covers.
- C. Storage – The on-site storage location for the geomembrane material, prepared by the Contractor to protect the geomembrane from punctures, abrasions and excessive dirt and moisture, shall have the following characteristics:
1. Level (no wooden pallets), and stacked no more than two high
 2. Smooth
 3. Dry
 4. Protected from theft and vandalism
 5. Adjacent to the area being lined
- D. Handling – Materials are to be handled so as to prevent damage. Instructions for moving geomembrane shall be provided by manufacturer/fabricator.

1.07 QUALITY ASSURANCE

- A. Perform work in accordance with these Specifications and the CQA Plan.
- B. Friction Angle Requirements and Testing
1. The effective interface shear strength envelope at the interface between the geomembrane and the materials in direct contact with the geomembrane shall be verified by the CQA Officer by performing interface friction testing on representative materials to be used for construction of the liner system.
 2. The interface frictional resistance shall be determined by direct shear tests in general accordance with ASTM D5321.
 3. The interface friction resistance for interfaces including GCLs shall be determined by direct shear tests in general accordance with ASTM D6243.
 4. The interfaces and/or soil shall be tested saturated with water.
- C. The Manufacturer shall sample and test the HDPE geomembrane material, at minimum frequencies specified. General manufacturing procedures shall be performed in accordance with the Manufacturer's internal quality control guide and/or documents.
- D. All non-conductive geomembrane sheets shall be continuously spark tested during manufacturing.
1. The spark tester shall be capable of detecting defects or pinholes less than 10 mils in diameter.
 2. All necessary repairs to the geomembrane shall be made by the manufacturer at the factory before shipment.
 3. The manufacturer shall provide writing certification to the Owner and/or Engineer that all the geomembrane rolls delivered to the project were continuously spark tested and do not contain pinhole defects.

- E. The Engineer shall examine the rolls upon delivery to the site and report any deviations from these Specifications to the Contractor.
- F. If a geomembrane sample fails to meet the quality control requirements of this Section, the Contractor and/or Engineer shall require that the Geomembrane Manufacturer sample and test each roll manufactured in the same lot or batch, or at the same time, as the failing roll. Additional sampling and testing shall be completed at no additional cost to the Owner. Sampling and testing of rolls shall continue until a pattern of acceptable test results is established.
- G. Any geomembrane sample that does not comply with this Section shall result in rejection of the roll from which the sample was obtained. The Contractor shall replace any rejected rolls at no additional cost to Owner. At the Geomembrane Manufacturer's discretion and expense, additional testing of individual rolls may be performed to more closely identify noncomplying rolls and to qualify individual rolls.

1.08 WARRANTY

- A. Material shall be warranted against Manufacturer's defects for a period of 5 years from the date of geomembrane installation.
- B. Installation shall be warranted against defects in workmanship for a period of 1 year from the date of geomembrane completion.

PART 2: PRODUCTS

2.01 MATERIALS

A. Raw Materials:

- 1. Materials shall be smooth, textured, or structured polyethylene geomembrane as shown on the drawings. Geomembrane shall be flat die-cast extruded.
- 2. Resin
 - i. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane.
 - ii. Natural resin (without carbon black) shall meet the following requirements:

Raw Material Properties

Property	Test Method	HDPE
Density (g/cc)	ASTM D792, Method B	≥0.932
Melt Flow Index (g/10 min)	ASTM D1238 (190/2.16)	≤1.0

- iii. Resin used in manufacturing geomembranes used for this Project shall meet the specifications set forth in the latest revision of the GRI GM13 for HDPE.
- 3. Recycled Polymer shall not be added to the resin. However, the resin may contain polymer reclaimed during the manufacturing process if reclaimed polymer content does not exceed 2 percent by weight.

B. Geomembrane Roll Goods:

- 1. HDPE geomembrane sheets used for this project shall meet the requirements set forth in the latest revision set forth by the GRI GM13 for HDPE.
- 2. Do not exceed a combined maximum total of 1 percent by weight of additives other than carbon black.

3. Geomembranes shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.
4. The geomembranes shall be supplied in rolls. Each roll is to be identified with labels indicating roll number, thickness, length, width, and Manufacturer.
5. All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in Sections 2.1 C and 2.1 D and be tested by an acceptable method of inspecting for pinholes.
6. All geomembranes shall contain edge markings which shall denote the name of the manufacturer, the product thickness, the year of manufacture and the length of the roll. These markings shall occur at uniformly spaced intervals throughout the entire length of the roll.

C. Smooth surface geomembrane shall meet the requirements shown in the following data sheet:

Table 1. AGRU HDPE Smooth Liner®

Tested Property	Test Method	Frequency	Minimum Average Value				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, (minimum average) mil (mm)	ASTM D5199	Every roll	30 (0.75)	40 (1.00)	60 (1.50)	80 (2.00)	100 (2.50)
Lowest individual reading (-10%)			27 (0.69)	36 (0.91)	54 (1.40)	72 (1.80)	90 (2.30)
Density, g/cm ³	ASTM D792, Method B	200,000 lb	0.94	0.94	0.94	0.94	0.94
Tensile Properties (each direction)	ASTM D6693, Type IV	20,000 lb					
	Dumbbell, 2 ipm						
Strength at Break, lb/in-width (N/mm)	G.L. 2.0 in (51 mm)		120 (21)	160 (28)	240 (42)	320 (56)	400 (70)
Strength at Yield, lb/in-width (N/mm)			66 (11)	88 (15)	132 (23)	176 (30)	220 (38)
Elongation at Break, %			700	700	700	700	700
Elongation at Yield, %		G.L. 1.3 in (33 mm)	13	13	13	13	13
Tear Resistance, lb (N)	ASTM D1004	45,000 lb	23 (102)	30 (133)	45 (200)	60 (267)	72 (320)
Puncture Resistance, lb (N)	ASTM D4833	45,000 lb	60 (267)	80 (356)	120 (534)	160 (712)	190 (845)
Carbon Black Content, % (Range)	ASTM D4218	20,000 lb	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D5596	45,000 lb	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾
Notched Constant Tensile Load, hr	ASTM D5397, Appendix	200,000 lb	500	500	500	500	500
Oxidative Induction Time, min	ASTM D3895, 200°C; O ₂ , 1 atm	200,000 lb	>140	>140	>140	>140	>140

NOTES:

- (1) Dispersion only applies to near spherical agglomerates. 10 views shall be Category 1 or 2.
- All AGRU geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.



D. Textured surface and structure surface geomembrane shall contain a smooth surface on each edge. Otherwise, texturing shall be uniform from edge to edge and roll to roll. Textured geomembrane shall be manufactured with an embossed surface to ensure uniformity of texture. Textured and/or structured geomembrane shall meet the requirements shown in the following tables:

Table 2. AGRU HDPE MicroSpike® Textured Geomembrane

Tested Property	Test Method	Frequency	Minimum Average Value				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, (minimum average) mil (mm)	ASTM D5199	Every roll	30 (0.75)	40 (1.0)	60 (1.5)	80 (2.0)	100 (2.5)
Lowest individual reading (-10%)			27 (0.68)	36 (0.90)	54 (1.35)	72 (1.8)	90 (2.25)
Density, g/cm ³	ASTM D792, Method B	200,000 lb	0.94	0.94	0.94	0.94	0.94
Tensile Properties (each direction)	ASTM D6693, Type IV Dumbbell, 2 ipm	20,000 lb					
Strength at Break, lb/in-width (N/mm)							
Strength at Yield, lb/in-width (N/mm)							
Elongation at Break, %	G.L. 2.0 in (51 mm)						
Elongation at Yield, %	G.L. 1.3 in (33 mm)						
Tear Resistance, lb (N)	ASTM D1004	45,000 lb	23 (102)	30 (133)	45 (200)	60 (267)	72 (320)
Puncture Resistance, lb (N)	ASTM D4833	45,000 lb	60 (267)	90 (400)	120 (534)	150 (667)	180 (801)
Carbon Black Content, % (Range)	ASTM D4218	20,000 lb	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D5596	45,000 lb	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾
Asperity Height, mil (mm)	ASTM D7466	Second roll	20 (0.5)	20 (0.5)	20 (0.5)	18 (0.45)	18 (0.45)
Notched Constant Tensile Load, hr	ASTM D5397, Appendix	200,000 lb	500	500	500	500	500
Oxidative Induction Time, min	ASTM D3895, 200°C;O ₂ , 1 atm	200,000 lb	>140	>140	>140	>140	>140

NOTES:

- (1) Dispersion only applies to near spherical agglomerates. 10 views shall be Category 1 or 2.
- All AGRU geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.

Table 3. AGRU HDPE MicroDrain® Liner

Tested Property	Test Method	Frequency	Minimum Average Value			
			50 mil	60 mil	80 mil	100 mil
Thickness, (Nominal) mil (mm)	ASTM D5994	Every roll	50 (1.25)	60 (1.5)	80 (2.0)	100 (2.5)
Thickness, (average) mil (mm)			47.5 (1.18)	57 (1.43)	76 (1.9)	95 (2.4)
Lowest individual reading 8 of 10 (-10%)			45 (1.12)	54 (1.35)	72 (1.8)	90 (2.3)
Lowest Individual 2 of 10			42.5 (1.06)	51 (1.28)	68 (1.7)	85 (2.1)
Drainage Stud Height, mil (mm)	ASTM D7466	Second roll	130 (3.3)	130 (3.3)	130 (3.3)	130 (3.3)
MicroSpike® Asperity Height, mil (mm)	ASTM D7466	Second roll	20 (0.51)	20 (0.51)	18 (0.46)	18 (0.46)
Density, g/cm ³	ASTM D792, Method B	200,000 lb	0.94	0.94	0.94	0.94
Tensile Properties (each direction)	ASTM D6693, Type IV	20,000 lb				

Strength at Break, lb/in-width (N/mm)	Dumbbell, 2 ipm		110 (19)	132 (23)	176 (30)	220 (38)
Strength at Yield, lb/in-width (N/mm)			110 (19)	132 (23)	176 (30)	220 (38)
Elongation at Break, %	G.L. 2.0 in (51 mm)		300	300	300	300
Elongation at Yield, %	G.L. 1.3 in (33 mm)		13	13	13	13
Tear Resistance, lb (N)	ASTM D1004	45,000 lb	38 (169)	42 (200)	56 (267)	70 (300)
Puncture Resistance, lb (N)	ASTM D4833	45,000 lb	80 (356)	95 (422)	126 (560)	158 (703)
Carbon Black Content, % (Range)	ASTM D4218	20,000 lb	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D5596	45,000 lb	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾
Notched Constant Tensile Load, hr	ASTM D5397, Appendix	200,000 lb	500	500	500	500
Oxidative Induction Time, min	ASTM D3895, 200°C;O ₂ , 1 atm	200,000 lb	>140	>140	>140	>140

NOTES:

- (1) Dispersion only applies to near spherical agglomerates. 10 views shall be Category 1 or 2.
- All AGRU geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.

E. Extrudate Rod or Bead:

1. Extrudate material shall be made from same type resin as geomembrane.
2. Additives shall be thoroughly dispersed.
3. Materials shall be free of contamination by moisture or foreign matter.

F. Neoprene Foam at Clamped Boots (if necessary):

1. Closed cell, weatherproof, black neoprene foam with adhesive backing suitable for long-term sun and liquid exposure. Dimensions shall be as specified on the Drawings or as required to suit application required in the field.

G. Clamped Boots (if necessary):

1. Boots required to seal the geomembrane to the structures passing through it shall be made of the same materials as the geomembrane. The boots shall be fabricated so that all field assembly, welding, and seam testing can be accomplished using equipment and procedures regularly employed in the field for geomembrane installation. Smooth geomembrane shall be used in all geomembrane boots.

H. Banding Straps (if necessary):

1. Type 302 stainless steel banding straps or approved equal suitable for use on the pipe diameters shown on the Drawings or encountered in the field. All surfaces of the banding straps shall be machined smooth to prevent tearing or puncturing of the geomembrane pipe boots. A sacrificial layer of geomembrane or geotextile shall separate all banding straps from geomembrane boots. Outer lip of boot shall be sealed with silicone sealant as shown on Drawings.

2.02 EQUIPMENT

Extruding equipment shall be equipped with a temperature gauge at the barrel and nozzle.

Fusion equipment shall be equipped with a temperature gauge capable of continuous monitoring.

Provide digital or dial continuous temperature recording instruments, in satisfactory working condition, with each welding unit. Welding equipment shall not be operated without functioning temperature recording instruments for measuring geomembrane sheet temperature.

A coupon cutter and a calibrated tensiometer shall be provided for in-field seaming prequalification testing and destructive sample testing.

Store, transport, and operate all equipment to avoid damage to geomembranes.

Glass top of each vacuum box must be clear and free of scratches for easy detection of air bubbles and easy reading of pressure gauge. The sealing gasket shall be intact and functioning to form close seals during testing.

Owner or Owner's Representative reserves the right to order the Installer to remove any equipment that in Owner's or Owner's Representative's opinion is not satisfactory. The Installer will remove the equipment promptly from the construction site and replace the unsatisfactory equipment with suitable equipment within 24 hours.

An adequate number of welding apparatuses shall be available to avoid delaying work.

Power source must be capable of providing constant voltage under combined line load.

PART 3: EXECUTION

3.01 EXAMINATION

- A. Installer shall certify in writing that the surface upon which the geomembrane is to be installed is acceptable (use the form attached at the end of this Section).
- B. Submit certification to Owner or Owner's Representative prior to installing geomembrane.

3.02 EARTHWORK PREPARATION

A. General:

- 1. After supporting soil is accepted by Installer, it shall be Installer's responsibility to indicate to Owner or Owner's Representative and to Contractor changes in supporting soil condition that may require repair Work. The Contractor shall maintain the prepared soil surface and the soil surface shall be observed daily prior to geomembrane installation. Damage to subgrade caused by installation shall be repaired at Installer's expense.
- 2. Do not place geomembrane in areas softened by precipitation.
- 3. Do not place geomembrane until subgrade certification survey is completed and approved by Engineer.

B. Anchoring System:

- 1. Excavate anchor trench to lines and grades shown on Drawings prior to geomembrane placement. Protect existing geomembrane and anchor trench.
- 2. The anchor trench shall be constructed free of sharp edges or corners and maintained in a dry condition. No loose soil shall be permitted beneath the geomembrane within the trench.
- 3. The anchor trench shall be inspected and approved by Owner's Representative prior to geomembrane placement, back-filling, and compaction of the anchor trench material.
- 4. Anchor trench excavated in subgrade is susceptible to desiccation. No more than amount of trench required for geomembrane to be anchored in one day shall be excavated in advance to minimize desiccation potential of anchor trench soils.

C. Backfilling of Anchor Trench:

- 1. Backfill anchor trench as shown on the Drawings and compact backfill.
- 2. Prevent damage to geomembrane when backfilling trenches.

3.03 DEPLOYMENT

- A. Assign each panel a simple and logical identifying code. The coding system shall be subject to approval by Owner's Representative and shall be determined at the job site.
- B. Installer shall visually inspect the geomembrane during the deployment for imperfections and mark faulty or suspect areas.
- C. Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:
 - 1. Geomembranes shall be installed according to site-specific specifications.
 - 2. Equipment used shall not damage geomembrane during handling, trafficking, leakage of hydrocarbons or other means.
 - 3. Unroll geomembranes using methods that will not damage geomembrane and will protect underlying surface from damage (spreader bar, protected equipment bucket).
 - 4. To prevent uplift, place ballast (commonly sandbags) on geomembrane which will not damage geomembrane.
 - 5. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it. Smoking will not be permitted on the geomembrane.
 - 6. Do not allow vehicular traffic directly on geomembrane. Rubber-tired ATV may be acceptable if wheel contact is less than 8 pounds per square inch (psi) and pre-approval is obtained from Engineer.
 - 7. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.
- D. Damage:
 - 1. Panels seriously damaged (torn or twisted permanently) shall be replaced whether or not at the direction of the Owner or Owner's Representative, and at no cost to Owner. Repair less serious damage.
 - 2. Remove rejected damaged panels or portions of rejected damaged panels from Work area.

3.04 FIELD SEAMING

- A. Seams shall meet the following requirements:
 - 1. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.
 - 2. Minimize number of field seams in corners, odd-shaped geometric locations and outside corners.
 - 3. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area. To maximum extent possible, minimize panel butt seams on slopes greater than 2 percent. Cut bottom of panel at a 45-degree angle across the entire roll width where butt seams are required on slopes greater than 2 percent slopes.
 - 4. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the Owner's Representative and Installer.
 - 5. Align seam overlaps consistent with the requirements of the welding equipment being used. A 6-inch overlap is commonly suggested.
- B. During Welding Operations

1. Provide at least one Master Seamer who shall provide direct supervision over all other welders.

C. Extrusion Welding

1. Hot-air tack adjacent pieces together using procedures that do not damage the geomembrane.
2. Clean geomembrane surfaces by disc grinder or equivalent.
3. Purge welding apparatus of heat-degraded extrudate before welding.
4. On materials 80 mil and thicker, bevel the top edge of liner to be welded to avoid air pockets.

D. Hot Wedge Welding

1. Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.
2. Clean seam area of dust, mud, moisture and debris immediately ahead of hot wedge welder.
3. Protect against moisture build-up between sheets.

E. Trial Welds

1. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.
2. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.
3. Minimum of two trial welds per day, per welding apparatus; one made prior to the start of work and one completed at mid shift.
4. Cut a minimum of six 1-inch-wide by 6-inch-long test strips from the trial weld.
5. Quantitatively and qualitatively test specimens for peel adhesion (minimum of 4 tests for both Peel A and Peel B) and for shear strength (minimum of 2 tests).
6. Trial weld specimens shall pass when the results shown in the following table for LLDPE are achieved with acceptable failure modes in both peel and shear testing.

Table 4. Minimum Weld Values for HDPE Geomembranes

Property	Test Method	60 mil	80 mil
Peel Strength (fusion), ppi (kN/m)	ASTM D 6392	91 (398)	121 (530)
Peel Strength (extrusion), ppi (kN/m)	ASTM D 6392	78 (340)	104 (445)
Shear Strength (fusion & ext.), ppi (kN/m)	ASTM D 6392	120 (525)	160 (701)

NOTES:

- The break, when peel testing, shall occur in the geomembrane material itself, not through peel separation (FTB).
 - The break shall be a ductile break.
7. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.
 8. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial welds.

F. Climatic Conditions for Seaming



1. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the geomembrane installation. Installer shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.
2. Seaming shall be performed only when panel temperatures are between 40°F and 115°F, unless otherwise approved by Owner or Owner's Representative. If seaming is permitted to be performed at panel temperatures below 40°F, the panel contact surface shall be preheated and Installer shall certify in writing that the low-temperature seaming procedures will not cause any short or long-term damage to the geomembrane.
3. Seaming during rainy weather or when dew is present on panels will not be permitted.
4. Contractor shall provide any special lighting required for seaming during low-light or dark hours. Stress on panels due to thermal expansion and contraction shall be minimized by performing field seaming operations during the coolest parts of the day or night, if necessary. Special scheduling or extended hours of operation require approval by Owner.

G. Defects and Repairs

1. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
2. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

3.05 FIELD QUALITY ASSURANCE

A. Manufacturer and Installer shall participate in and conform to all terms and requirements of this Section and of the Owner's quality assurance program as described in Section 01 45 00 – Quality Control.

B. Quality assurance requirements are as specified in this Section.

C. Field Testing

1. Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming.

a. Vacuum Testing

- 1) Shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
- 2) The vacuum shall be applied for not less than 10 seconds with a minimum of 4 to 8 psi registered on the vacuum gauge.
- 3) If bubbles appear on the geomembrane seam, the area is considered defective and shall be marked for repair.

b. Air Pressure Testing

- 1) Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.
- 2) Pressurize the air channel to 30 psi.
- 3) Note the time test starts and wait a minimum of 5 minutes to check. If pressure after 5 minutes has dropped less than 2 psi then the test is successful.



- 4) If the recorded pressure drop is above the maximum allowable after the test period, the end seals shall be checked and resealed if a leak is present. The entire test shall then be repeated.
 - 5) If the repeated test fails, then the test shall be performed farther down the seam until a passing test is achieved between two locations. The portion of the seam that failed shall be considered defective and shall be marked for repair.
- c. The following information shall be logged for each seam tested:
- 1) Date and time of the completion of the test,
 - 2) seam number,
 - 3) general seam location,
 - 4) test crew,
 - 5) air pressure at the beginning and end of the test for double-track fusion,
 - 6) length of time that the air pressure was held for double-track fusion welds, and
 - 7) pass or fail of the test.

D. Destructive Testing (performed by Installer)

1. Location and Frequency of Testing

- a. Collect destructive test samples at a frequency of one per every 500 lineal feet of seam length.
- b. Test locations will be determined after seaming by Owner's Representative, and shall be in non-critical areas (e.g., anchor trench) to the extent possible.

2. Sampling Procedures are performed as follows:

- a. Installer shall cut samples at locations designated by the Owner's Representative as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.
- b. Installer will number each sample, and the location will be noted on the installation as-built.
- c. Samples shall be twelve (12) inches wide by minimal length with the seam centered lengthwise.
- d. Cut a 2-inch-wide strip from each end of the sample for field testing.
- e. Cut the remaining sample into two parts for distribution as follows:
 - 1) One portion for Owner's Representative, 12-inches by 12 inches.
 - 2) One portion for the Third Party laboratory, 12-inches by 18-inches.
- f. Additional samples may be archived if required.
- g. Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
 - 1) Five weld specimens shall be tested for peel and five shall be tested for shear. The weld shall pass when:

- a. Four of five specimens (both peel and shear) exceed the values shown in Table 3, and the fifth specimen meets or exceeds 80% of the value shown in Table 3.
 - b. The break, when peel testing, shall occur in the geomembrane material itself, not through peel separation (FTB – Film Tear Bond).
 - c. The break shall be a ductile break.
 - h. Installer shall repair all holes in the geomembrane resulting from destructive sampling.
 - i. Repair and test the continuity of the repair in accordance with these Specifications.
- E. The Owner or Owner's Representative will be responsible to collect and send out the destructive test samples for the Independent Third Party laboratory testing. Third Party laboratory testing of the destructive samples may be reduced during the duration of the Project at the discretion of the Engineer. The Owner will be responsible for all costs associated with the Third Party laboratory testing. The test results shall be provided to the Installer and Contractor no later than 48 hours after they have been received from the Independent Third Party testing company.
- F. Failed Seam Procedures
 - 1. If the seam fails, Installer shall follow one of two options:
 - a. Reconstruct the seam between any two passed test locations.
 - b. Trace the weld to intermediate location at least 10 feet minimum or where the seam ends in both directions from the location of the failed test.
 - 2. The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than 10 feet long.
 - 3. If sample passes, then the seam shall be reconstructed or capped between the test sample locations.
 - 4. If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

3.06 REPAIR PROCEDURES

- A. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.
- B. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.
- C. Installer shall be responsible for repair of defective areas.
- D. Agreement upon the appropriate repair method shall be decided between Owner's Representative and Installer by using one of the following repair methods:
 - 1. Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
 - 2. Abrading and Re-welding- Used to repair short section of a seam.
 - 3. Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
 - 4. Capping- Used to repair long lengths of failed seams.

5. Flap Welding- Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.
 6. Remove the unacceptable seam and replace with new material.
- E. The following procedures shall be observed when a repair method is used:
1. All geomembrane surfaces shall be clean and dry at the time of repair.
 2. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.
 3. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.
- F. Repair Verification
1. Number and log each patch repair (performed by Installer).
 2. Non-destructively test each repair using methods specified in this Specification.
- G. Daily Installation Information:
1. At the end of each working day, provide to the Owner's Representative a signed detailed report and sketch of Work completed on that day. Report and sketch shall include but not be limited to:
 - a. Panel placement.
 - b. Trial welds.
 - c. Seam locations, length and type.
 - d. Seam testing and results.
 - e. Destructive testing and results.
 - f. Repair locations and log.
- H. Owner or Owner's Representative shall review and sign report acknowledging receipt of report.
- 3.07 GEOMEMBRANE ACCEPTANCE
- A. Contractor shall retain ownership and responsibility for geomembrane until acceptance by Owner. Geomembrane accepted by Owner when:

1. Installation Complete.
2. "As-built" record Drawings showing panel layout including panel dimensions, number, roll number and location of destructive seam samples and repairs received.
3. Copy of all field testing results received.
4. Copy of warranty received from manufacturer/fabricator, installer via Contractor.
5. Verification of adequacy of field seams and repairs, including associated testing, is complete.

END OF SECTION 31 05 19.16

SECTION 31 05 19.23
GEOSYNTHETIC CLAY LINER

PART 1: GENERAL

1.01 SUMMARY

- A. Work under this section includes installation of the geosynthetic clay liner (GCL) for the Dry Stack facility.
- B. This specification covers the technical requirements for the furnishing and Installation of the GCL described herein. All materials shall meet or exceed the requirements of this specification, and all work shall be performed in accordance with the procedures provided in these project specifications.

1.02 REFERENCES

- A. Latest edition of the following American Society for Testing and Materials (ASTM) standards:
 - 1. ASTM D 4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
 - 2. ASTM D 4643 Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
 - 3. ASTM D 5084 Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
 - 4. ASTM D 5261 Standard Test Method for Measuring Mass Per Unit Area of Geotextiles
 - 5. ASTM D 5321 Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
 - 6. ASTM D 5887 Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter
 - 7. ASTM D 5888 Standard Guide for Storage and Handling of Geosynthetic Clay Liners
 - 8. ASTM D 5889 Standard Practice for Quality Control of Geosynthetic Clay Liners
 - 9. ASTM D 5890 Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners
 - 10. ASTM D 5891 Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners
- B. Latest edition of the following Geosynthetic Research Institute (GRI) standard:
 - 1. GCL3 - Test Methods, Required Properties, and Testing Frequencies of Geosynthetic Clay Liners (GCLs)

1.03 DEFINITIONS

- A. Geosynthetic Clay Liner (GCL). A factory-manufactured hydraulic barrier consisting of sodium bentonite clay sandwiched between, supported, and encapsulated by two geotextiles, held together by needlepunching.
- B. Geomembrane. An essentially impermeable geosynthetic composed of one or more geosynthetic sheets.

- C. Geotextile. A semi-permeable woven or nonwoven fabric, comprised solely of textiles, used to contain the bentonite used in a GCL.
- D. Sodium Bentonite. The high swelling clay component of GCLs consisting primarily of the mineral Montmorillonite.
- E. Needlepunching. A GCL manufacturing process whereby boards of barbed needles incorporate the staple fibers from a nonwoven geotextile, through a sodium bentonite clay layer, into the matrix of a second geotextile layer.
- F. Minimum Average Roll Value (MARV). The minimum average value of the material in a particular lot calculated as the mean of the tested values minus two standard deviations providing a 95-percent confidence level.
- G. Overlap. Where two adjacent GCL panels contact, the distance measuring perpendicular from the overlying edge of one panel to the underlying edge of the other.

1.04 SUBMITTALS

- A. Three copies of the project submittals shall be forwarded to Owner or Owner's Representative as designated below.
- B. Prior to Deployment. The following information shall be submitted by the Lining Contractor to Owner or Owner's Representative prior to the deployment of any GCL material to ensure that the materials and subgrade preparation meet the requirements of this specification:
 - 1. Conceptual description of the proposed plan for placement of the GCL panels over the area of installation.
 - 2. GCL Manufacturer's Quality Control Certifications.
 - 3. GCL Manufacturer's Quality Control Plan for documenting compliance to Sections 2.1 and 2.2 of these specifications.
 - 4. GCL Manufacturer's historical data for
 - a. 10,000-hour creep shear testing per Section 2.1.
 - b. Seam flow data at 2 psi confining pressure per Section 2.1 E.
 - 5. Certifications of subgrade acceptance for each area covered by GCL, signed by the earthwork Contractor and Owner's Representative.
 - 6. A copy of GCL Manufacturer's ISO quality Certificate of Registration.
- C. At the Engineer's or Owner's request the Contractor shall furnish:
 - 1. A representative sample of the GCL.
 - 2. A project reference list for the GCL consisting of the principal details of at least 10 projects totaling at least 10 million square feet (100,000 square meters) in size.
- D. Upon shipment, Contractor shall furnish the GCL Manufacturer's Quality Assurance/Quality Control (QA/QC) certifications to verify that the materials supplied for the project are in accordance with the requirements of this specification.
- E. As installation proceeds, Contractor shall submit certificates of subgrade acceptance, signed by the Contractor and Construction Quality Assurance (CQA) Inspector (see Sections 1.6 and 3.4) for each area that is covered by the GCL.

1.05 QUALIFICATIONS

- A. The GCL Manufacturer, Installer CQA Inspector shall all be skilled in accordance with the following experience requirements. Any exceptions must be approved by Owner prior to the project bid.
- B. GCL Manufacturer. The GCL manufacturer selected for use on this project shall have successfully produced at least 300 million square feet (30 million square meters) of needlepunched GCL product within the past three years with 3.5 lb/in (610 N/m) peel strength. The manufacturing facility must have produced at least 1 million square feet (100,000 square meters) of GCL within the past 5 years in order to ensure consistency in material and workmanship. The following GCL suppliers are approved for this project (other suppliers may be acceptable, provided Engineer approval is obtained):
 - 1. CETCO Lining Technologies
 - 2. AGRU America
- C. Contractor request for approval of alternate supplier (if any) must be submitted to Owner. Contractor must obtain Owner's written approval of alternate supplier in order to include alternate in Bid.
- D. GCL Installer. The installer shall provide to Owner sufficient evidence of installation experience and competence with the specified geosynthetic materials.
 - 1. GCL Only Installation. The GCL installer shall demonstrate a minimum of 1,000,000 square feet (100,000 square meters) of GCL installation experience, shall provide sufficient evidence of installation experience and competence with other geosynthetics or shall demonstrate an acceptable level of training and supervision will be utilized in order to ensure the quality of the installation.
 - 2. Multi-Component Composite Liner System. The GCL shall be installed by the lining contractor responsible for the installation of the overlying geomembrane liner. The GCL/geomembrane lining contractor shall demonstrate a minimum of 1,000,000 square feet of successfully completed multi-component composite liner installation experience or shall provide sufficient evidence of the appropriate level of installation experience and competence with other geosynthetics.

1.06 CONSTRUCTION QUALITY ASSURANCE (CQA)

- A. The Owner and Engineer shall provide a third-party inspector for CQA of the GCL installation. The inspector shall be an individual or company who is independent from the manufacturer and installer, who shall be responsible for monitoring and documenting activities related to the CQA of the GCL, throughout installation. The inspector shall have provided CQA services for the installation of the proposed or similar GCL for at least 5 completed projects totaling not less than 1 million square feet (100,000 square meters).
- B. Testing of the GCL, as necessary to support the CQA effort, shall be performed by a third-party laboratory retained by the Contractor and independent from the GCL manufacturer and installer. The laboratory shall have provided GCL CQA testing of the proposed or similar GCL for at least 5 completed projects totaling not less than 1 million square feet (100,000 square meters).
- C. CQA shall be provided in accordance with the GCL CQA Manual provided by the engineer.

1.07 WARRANTY

- A. GCL material as well as installation warranties provided by the manufacturer and installer shall be made a part of the final submittal documents.



- B. The installer of the GCL material shall provide a one-year installation workmanship warranty, repairing and or replacing any material not installed in full compliance with the requirements of the specification.

PART 2: PRODUCTS

- A. The GCL shall consist of a layer of granular sodium bentonite clay needlepunched between two geotextiles and shall comply with all criteria listed in this Section.
- B. Bentonite shall be a high-swelling sodium bentonite, with a minimum swell index of 24 mL/2g and a maximum fluid loss of 18 mL. Bentonite shall be CG-50 granular bentonite, mined and processed by American Colloid Company, or Engineer approved equivalent.
- C. Bentonite shall have a granular consistency (1 percent max. passing a No. 200 sieve [75 µm]), to ensure uniform distribution throughout the GCL and minimal edge loss during handling and installation.
- D. Prior to using an alternate GCL, the Contractor must furnish independent test results demonstrating that the proposed alternate material meets all requirements of this specification. Contractor must also provide evidence of successful use of the proposed alternate material on past similar projects. This evidence can include past direct shear results against similar materials under similar site conditions, and/or past permeability/compatibility test results with a similar leachate or waste stream. The Contractor also must obtain prior approval of the alternative GCL by the Engineer.

2.01 GCL MATERIALS

- A. Acceptable GCL products are Bentomat® DN, as manufactured by CETCO, 2870 Forbs Avenue, Hoffman Estates, Illinois 60192 USA (800-527-9948), or an engineer-approved equal.
- B. The GCL and its components shall have the properties shown in the GCL Properties Table.
- C. The moisture content of the bentonite in the finished GCL shall be between 20 and 40 percent, to ensure uniform bentonite distribution, consistent needlepunch density, and adequate electrical conductivity to maximize leak location survey sensitivity.
- D. GCL shall be needlepunch-reinforced, with a minimum peel strength of 3.5 lb/in (610 N/m). To maximize large-displacement shear strength, GCL reinforcement shall be achieved solely through needepunching, without any supplemental heat treatment.
- E. The GCL shall have 10,000-hour test data for large-scale constant-load (creep) shear testing under hydrated conditions. The displacement shall be 0.07 in. (1.8 mm) or less at a constant shear load of 250 psf (12 kPa) and a normal load of 500 psf (24 kPa).
- F. The GCL shall have seam test data from an independent laboratory showing that the seam flow with a grooved cut in one of the nonwoven geotextiles is less than 1×10^{-8} m³/m²/s at 2 psi hydraulic pressure.
- G. G. The minimum acceptable dimensions of full-size GCL panels shall be 150 feet (45.7 m) in length. Short rolls (those manufactured to a length greater than 70 feet (21 m) but less than a full-length roll) may be supplied at a rate no greater than 3 per truckload or 3 rolls every 36,000 square feet (3,500 square meters) of GCL, whichever is less.
- H. A 6-inch (150-mm) overlap guideline shall be imprinted on both edges of the upper geotextile component of the GCL as a means for providing quality assurance of the overlap dimension. Lines shall be printed in easily visible, non-toxic ink.
- I. GCL shall meet the requirements of GRI – GCL3 for Non-Reinforced GCL.

2.02 PRODUCT QUALITY DOCUMENTATION

- A. The GCL shall be tested for compliance with this specification by the test methods and frequencies indicated on the material specification. GCL materials may be tested pre-approved at the manufacturing location.
1. Manufacturer Quality Control Certification. Quality Control certificates shall be issued by the GCL manufacturer to Owner or Owner's Representative for each delivery of material. The certifications shall be signed by the quality control manager of the GCL manufacturer or other responsible party and shall include the following information:
 - a. Shipment Packing List. A list indicating the rolls shipped on a particular truckload.
 - b. Bill of Lading. The shipping documents for the truck used for the shipment.
 - c. Letter of Certification. The letter indicating the material is in conformance with the physical properties specified.
 - d. Physical Properties Sheet. The material specification for the GCL supplied in accordance with this specification.
 2. Manufacturer Quality Control Submittal. Quality Control submittals shall be issued by the GCL Manufacturer to Owner or Owner's Representative. The submittals shall include the following information:
 - a. Bentonite Manufacturer Certification. Bentonite Manufacturer quality documentation for the particular lot of clay used in the production of the rolls delivered, demonstrating compliance with the swell index and fluid loss values shown in the GCL Properties Table.
 - b. Geotextile Manufacturer Certification. Geotextile manufacturer quality control documentation for the particular lots of geotextiles used in the production of the rolls delivered.
 - c. GCL Manufacturer Tracking List. Cross-referencing list delineating the corresponding geotextile and bentonite lots for the materials used in the production of the rolls delivered.
 - d. Manufacturing Quality Control Data. The manufacturing quality control test data indicating the actual test values obtained when tested at the appropriate frequencies for the properties specified.
 - e. GCL lot and roll numbers supplied for the project (with corresponding shipping information).

2.03 DIMENSIONS

- A. The minimum acceptable dimensions for the GCL panels shall be 15 feet wide and 125 feet long. Short rolls (rolls less than 125 feet long) may be supplied, but at a rate not to exceed 5-percent of the total square footage produced for this project.
- B. A minimum overlap guide-line and a construction match-line delineating the overlap zone shall be imprinted with non-toxic ink on both edges of the GCL panel to ensure the accuracy of the seam. The minimum overlap guideline shall indicate where the edge of the panel must be placed in order to achieve a full six inches of bentonite overlap for each panel.

2.04 PACKAGING

- A. All GCL rolls shall be packaged in moisture resistant plastic sleeves. The cardboard cores shall be sufficiently strong to resist collapse during transit and handling.

B. Prior to shipment, the manufacturer shall label each roll, both on the GCL roll and on the surface of the plastic protective sleeve. Labels shall be resistant to fading and moisture degradation to ensure legibility at the time of the installation. At a minimum the roll labels shall identify the following:

1. Product identification information (Manufacturer’s name and address, brand product code).
2. Length and width of roll
3. Total weight of roll
4. Type of GCL material
5. Production Lot number and Individual Roll number

2.05 ACCESSORY BENTONITE

A. Any accessory bentonite used for sealing seams, penetrations, or repairs, shall be the same granular bentonite as used in the production of the GCL itself and shall be recommended by the GCL Manufacturer. Seaming of GCLs shall be conducted in accordance with Manufacturer guidelines for each particular GCL.

2.06 GCL PROPERTIES TABLE

MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY	REQUIRED VALUES
Bentonite Swell Index ¹	ASTM D 5890	1 per 50 tonnes	24 mL/2g min.
Bentonite Fluid Loss ¹	ASTM D 5891	1 per 50 tonnes	18 mL max.
Bentonite Mass/Area ²	ASTM D 5993	40,000 ft ² (4,000 m ²)	0.75 lb/ft ² (3.6 kg/m ²) min.
GCL Tensile Strength ³	ASTM D 6768	200,000 ft ² (20,000 m ²)	50 lbs/in (88 N/cm) MARV
GCL Peel Strength ³	ASTM D 6496	40,000 ft ² (4,000 m ²)	3.5 lbs/in (6.1 N/cm) min.
GCL Index Flux ⁴	ASTM D 5887	Weekly	1x10 ⁻⁸ m ³ /m ² /sec max.
GCL Hydraulic Conductivity ⁴	ASTM D 5887	Weekly	5x10 ⁻⁹ cm/sec max.
GCL Hydrated Internal Shear Strength ⁵	ASTM D 5321 ASTM D 6243	Periodic	500 psf (24 kPa) typ. @ 200psf

Notes

¹ Bentonite property tests performed at a bentonite processing facility before shipment to Manufacturer’s GCL production facilities.
² Bentonite mass/area reported at 0 percent moisture content.
³ All tensile strength testing is performed in the machine direction using ASTM D 6768. All peel strength testing is performed using ASTM D 6496. Upon request, tensile and peel results can be reported per modified ASTM D 4632 using 4-inch grips.
⁴ Index flux and permeability testing with deaired distilled/deionized water at 80 psi (551kPa) cell pressure, 77 psi (531 kPa) headwater pressure and 75 psi (517 kPa) tailwater pressure. Reported value is equivalent to 925 gal/acre/day. This flux value is equivalent to a permeability of 5x10⁻⁹ cm/sec for typical GCL thickness. Actual flux values vary with field condition pressures. The last 20 weekly values prior the end of the production date of the supplied GCL may be provided.
⁵ Peak values measured at 200 psf (10 kPa) normal stress for a specimen hydrated for 48 hours. Site-specific materials, GCL products, and test conditions must be used to verify internal and interface strength of the proposed design.

PART 3: EXECUTION

3.01 EXECUTION

- A. The following installation procedures are as specific as possible while recognizing that the specific requirements of the project may necessitate minor modifications. Significant deviations from these procedures shall be pre-approved by Owner or Owner's Representative or other designated party.

3.02 SHIPPING AND HANDLING EQUIPMENT

- A. The party responsible for unloading the GCL shall contact the Manufacturer prior to shipment to determine the correct unloading methods and equipment if different from the pre-approved and specified methods.
- B. GCL must be supported during handling to ensure worker safety and prevent damage to the liner. Under approved circumstances only, shall the rolls be dragged, lifted from one end, lifted with only the forks of a lift truck or pushed to the ground from the delivery vehicle.
- C. Owner or Owner's Representative shall verify that Contractor's proper handling equipment exists which does not pose any danger to installation personnel or risk of damage or deformation to the liner material itself. Suitable handling equipment is described below:
 - 1. Spreader Bar Assembly. A spreader bar assembly shall include both a core pipe or bar and a spreader bar beam. The core pipe shall be used to uniformly support the roll when inserted through the GCL core while the spreader bar beam will prevent chains or straps from chafing the roll edges. The cardboard roll supplied with the GCL shall not be used in place of a steel core pipe.
 - 2. Stinger. A stinger is a rigid pipe or rod with one end directly connected to a forklift or other handling equipment. If a stinger is used, it should be fully inserted to its full length into the roll to prevent excessive bending of the roll when lifted.
 - 3. Roller Cradles. Roller cradles consist of two large diameter rollers spaced approximately 3 inches apart, which both support the GCL roll and allow it to freely unroll. The use of roller cradles shall be permitted if the rollers support the entire width of the GCL roll.
 - 4. Straps. Straps may be used to support the ends of spreader bars but are not recommended as the primary support mechanism. As straps may damage the GCL where wrapped around the roll, and generally do not provide sufficient uniform support to prevent roll bending or deformation, great care must be exercised when this option is used.
- D. GCL Inspection Upon Delivery. Each roll shall be visually inspected when unloaded to determine if any packaging or material has been damaged during transit. Repairs to damaged GCL shall be performed in accordance with this specification.
 - 1. Rolls exhibiting damage shall be marked and set aside for closer examination during deployment.
 - 2. Minor rips or tears in the plastic packaging shall be repaired with moisture resistant tape prior to being placed in storage to prevent moisture damage.
 - 3. GCL rolls delivered to the project site shall be only those indicated on GCL manufacturing quality control certificates.
- E. Storage / Stockpiling / Staging
 - 1. Storage of the GCL rolls shall be the responsibility of the installer or other designated party. All GCL rolls shall be stock-piled and maintained dry in a flat location area away

from high-traffic areas but sufficiently close to the active work area to minimize handling.

2. For needlepunched GCLs, the presence of free-flowing water within the packaging shall require that roll to be set aside for further examination to ascertain the extent of damage, if any. Free-flowing water within the packaging of unreinforced GCLs shall be cause for rejection of that roll.
3. GCL should be stored no higher than three to four rolls high or limited to the height at which the handling apparatus may be safely handled by installation personnel. Stacks or tiers of rolls should be situated in a manner that prevents sliding or rolling by “choking” the bottom layer of rolls.
4. Rolls shall not be stacked on uneven or discontinuous surfaces in order to prevent bending, deformation, damage to the GCL or cause difficulty inserting the core pipe.
5. An additional tarpaulin or plastic sheet shall be used over the stacked rolls to provide extra protection for GCL material stored outdoors.
6. Bagged bentonite material shall be stored and tarped next to GCL rolls unless other more protective measures are available. Bags shall be stored on pallets or other suitably dry surface which will prevent undue prehydration.
7. The integrity and legibility of the labels shall be preserved during storage.

3.03 EXAMINATION

- A. The earthen subgrade shall be continuously inspected, approved and certified in writing prior to GCL placement.
- B. Submit certification to Owner or Owner’s Representative prior to installing GCL.

3.04 SUBGRADE PREPARATION

- A. Earthen Subgrade. The surface upon which the GCL will be installed shall be inspected by the installer and certified by the earthwork contractor to be in accordance with the following:
 1. Subgrade soils should range between fines and 1 inch (25mm).
 2. Finished surface of Earthen Subgrade shall be free of all angular stones, and free of all angular stones greater than ½ inch (12 mm) protruding from the finished surface.
 3. Subgrade surface shall be smooth rolled to achieve a finished surface suitable for placement of GCL.
 4. The surfaces to be lined shall be smooth and free of any debris, vegetation, roots, sticks, sharp rocks, or other deleterious materials as well as free of any voids, large cracks or standing water or ice.
 5. Directly prior to GCL deployment, the subgrade shall be final-graded to fill in all voids or cracks and then smooth-rolled to provide the best practicable surface for the GCL. At completion of this activity, no wheel ruts, footprints or other irregularities shall exist in the subgrade. Furthermore, all protrusions extending more than ½ inch (12 mm) from the surface shall either be removed, crushed or pushed into the surface with a smooth-drum compactor.
 6. On a continuing basis, the project CQA inspector shall certify acceptance of the subgrade before GCL placement.

7. It shall be the installer's responsibility thereafter to indicate to the Engineer any change in the condition of the subgrade that could cause the subgrade to be out of compliance with any of the requirements listed in this Section.

B. Anchor Trench (if necessary). An anchor trench shall be excavated by the earthwork contractor or liner installer to the lines and grades shown on the project Drawings.

1. The anchor trench shall be constructed free of sharp edges or corners and maintained in a dry condition. No loose soil shall be permitted beneath the GCL within the trench.
2. The anchor trench shall be inspected as well as approved by Owner or Owner's Representative prior to GCL placement, backfilling and compaction of the anchor key material.

3.05 GCL PLACEMENT

- A. The areas to be lined with GCL shall be agreed upon by the Installer and the Engineer prior to installation.
- B. GCL rolls should be delivered to the working area of the site in their original packaging. Immediately prior to deployment, the packaging should be carefully removed without damaging the GCL. The orientation of the GCL (i.e., which side faces up) should be in accordance with the Engineer's recommendations.
- C. Equipment, which could damage the GCL, shall not be allowed to travel directly on it. If the installation equipment causes rutting of the subgrade, the subgrade must be restored to its originally accepted condition before placement continues.
- D. Care must be taken to minimize the extent to which the GCL is dragged across the subgrade in order to avoid damage to the bottom surface of the GCL. A temporary geosynthetic subgrade covering commonly known as a slip sheet or rub sheet may be used to reduce friction damage during placement.
- E. The GCL panels shall be placed parallel to the direction of the slope.
- F. All GCL panels should lie flat on the underlying surface, with no wrinkles or fold, especially at the exposed edges of the panels.
- G. Only as much GCL shall be deployed as can be covered at the end of the working day with soil, a geomembrane, or a temporary waterproof tarpaulin. The GCL shall not be left uncovered overnight. If the GCL is hydrated when no confining stress is present, it may be necessary to remove and replace the hydrated material. The project Engineer, CQA inspector, and GCL supplier should be consulted for specific guidance if premature hydration occurs.

3.06 ANCHORAGE

- A. All GCL material installed on slopes shall be anchored to prevent potential GCL panel movement.
- B. Standard Anchor. The GCL shall be placed into and across the base of the excavated trench, stopping at the back wall of the excavation.
- C. The front edge of the anchor trench should be rounded so as to eliminate any sharp corners.
- D. Loose soil should be removed from the floor of the trench.
- E. "Run-Out" Anchor. On gentle slopes or locations where it is difficult to create an anchor trench, the GCL may alternatively be anchored by a material run-out past the crest of the slope. The length of the run-out shall be pre-approved by Owner or Owner's Representative prior to the use of this method.

3.07 SEAMING

- A. The GCL seams are constructed by overlapping adjacent panel edges and ends. Care should be taken to ensure that the overlap zone is not contaminated with loose soil or other debris.
- B. Longitudinal seams should be overlapped a minimum of 6 inches (150 mm). If the GCL is manufactured with a grooved cut in the nonwoven geotextile that allows bentonite to freely extrude into the longitudinal overlap, then no bentonite-enhanced seam is required for this overlap. If the GCL does not have a grooved cut in one of the nonwoven geotextiles in the longitudinal overlap, then longitudinal bentonite-enhanced seams are required as described below.
- C. End-of-roll overlapped seams should be constructed with a minimum overlap of 24 inches (600 mm). Seams at the ends of the panels should be constructed such that they are shingled in the direction of the grade to prevent the potential for runoff flow to enter the overlap zone. End-of-roll overlapped seams for all reinforced GCL seams require bentonite-enhanced seams as described below.
- D. Bentonite-enhanced seams are constructed between the overlapping adjacent panels described above. The underlying edge of the longitudinal overlap is exposed and then a continuous bead of granular sodium bentonite is applied along a zone defined by the edge of the underlying panel and the 6-inch (150-mm) line. A similar bead of granular sodium bentonite is applied at the end-of-roll overlap. The granular bentonite shall be applied at a minimum application rate of one quarter pound per lineal foot (0.4 kg/m).
- E. Cyclical wetting and drying of GCL covered only with geomembrane can cause overlap separation. Soil cover should be placed promptly whenever possible. Geomembranes should be covered with a white geotextile and/or operations layer without delay to minimize the intensity of wet-dry cycling. If there is the potential for unconfined cyclic wetting and drying over an extended period of time, the longitudinal seam overlaps should be increased based on the project engineer's recommendations.
- F. To avoid seam separation, the GCL should not be put in excessive tension by the weight or expansion of textured geomembrane on steep slopes. The Engineer should be consulted about the potential for GCL tension to develop.

3.08 DETAIL WORK

- A. The GCL shall be sealed around penetrations and embedded structures embedded in accordance with the design drawings and the GCL Manufacturer.
- B. Cutting the GCL shall be performed using a sharp utility knife. Frequent blade changes are recommended to avoid damage to the geotextile components of the GCL during the cutting process.

3.09 DAMAGE REPAIR

- A. Prior to cover material placement, damage to the GCL shall be identified and repaired by the installer. Damage is defined as any rips or tears in the geotextiles, delamination of geotextiles or a displaced panel.
 - 1. Rip and Tear Repair (Flat Surfaces). Rips or tears may be repaired by completely exposing the affected area, removing all foreign objects or soil, and by then placing a patch cut from unused GCL over the damage (damaged material may be left in place), with a minimum overlap of 12 inches on all edges. Accessory bentonite should be placed between the patch edges and the repaired material at a rate of a quarter pound per lineal foot of edge spread in a continuous 6-inch fillet.

2. Rip and Tear Repair (Slopes). Damaged GCL material on slopes shall be repaired by the same procedures above, however, the edges of the patch should also be adhered to the repaired liner with an adhesive to keep the patch in position during backfill or cover operations.
3. Displaced Panels. Displaced panels shall be adjusted to the correct position and orientation. The adjusted panel shall then be inspected for any geotextile damage or bentonite loss. Damage shall be repaired by the above procedure.
4. Premature Hydration. If the GCL is prematurely hydrated, installer shall notify the QA/QC technician and Owner or Owner's Representative for a site-specific determination as to whether the material is acceptable or if alternative measures must be taken to ensure the quality of the design - dependent upon the degree of damage.

3.10 COVER MATERIAL

- A. The cover materials shall be compatible as well as suitable for use over the GCL and placed in a manner appropriate to the particular subgrade. Regardless of the cover material, the uncovered edge of GCL panels shall be protected at the end of the working day with a waterproof sheet which is secured adequately with ballast.
- B. Earthen Cover Soil. If the cover material is soil or gravel, a minimum thickness of 12-inches shall be placed over the GCL. The soil cover shall be free of sharp-edged stones greater than 1-inches in size.
 1. Equipment. Soil cover shall be placed with low ground pressure equipment. Care must be taken to avoid damaging the GCL by making sharp turns or pivots with equipment as well as sudden starts or stops.
 2. Placement. Soils may be placed on the GCL by pushing with a track dozer or by carefully placing it with a loader or a back-hoe. The use of scrapers or pans directly over the GCL is strictly prohibited.
 3. Thickness. A minimum thickness of 36 inches of cover shall be kept between heavy equipment and the GCL at all times, except when final-grading. No heavy vehicles should be driven directly on the GCL until the proper thickness of cover has been placed.
 4. Slope Placement. When covering GCL on sloped areas steeper than 4H:1V, cover should be pushed up-slope to minimize tension on the GCL.
- C. Geosynthetic Cover. Precautions shall be taken to prevent damage to the GCL by restricting the use of heavy equipment over the liner system.
 1. Equipment. Installation of the overlying geosynthetic component can be accomplished through the use of lightweight, rubber-tired equipment such as a four-wheel all-terrain vehicle (ATV). This vehicle can be driven directly on the GCL, provided the ATV makes no sudden stops, starts, or turns.
 2. Placement. Smooth HDPE may be dragged across the GCL surface with equipment or by hand labor during positioning. Similarly, the HDPE may be unrolled with the use of low ground pressure equipment.
 3. Use of Textured Liners. If a textured geomembrane is placed over the GCL, a slip sheet (such as 20-mil smooth HDPE) shall first be placed over the GCL in order to allow the geomembrane to slide into its proper position. Once the overlying geomembrane is

properly positioned, the slip-sheet shall be carefully removed paying close attention to avoiding any movement to the geomembrane.

END OF SECTION 31 05 19.23



SECTION 31 10 10
CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Clear, grub, remove, and dispose of trees, stumps, and debris within the designated limits of the roadways, channels, easements, and other designated areas.
- B. Related Sections (UDOT)
 - 1. Section 01355: Environmental Compliance
 - 2. Section 01571: Temporary Environmental Controls
 - 3. Section 02221: Remove Structure and Obstruction

1.02 REFERENCES

- A. Utah Department of Transportation Standard Specifications, 2023 Edition.

1.03 DEFINITIONS

- A. Clear – Remove and dispose of trees, stumps, logs, limbs, sticks, vegetation, debris, and other material on the natural ground surface.
- B. Grub – Remove and dispose of roots, buried logs, debris, organic matter, and other deleterious materials under the ground surface.

1.04 SEQUENCING AND SCHEDULING

- A. Obtain Notice to Proceed from Owner before beginning any clearing and grubbing operations.
- B. Provide staking for clearing and grubbing limits.
- C. Meet with Owner and Engineer to review all clearing and grubbing limits before starting any removal operations.

1.05 BASIS FOR COMPENSATION

- A. Compensation for all work performed under this section of these Specifications shall be as set forth in Section 01 22 00 of these Specifications.

PART 2 - PRODUCTS

- A. Not used

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify with the Engineer the vegetation or objects to be removed.
- B. Review work procedures with the Engineer.



- C. Schedule work carefully with consideration for property owners and general public.
- D. Refer to UDOT Section 01571 for temporary environmental measures.

3.02 VEGETATION REMOVAL

- A. Grub the areas 2 ft below natural ground, within the limits of clearing, of all stumps, roots, buried logs, and all other underground obstructions.
- B. Stumps, roots, and non-perishable solid objects may remain in cleared areas where the ground surface is:
 - 1. 2 ft or more above the natural ground.
 - 2. At least 2 ft away outside the slope stake lines.
- C. Completely grub stumps and roots where a structure is to be constructed, piles are to be driven, or unsuitable material is to be removed.

3.03 BACKFILLING

- A. Backfill all stump holes, cuts, depressions, and other holes resulting from clearing and grubbing within areas to receive fill, tailings, and/or liner.
 - 1. Compact backfilled areas to the density of the surrounding ground.
- B. Measure and pay separately for materials used for backfilling under Roadway Excavation or Borrow.
- C. Consider Roadway Excavation and Borrow as incidental to the work when these items are not included in the bid proposal.
 - 1. No separate measurement or payment made in this case.

3.04 DISPOSAL

- A. Dispose of material. Refer to UDOT Section 01355.
- B. Do not dispose of material within the designated roadbed.
- C. Outside of the Right-of-Way
 - 1. Acceptable when done according to prevailing laws including environmental laws, ordinances, regulations, and rules.
- D. Inside the Right-of-Way
 - 1. Bury material at locations specified by or acceptable to the Engineer.
 - 2. Use material to widen ground surface and flatten ground surface side slopes as approved by the Engineer.
 - 3. Cover disposed material with at least 2 ft of earth and grade to drain properly.
 - 4. Reduce wood to chips a maximum of ½ inch thick for mulching cut and fill slopes.
 - a. Chips may be buried or distributed uniformly on the ground surface and mixed with the underlying earth so the mixtures will not sustain burning.

3.05 TREE REMOVAL

- A. Refer to UDOT Section 02221



3.06 PROTECTION

- A. Land monuments, property markers, or official datum points
 - 1. Protect until their removal is approved.
 - 2. Reference for re-establishment before removing.
- B. Protect trees from damage to roots and branches if they are designated to remain.
- C. Protect other vegetation and objects designated to remain.

3.07 FIELD QUALITY CONTROL

- A. Establish and maintain quality control for work under this section to assure compliance with contract requirements and maintain records of quality control for all construction operations including but not limited to the following:
 - 1. Clearing.
 - 2. Grubbing and backfilling holes.
 - 3. Disposal.
 - 4. Protection of vegetation and trees outside the clearing limits.
- B. A copy of the quality control records, including inspections and tests, as well as the records of corrective action taken, shall be submitted.

END OF SECTION 31 10 10



SECTION 31 23 19
DEWATERING

PART 1: GENERAL

1.01 SUMMARY

- A. Surface water runoff volumes will vary from area to area and season to season and dewatering may be required for installation of this project.
- B. Dewatering activities shall be coordinated with Owner.

1.02 PERFORMANCE REQUIREMENTS

- A. Water shall be discharged in accordance with the Site's active permits. Coordinate with Owner for approved discharge locations.
- B. Water cannot be pumped outside of the permit footprint, all pond water must be contained within its respective limits.
- C. Maintain all surface water runoff within the permit boundary; carry-over of this runoff off site is strictly prohibited.
- D. Control of water from the borrow sources outside of the permit area shall not violate standards set forth in the Clean Water Act of 1977, nor violate the standards of other applicable Laws and Regulations.

PART 2: PRODUCTS

2.01 EQUIPMENT

- A. Contractor shall be responsible to have pumps, hoses, and other equipment necessary for dewatering.

PART 3: EXECUTION

3.01 APPLICATION

- A. Coordinate all dewatering activities with Owner's Construction Manager.
- B. Areas shall be dewatered as necessary so construction of subgrade, geomembrane cover, cover soils, ditches, and other structures are completed under dry conditions.
- C. Discharge water shall be routed to a location determined by Owner. Discharge water from dewatering shall be discharged in such a manner as not to cause erosion or damage to adjacent property.
- D. Surface water runoff shall be directed away from the permit area and contained within the permit boundary.
- E. Contractor shall be fully responsible and liable for all damages which may result from failure to adequately keep excavations dewatered.
- F. Keep excavation free from surface and groundwater through all stages of construction.



1. Maintain adequate drainage during all stages of construction through pumping, pipe culverts, and drainage ditches.
2. Provide temporary facilities when interrupting items such as irrigation systems, sewers, and under drainages.

END OF SECTION 31 23 19



SECTION 31 25 00

EROSION AND SEDIMENTATION CONTROLS

PART 1: GENERAL

1.01 SUMMARY

- A. Temporary environmental controls to control erosion and prevent sediment-laden runoff from leaving the construction site and areas under the Contractor's control.

1.02 REFERENCES

- A. The following are complete titles of references cited in this Section:
 1. American Association of State Highway and Transportation Officials hereafter referred to as ASSHTO.
 2. Utah Department of Transportation Standard Specifications for Road and Bridge Construction, 2023 Edition, hereafter referred to as UDOT Standard Specifications.
 3. Utah Pollutant Discharge Elimination System, Utah Construction General Permit (CGP) and UDOT Municipal Separate Storm Sewer System (MS4) Permit.
 4. AASHTO M 288: Geotextile Specifications for Highway Applications
 5. AASHTO Construction Stormwater Field Guide
 6. ASTM D 4355: Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
 7. ASTM D 4491: Water Permeability of Geotextiles by Permittivity
 8. ASTM D 4751: Determining Apparent Opening Size of a Geotextile

1.03 DEFINITIONS

- A. Check Dam – A fiber roll or stone structure placed across a roadside ditch to temporarily protect ditch from channel erosion by slowing velocity of stormwater runoff and intercepting and trapping sediment.
- B. Disturbed Area – Areas within a construction site where existing vegetative cover, or existing stabilized areas, have been removed or altered and exposed soils are susceptible to increased erosion and sedimentation.
- C. Drop-Inlet Barrier – A barrier placed around a storm drain inlet grate, situated outside of roadway pavement condition, that is designed to intercept and trap sediment-laden runoff before entering the storm drain system.



- D. Fiber Roll – Wood excelsior, rice or wheat straw or coconut fibers rolled or bound with netting to form a tube-like structure used to intercept and trap sediment.
- E. Final Stabilization – Procedures and controls completed as the final measure to protect disturbed areas of a construction site from erosion and sedimentation until vegetation regrowth occurs to provide ultimate erosion protection.
 - 1. Includes work within areas to be vegetated such as establishing final grades, placing topsoil, incorporating seed; roughening slopes by walking track-mounted equipment up and down slopes; applying rolled and hydraulic erosion control products; and installing other landscape treatments to protect exposed soils from erosion.
 - 2. Includes work within areas intended to remain unvegetated such as placing final pavement; installing stone, gravel and other stable material that will prevent erosion of underlying soil.
- F. Gutter-Inlet Barrier – A device designed and prefabricated to secure to the top, envelop or hang below a storm drain inlet grate, situated within roadway pavement condition, that keeps sediment and debris from entering the storm drain system.
- G. Pipe-Inlet Barrier – A barrier placed at a pipe inlet that intercepts and traps sediment before entering the pipe.
- H. Sediment Trap – A small temporary excavated basin installed at low points on a construction site designed to trap sediment-laden runoff to allow sediment to settle out before leaving site.
- I. Silt Fence – A geotextile fabric fence used to intercept and trap sediment in a sheet flow situation, along the perimeter of a disturbed area.
- J. Slope Drain – A polyethylene pipe temporarily placed on a slope to collect and transport storm runoff down the face of a slope until permanent drainage facilities are installed or vegetation growth is adequate.
- K. Stabilized Construction Entrance – A layer of stone, underlined with a geotextile fabric, placed at a construction site entrance or exit used to reduce the amount of sediment or mud tracked onto adjacent paved roadways by vehicles leaving the construction site.
- L. Fiber Roll or Straw Bale Barrier – Temporary barriers installed by securing fiber rolls or straw bales end to end along perimeter of a disturbed area designed to intercept and slow sediment laden runoff before it leaves a construction site.
- M. Temporary Berm – A ridge of compacted soil with or without a shallow ditch that diverts stormwater runoff from a slope to a controlled release point.
- N. Temporary Environmental Fence – A high-visibility fence barrier used to delineate and prevent encroachment on sensitive areas.

PART 2: PRODUCTS

2.01 TEMPORARY ENVIRONMENTAL CONTROLS



A. Fiber Roll

1. Diameter (minimum weight per linear foot)
 - i. 18 inches (3 lb per linear foot)
 - ii. 12 inches (2 lb per linear foot)
 - iii. 9 inches (1 lb per linear foot)
2. Functional Longevity – 24 months minimum (includes netting material).
3. Matrix material – Wood excelsior, rice or wheat straw, and coconut fibers (coir) or in combination.
 - i. Material must be weed free.
4. Netting – UV stabilized synthetic or coir material, with 1 inch maximum opening size, secured at end for matrix containment.
5. Wood Stakes
 - i. 18-inch Fiber Roll – $\frac{3}{4}$ inches by $1\frac{1}{2}$ inches by 3 feet minimum dimensions.
 - ii. 12-inch Fiber Roll – $\frac{3}{4}$ inches by $1\frac{1}{2}$ inches by 18 inches minimum dimensions.
 - iii. 9-inch Fiber Roll – $\frac{3}{4}$ inches by $1\frac{1}{2}$ inches by 18 inches minimum dimensions.

B. Silt Fence. Refer to EN Series Standard Drawings.

1. Silt Fence Fabric – 3-foot minimum width, conforming to Table 7 of AASHTO M 288.
2. Wood Post – $1\frac{1}{2}$ inches by $1\frac{1}{2}$ inches by 4 feet minimum dimensions.
3. Fasteners – Staples, wire, cable ties, or nails sufficient to maintain fabric attachment to post.

C. Check Dam. Refer to EN Series Standard Drawings

1. Fiber Roll – 12-inch diameter, or
2. Stone – Angular, well-graded 2- to 6-inch diameter.

D. Drop-Inlet Barrier. Refer to EN Series Standard Drawings

1. Fiber Roll – 18-inch diameter, or
2. Silt Fence
 - i. Wooden Support Frame – 2-inch by 4-inch (nominal) wood studs.

E. Gutter-Inlet Barrier

1. Apparent Opening Size (ASTM D 4751) – between 20 and 40 sieve.
2. UV Resistance (ASTM D 4355) – 65 percent minimum.
3. Flow Rate (ASTM D 4491) – 100 gpm/ft² minimum.
4. Filter Material – Monofilament, woven or nonwoven geotextile.
5. Provide protection to entire inlet opening.
6. Types:
 - i. Above Inlet Grate
 1. Mount securely to the top side of the inlet grate at each corner with cable ties, wire or similar.
 - ii. Inlet Cover Grate
 1. Sewn geotextile fabric that envelopes entire inlet grate.
 2. Must have built-in lifting straps or other device to allow removal of inlet grate and barrier.
 - iii. Below Inlet Grate
 1. Mount device securely to the inlet grate or have independent frame that allows geotextile bag to hang below grate to capture runoff.
 2. Must be designed with a bypass feature that allows stormwater to be conveyed into the conveyance system when geotextile is filled to capacity.
 3. Must be able to remove from storm drain inlet and maintain device without dumping captured sediment into the storm drain system.

F. Pipe-Inlet Barrier. Refer to EN Series Standard Drawings.

1. Fiber Roll – 18-inch diameter, or
2. Stone – Angular, well-graded 2- to 6-inch diameter.

G. Temporary Berm. Refer to EN Series Standard Drawings.

1. Compacted existing soil.
2. Free of debris, such as trees, brush, obstructions, and other objectionable material that will not allow for compaction of berm material.

H. Temporary Environmental Fence

1. Fence Fabric

- i. Polyethylene, high-density (HDPE) and UV stabilized
- ii. Height – 4 ft minimum
- iii. Color – Orange

2. Posts

- i. Wood Post – 1½ inches by 1½ inches by 4 feet minimum dimensions.
- ii. Fasteners – Staples, wire, cable ties or nails sufficient to maintain fabric attachment to post.

I. Sediment Trap. Refer to EN Series Standard Drawings.

1. Stone – Angular, well-graded 6- to 12-inch diameter

J. Slope Drain. Refer to EN Series Standard Drawings.

1. 12-inch-diameter single-wall polyethylene pipe
2. Polyethylene pipe end section
3. Stone – Angular, well-graded 6- to 12-inch diameter
4. Wood Stakes – 1½ inches by 1½ inches by 3 feet minimum dimensions.

K. Stabilized Construction Entrance. Refer to EN Series Standard Drawings.

1. Stone – Crushed aggregate, well-graded 2- to 3-inch diameter.
2. Geotextile Fabric (Separation) – Refer to Section 02075.

L. Fiber Roll Barrier. Refer to EN Series Standard Drawings.

1. Fiber Roll – 18-inch diameter.

M. Straw Bale Barrier. Refer to EN Series Standard Drawings.

1. Straw Bales – Certified weed free straw bales by the Utah Department of Agriculture.
2. Wood Stakes – 1½ inches by 1½ inches by 4 feet minimum dimensions.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Install appropriate controls as shown before beginning earth disturbing activities.



- B. Refer to installation procedures outlined in EN Series Standard Drawings and the AASHTO Construction Stormwater Field Guide.
- C. Install temporary environmental fence in the required locations before construction activities begin.
 - 1. Install posts at a 12-ft maximum spacing so the fence does not sag more than 2 inches between posts.
 - 2. Weave the fence over the support posts alternating every two loops and secure it to the posts with fasteners.
- D. Install Gutter-Inlet Barrier according to manufacturer's recommendations.

3.02 INSPECTION

- A. Check installed controls before and after each rain event to verify proper working function and compliance with the CGP.
- B. Replace controls that are not properly working to prevent erosion and sedimentation.

3.03 MAINTENANCE

- A. Maintain controls to function properly until surrounding disturbed areas have met final stabilization measures.
- B. Move accumulated sediments from controls when depth reaches 50 percent of the control height or when it interferes with the performance of the control.
- C. Properly dispose of accumulated sediment.

3.04 REMOVAL

- A. Remove temporary environmental controls when surrounding disturbed areas have met final stabilization measures, except as follows:
 - 1. Do not remove perimeter controls, such as silt fence, fiber rolls or straw bales, when they protect a wetland or waterway unless the surrounding area meets final stabilization requirements identified within the CGP.
 - 2. When the Engineer determines that controls should remain in place.
- B. Remove temporary environmental fence and posts upon completion of construction.

END OF SECTION 31 25 00

SECTION 31 37 00

RIPRAP

PART 1: GENERAL

1.01 SUMMARY

- A. Work included in this section includes providing the riprap and associated materials as shown on the Drawings.

1.02 REFERENCES

- A. AASHTO T 85: Specific Gravity and Absorption of Coarse Aggregate
- B. AASHTO T 96: Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- C. AASHTO T 104: Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
- D. Utah Department of Transportation Standard Specifications for Construction, 2023 Edition, hereafter referred to as UDOT Standard Specifications.

1.03 SECTIONS

- A. Section 32 05 19.13 Geotextiles

1.04 DEFINITIONS

- A. D_{50} - The median rock diameter within a riprap mass for which 50 percent of the rocks by mass are smaller and 50 percent by mass are larger.
- B. Rock diameter - The equivalent diameter (average width) of a given rock.

1.05 SUBMITTALS

- A. The rock source, gradation, and laboratory values for the properties in Table 1, for information.

PART 2: PRODUCTS

2.01 RIPRAP

A. Rock

1. Angular, hard, durable, resistant to weathering and free from seams, cracks, and other structural defects.
 - i. Do not use shale, mudstone, or other rock that may break into smaller pieces in the process of handling and placing.
 - ii. Do not use concrete or asphalt rubble.

2. Meet the properties listed in Table 1.

Table 1 – Physical Properties		
Property	Value	Test Method
Specific Gravity	2.5 min	AASHTO T 85
Absorption	2% max	AASHTO T 85
Soundness of Aggregate using Sodium Sulfate or Magnesium Sulfate	12% max or 17.5% max	AASHTO T 104
Resistance to Degradation	40% max	AASHTO T 96

3. Well graded rock throughout the riprap layer to produce a dense mass. Refer to Table 2 for riprap gradation limits.
 - i. Control gradation by sample measurement or by visual inspection, as determined by the Engineer.

Table 2 – Riprap Gradation Limits	
Rock Diameter Range (ft)	Percent of Gradation Smaller Than
1.5D ₅₀ to 1.7D ₅₀	100
1.2D ₅₀ to 1.4D ₅₀	85
1.0D ₅₀ to 1.15D ₅₀	50
0.4D ₅₀ to 0.6D ₅₀	15

2.02 RIPRAP GEOTEXTILE

- A. Refer to Section 32 05 19.13 Geotextiles.

PART 3: EXECUTION

3.01 PREPARATION

- A. Excavate and grade to provide a firm and uniform bearing surface.
- B. Install riprap geotextile as shown.

3.02 LOOSE RIPRAP

- A. Place rocks to provide a secure unsegregated dense mass.
 1. Distribute and manipulate the rocks so that the larger rocks are uniformly distributed and the smaller rocks serve to fill the spaces between the larger rocks.

3.03 INSTALLATION

- A. Place riprap in the locations and depths shown on the Drawings.
- B. Areas on which riprap are to be placed shall be graded and dressed to lines and grades shown on Drawings or as directed by Owner's Representative.
- C. Contractor shall place geotextile under riprap and cover completely. No geotextile shall be exposed along edges or under riprap. Contractor shall place riprap so geotextile is not damaged.
- D. Place riprap according to section 3.02 of this specification.

END OF SECTION 31 37 00

SECTION 32 05 19.13

GEOTEXTILES

PART 1: GENERAL

1.01 DESCRIPTION

- A. All Work included in this Section shall be performed in accordance with the following paragraphs and the provisions of the other Contract Documents.
- B. Work covered under this Section includes providing all materials, equipment, and labor necessary to install the Erosion Control Geotextile in the Leachate Pond and for geotextile underneath the geoweb reinforced ditches as shown on the Drawings, and any other application such as the rock construction entrance and other temporary erosion control that is not shown on the Drawings.

1.02 REFERENCES

- A. American Society for Testing and Material International, Current Edition, hereafter referred to as ASTM:
 - 1. ASTM D1777-Method for Measuring Thickness of Textile Materials.
 - 2. ASTM D3776-Test Methods for Mass per Unit Area (Weight) of Woven Fabric.
 - 3. ASTM D3786-Test Method for Hydraulic Bursting Strength of Knitted Goods and Non-woven Fabrics: Diaphragm Bursting Strength Tester Method.
 - 4. ASTM D4355-Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon Arc-Type Apparatus).
 - 5. ASTM D4533-Test Method for Trapezoid Tearing Strength of Geotextiles.
 - 6. ASTM D4632-Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - 7. ASTM D4751-Test Method for Determining the Apparent Opening Size of a Geotextile.
 - 8. ASTM D4833-Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
 - 9. ASTM D4833-Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
- B. American Association of State Highway and Transportation Officials, hereafter referred to as AASHTO:
 - 1. AASHTO M 288: Geotextile Specification for Highway Applications

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Roll Identification:
 - 1. Provide geotextile filter fabric in rolls protected by impermeable and opaque covers and

tagged with the following information:

- a. Manufacturer's name, address, and telephone number.
 - b. Product identification.
 - c. Lot number.
 - d. Roll number.
 - e. Roll dimensions.
2. Provide instructions on special handling during hauling and storage.
 3. Handle and protect product to ensure product is not damaged.
- B. Material will not be accepted on-site without Quality Control Certificates.

1.04 SUBMITTALS

- A. Submit quality control certificates from the manufacturer, representative of the rolls delivered to the Site. The document shall present test results for the physical properties specified below. A quality control certificate shall be submitted for each 50,000 square feet of continuously produced material. A quality control certificate shall be submitted for each roll of material that is not from a continuous production run for which a certificate has previously been provided.

PART 2: PART 2 PRODUCTS

2.01 MATERIALS

- A. Furnish materials whose minimum roll values meet or exceed those specified in the Geotextile Fabric Properties paragraph.
- B. Unless specifically authorized, do not furnish special run or value added products.
- C. Material shall retain a minimum 70 percent strength after 500 hours direct exposure to sunlight. (Ultra Violet Resistance ASTM D4355-84).
- D. Manufacturer's application indicates geomembrane protection.

2.02 GEOTEXTILE FABRIC PROPERTIES

- A. Riprap Geotextile
1. Conforming to AASHTO M 288 Class 1, US 205NW.
- B. Drainage Geotextile
1. Class 1 fabric according to AASHTO M 288 with Apparent Opening Size of 0.60 mm maximum average roll value.
 - a. Do not use woven slit film geotextiles in or under the pavement structure.
 - b. Additional clarifications to be provided by manufacturer.
- C. Each roll of geotextile fabric delivered to the Site shall be marked to show a minimum of the following information: product type, product thickness, manufacturing batch code, date of

manufacture, and physical dimensions.

PART 3: EXECUTION

3.01 EXAMINATION

- A. Examine and verify acceptability of surface to receive installation of geotextile.

3.02 INSTALLATION

- A. Place geotextile on areas that are smooth and free of projections or depressions.
 - 1. Install geotextile fabric at the locations and to the dimensions shown on the Drawings. The geotextile fabric shall overlap at least 12 inches between panels.
 - 2. Do not drag the geotextile across subgrade.
 - 3. Roll geotextile out as smoothly as possible in the direction of vehicle travel.
 - 4. Roll out in a manner to keep material in constant tension.
 - 5. Weight material with sandbags or approved equivalent during installation to prevent movement and wind disruption. Keep weight in-place until cover material is applied.
 - 6. Prevent damage to underlying material during installation.
 - 7. During installation, do not entrap stones, soil, dust, or moisture which would damage underlying material, hamper seaming, or impede performance of the product.
 - 8. Do not expose material to precipitation prior to installation.
 - 9. Do not expose material to direct sunlight for more than 300 hours prior to installation.

- B. Seams

- 1. Seam shall be continuous.
- 2. Seam with sewing, fusion, or other approved methods.
- 3. Orient overlap in direction of filling (cover material).

- C. Install geotextile around protruding appurtenances as shown on the Drawings.

3.03 REPAIR

- A. Slope Areas (steeper than 10 horizontal to 1 vertical)
 - 1. Sew fabric in-place using a double-lock stitch, seam stitches 1/2 to 3/4 inches apart and no closer than one inch from edges.
 - 2. For tears exceeding 10 percent of roll width, remove roll from slope and replace.
- B. Non slope areas - spot seam fabric patch in-place with a minimum 24-inch overlap in each direction.

C. Remove debris, soil, or other material which may have penetrated geotextile.

END OF SECTION 320519.13

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1: GENERAL

1.01 SUMMARY

- A. All Work included in this Section shall be performed in accordance with the following paragraphs, the General Requirements set forth in Division 1 of these Specifications, and provisions of the other Contract Documents.
- B. The Work covered under this Section includes installing chain link safety fencing and furnishing any additional parts needed to install new fencing. Extent and location shall be as shown on the Drawings.
 - 1. Furnishing and installing chain link fencing.
 - 2. Furnish and install chain link gates and fixtures.
 - 3. Furnish and install all posts and foundations, rails, fencing material, and miscellaneous fittings.

1.02 REFERENCES

- A. The following are complete titles of references cited in this Section:
 - 1. Utah Department of Transportation Standard Specifications for Construction 2023 Edition, hereafter referred to as UDOT Standard Specifications
 - 2. American Association of State Highway and Transportation Officials hereafter referred to as AASHTO.
 - 3. American Society for Testing and Materials International, Current Edition, hereafter referred to as ASTM.
 - 4. American Welding Society hereafter referred to as AWS.
 - 5. AASHTO M 111: Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
 - 6. AASHTO M 181: Chain Link Fence
 - 7. AASHTO M 232: Zinc Coating (Hot Dip) on Iron and Steel Hardware
 - 8. AASHTO M 270: Structural Steel for Bridges
 - 9. AASHTO M 280: Standard Specification for Metallic-Coated (Carbon) Steel Barbed Wire
 - 10. ASTM A 121: Metallic-Coated Carbon Steel Barbed Wire
 - 11. ASTM A 194: Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
 - 12. ASTM A 392: Zinc-Coated Steel Chain-Link Fence Fabric
 - 13. ASTM F 436: Hardened Steel Washers
 - 14. ASTM A 491: Aluminum-Coated Steel Chain-Link Fence Fabric
 - 15. ASTM A 563: Carbon and Alloy Steel Nuts



16. ASTM F 668: Polyvinyl Chloride (PVC) and Other Organic Polymer- Coated Steel Chain-Link Fence Fabric
17. ASTM C 1107: Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
18. ASTM F 1043: Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework
19. ASTM F 1083: Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
20. ASTM F 1554: Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
21. AWS D1.1 Structural Welding Code

1.03 DEFINITIONS

Not Used

1.04 SUBMITTALS

- A. Shop drawings consistent with General Conditions, showing typical layout, elevation, and section drawings for fences and gates. Show installation details for all end, corner, gate, and line posts.
- B. Submit product certification of all galvanized chain link fencing materials.
- C. Submit product certification of concrete post setting mix.

1.05 QUALITY ASSURANCE

- A. Standard of Manufacture, Chain Link Fence: Comply with the standards of the Chain Link Fence Manufacturers Institute for Galvanized Steel Chain Link Fence Fabric and as herein specified.

PART 2: PRODUCTS

2.01 GENERAL

- A. Concrete
 1. Class B Concrete – Refer to Section 03055.
- B. Non-shrink Grout
 1. Refer to ASTM C 1107.
- C. Anchor Bolt Assembly
 1. Anchor Bolts – Refer to ASTM F 1554.
 2. Nuts – Refer to ASTM A 563 or ASTM 194.
 3. Washers – Refer to ASTM F 436.
- D. Base Plate
 1. AASHTO M 270, Grade 36.
 2. Weld post to base plate according to AWS D1.1.
 3. Galvanize after fabrication according to AASHTO M 111.



2.02 POSTS, CAPS, RAILS, AND COUPLINGS

A. Pipe Posts and Rails

1. Schedule 40, hot-dip galvanized coated pipe.
 - a. Refer to ASTM F 1043 IA and ASTM F 1083
2. High strength, galvanized coated pipe.
 - a. Refer to ASTM F 1043 IC

B. Fittings

1. Malleable cast iron or pressed steel coated.
 - a. Refer to AASHTO M 232.

C. Caps

1. Equip all pipe posts with a galvanized steel or malleable iron weather-resistant cap that fits securely over the posts, with an apron around the outside of the post.
 - a. Refer to AASHTO M 232.
 - b. Provide cap to permit passage of top rail when top rail is used.

2.03 CHAIN LINK FABRIC

- A. Provide either Type I zinc-coated steel or Type II aluminum-coated steel fence fabric as specified in AASHTO M 181, ASTM A 392, and ASTM A 491.
- B. Provide a polyvinyl chloride (PVC) coating when shown.
 1. Refer to ASTM F 668
- C. Use 0.148-inch-diameter wire for fence fabric 6 ft or higher and 0.120-inch-diameter wire for fabric less than 6 ft high.
- D. Provide 0.177-inch-diameter spiral material for tension wires.
- E. Tie fence fabric to supporting members with wire of the same diameter as the fence fabric wire.

2.04 BARBED WIRE

- A. Provide zinc-coated barbed wire when zinc-coated fence is used as specified in AASHTO M 280.
- B. Use 0.099-inch-diameter barbed wire with 0.080-inch-diameter four-point barbs on 5-inch centers.
- C. Provide aluminum-coated barbed wire when aluminum coated fence is used as specified in ASTM A 121.
- D. Provide a support arm for barbed wire on top of a chain link fence that supports a 200-lb vertical load at the end of the arm without causing permanent deflection.

2.05 GATES

- A. Fabricate gate posts and frames of the sizes according to FG Series Standard Drawings.
 1. Fasten gate frame corners together with pressed steel or malleable iron corner ells, riveted or welded as shown.
 2. Galvanize welded steel gate frames after fabrication.

- a. Refer to AASHTO M 111.
- 3. Do not use closed cells that will prohibit dipping into galvanizing tanks.
- B. Follow the same standards for chain link fence fabric for covering the gate frames as for other fence fabric.
- C. Furnish each gate with the appropriate hinges, latch, and drop-bar locking device.

2.06 CONCRETE

- A. Provide concrete consisting of Portland cement, ASTM C94, ¾ inch aggregates, ASTM C33, and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 3,000 psi, using at least four sacks of cement per cubic yard, 1-inch maximum size aggregate, maximum 3-inch slump, and 2 to 4 percent entrained air.

PART 3: EXECUTION

3.01 INSTALL POSTS

- A. Install according to FG Series Standard Drawings.
- B. Do not exceed the following spacing requirements when placing posts:

Radii of Curve	Maximum Post Spacing
Tangent or 500 ft	10 ft
200 ft to 500 ft	8 ft
100 ft to 200 ft	6 ft
0 ft to 100 ft	5 ft

- C. Install brace posts at maximum 500-ft intervals and at angle points of 30 degrees or greater.
- D. Set posts in concrete bases.
 - 1. Place concrete at least 6 inches below each post.
 - 2. Construct at least 12-inch-diameter bases for end posts, pull posts, corner posts, gate posts, and line posts.

3.02 INSTALL FENCE FABRIC

- A. Locate bottom of fence fabric on the roadway side of posts unless otherwise specified.
 - 1. Place fabric approximately 1 inch above the ground.
 - 2. Maintain a straight grade between posts by excavating high points of the ground.
 - 3. Fill depression in the natural ground to within 1 inch of the bottom of fence.
- B. Stretch the fabric taut and securely fasten to fence posts.
 - 1. Use stretch bars and metal bands to fasten fence fabric to terminal, gate, corner, and pull posts.



- a. Space metal bands at 1-ft intervals along the post.
2. Cut the fabric at corner and pull posts.
3. Fasten fabric to line posts with tie wires or metal bands at 14-inch intervals.
4. Attach the top edge of fabric to the top rail or tension cable with wire ties at approximately 24-inch intervals.
5. Attach the bottom edge of the fabric to the bottom tension wire with wire ties spaced at 24-inch intervals.

3.03 INSTALL GATES

- A. Install single gate or double gate as shown. Install plumb, level, and secure for full opening without interference.
- B. Install ground-set items in concrete for anchorage as shown in the standard drawing or as recommended by the manufacturer. Adjust hardware for smooth operation.
- C. Set gate openings according to manufacturer's dimensions.
- D. Fabric description numbers:
 1. First number indicates height.
 2. Second number indicates width of fabric opening.

3.04 FIELD QUALITY CONTROL

- A. Contractor shall establish and maintain quality control for work under this Section to assure compliance with contract requirements.

END OF SECTION 32 31 13

SECTION 32 90 00

PLANTING

PART 1: GENERAL

1.01 SUMMARY

- A. Seed, turf seed, and turf sod requirements and application.
- B. Surface preparation.

1.02 REFERENCES

- A. Utah Department of Transportation Standard Specifications for Construction, 2023 Edition, hereafter referred to as UDOT Standard Specifications.
- B. Utah Seed Law

1.03 RELATED SECTIONS

- A. UDOT Standard Specification Section 02912: Topsoil

1.04 SUBMITTALS

- A. Submit for information, copy of the purchase order documenting that all seeds, including substitutions, have been acquired before the seeding window begins.
 - 1. Refer to this Section, article 1.6 for seeding information.
 - 2. List the common and botanical name for each seed species on the purchase order.
- B. Submit for information, certification that turf sod is nursery grown and contains a minimum of three varieties of Kentucky Blue Grass.
- C. Submit for information, certification indicating the date and time sod was cut at the nursery.
- D. Submit for information, fertilizer labels.
- E. Submit for information legible copy of Seed Certification – Include the following on seed certification reports and labels:
 - 1. Botanical name (include variety if applicable)
 - 2. Common name
 - 3. Name of seed testing laboratory
 - 4. Lot number and address of the seed company
 - 5. Weed seed (percent)
 - 6. Other crop seed (percent)
 - 7. Inert matter (percent)
 - 8. Pure live seed (percent)
 - 9. Noxious weed seed (name and rate of occurrence)
 - 10. Date tested (month and year)
 - 11. Germination (percent)

12. Hard seed (percent)
 13. Net weight (do not include container weight)
 14. Pure live seed weight
 15. Collection locations for native shrub and tree species (state, county, elevation)
- F. Submit for information manufacturer's directions on drill calibration two working days before seeding. Refer to this UDOT Standard Specification Section 02922, Article 3.3.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Mixing Seed

1. Notify Engineer seven calendar days before mixing seed.
2. Engineer will verify that the seed certification report or label represents the seed lot from which the seed is furnished.
3. Mix the different seed varieties to provide an even blend.
4. Bag the mixed seed, seal the container, and attach a signed Department label to the exterior.

B. Deliver seed or turf seed to job site in original containers showing analysis of seed mixture, net weight, and date and location of packaging. Damaged packages are not acceptable.

C. Strip turf sod from nursery no more than 24 hours before laying.

D. Deliver fertilizer in containers showing weight, chemical analysis, and name of manufacturer. Store fertilizer in a weatherproof location.

E. Fertilizer (and Agricultural Lime if required):

1. Deliver to site in unopened, original waterproof containers, each bearing name, address, and manufacturer's guaranteed analysis.

F. Seed:

1. Tag or label bag as required by state law. Supplier's name shall be shown on or attached to each bag with:
 - a. Type of seed contained.
 - b. County of seed origin.
 - c. Percentage of purity and germination.
 - d. Percentage of hard seed, if any.
 - e. Percentage of inert material.

1.06 SCHEDULE

A. Pre-measure the area to be seeded before ordering seed from supplier. The Engineer must approve the measuring technique and determined quantity.

B. Seeding Window

1. Complete all general roadside seeding within the appropriate seeding window.
2. Postpone seeding until the following year if the seeding is not completed within the given window.

3. A late winter exception to the seeding window may be obtained from the Engineer if suitable weather and soil conditions exist.

<u>Elevation</u>	<u>Seeding Window</u>
Below 4,000 ft	October 1 – December 31
4,000 to 6,000 ft	September 15 – December 1
Above 6,000 ft	September 1 – November 15

C. Turf seed and turf sod can be placed only after irrigation system is installed and operational.

D. Topsoil

1. Refer to UDOT Standard Specification Section 02912.
2. Place topsoil just before seeding to eliminate competition from weeds.

Coordinate topsoil placement with the above seeding window.

PART 2: PRODUCTS

2.01 SEED AND TURF SEED

- A. Meet the Utah Seed Law – Utah Code - Title 4, Chapter 16.
- B. Supply seed on a pure live seed (PLS) basis.
- C. Obtain seed from lots that have been tested by a state-certified seed testing laboratory such as Association of Seed Analyst (AOSA) or Society of Commercial Seed Technologists (SCST).
 1. Seed germination test older than 18 months for grass seed and 9 months for shrub or tree seed are not acceptable.
 2. Based on the amount or type of seed required on a project, the Department may require additional testing by the Department of Agriculture.
- D. Do not use wet, moldy, or otherwise damaged seed.
- E. Seed Substitutions
 1. Contact the major seed brokers in the state to verify that the seed is unavailable before requesting a seed substitution.
 2. Obtain approval for a seed substitution.

2.02 TURF SOD

- A. Healthy and well-rooted nursery grown Kentucky Blue Grass sod comprising a minimum of three varieties and free of weeds.
- B. Machine cut in straight, uniform strips or rolls, cut at a depth between ¾ inch and 1 inch.

2.03 FERTILIZER (TURF SOD AND TURF SEED AREAS ONLY)

- A. Uniform in composition, dry, and free flowing.
 1. Turf seed or turf sod – Elemental nitrogen in granular form. Phosphorus and potassium are optional and may be applied with nitrogen in granules. Use a slow-release form of a minimum 50 percent nitrogen such as sulfur coated urea or urea formaldehyde.

2. Apply elemental nitrogen with a concentration ranging from 21-34 percent if hydroseeding method is used.

2.04 MATERIALS

A. Topsoil:

1. Conform to Section 31 00 00 - Earthwork.

B. Water:

1. Contractor shall be responsible for water used for native seed establishment.

2.05 SOURCE QUALITY CONTROL

A. Contractor shall perform source quality control testing on the topsoil material as described in Section 01 45 00 – Quality Control.

B. Owner may take samples of the materials after they have been furnished to the Site for additional testing. Owner will pay for testing of samples that meet the Specifications. Contractor shall pay for testing of samples that do not meet Specifications.

PART 3: EXECUTION

3.01 PREPARATION

A. Complete all final grading, irrigation work, trench settling, topsoil placement, and surface preparation before seed or sod application.

B. Prepare general seedbed for all seeded and sodded areas.

1. Verify that a suitable topsoil surface has been prepared according to Section 02912 before seeding.
2. Do not work topsoil or seed when the soil is saturated or frozen.

C. Prepare Turf Seedbed

1. Review finish grade to confirm that topsoil is 1 inch below the top of all walks, curbs, mow strips, and other hard surfaces.
2. Apply fertilizer at the rate of 2 lb/100 yd² and mix thoroughly into upper 2 inches of topsoil.
3. Do not apply fertilizer and seed at the same time in the same machine.

D. Prepare Turf Sod Surface

1. Review finish grade to confirm that topsoil is 1½ inches below the top of all walks, curbs, mow strips, and other hard surfaces.
2. Apply fertilizer at the rate of 2 lb/100 yd² and mix thoroughly into upper 2 inches of topsoil.
3. Level and roll prepared areas using a 21-gal water-filled hand roller containing 8 to 10 gal of water.
4. Lightly rake and dampen with water the top ¼ to ⅝ inches of soil just before laying the sod.

3.02 SEEDING – GENERAL



- A. Notify the Engineer seven working days before seeding.
- B. Apply seed at the rate indicated in the Seed Schedule as shown. Note that drill seed and broadcast seed are applied at different rates.

3.03 DRILL SEEDING METHOD

- A. Use the drill method of seeding on accessible slopes 3H:1V and flatter.
- B. Use a drill equipped with the following:
 - 1. Depth band
 - 2. Seed box agitator
 - 3. Seed metering device
 - 4. Furrow opener
 - 5. Packer wheels or drag chains
- C. Use the drill manufacturer's directions in the presence of the Engineer. Calibrate the drill to apply seed at the rate indicated in the seeding schedule.
- D. Space drill rows a minimum of 6 inches and a maximum of 8 inches.
- E. Fill the seed boxes no more than half full when drilling on a slope.
- F. Set depth bands to drill seeds to a ½ inch depth.
- G. Drill along the contour.
- H. Maintain the drill at the calibrated setting throughout the seeding operation.
- I. Allow the furrows that are created by the drill to remain.

3.04 BROADCAST SEEDING METHOD

- A. Use the broadcast method of seeding under the following conditions:
 - 1. Slopes steeper than 3H:1V.
 - 2. Slopes 3H:1V and flatter where the area to be seeded is inaccessible to drill.
 - 3. The area to be seeded is not large enough to justify using a drill.
 - 4. Rocky surface conditions will damage a drill.
- B. Obtain approval of the broadcast method by demonstrating the procedure on a 100 yd² area.
- C. Evenly broadcast seed using either:
 - 1. A cyclone seeder or other approved mechanical seeder.
 - 2. A hydroseeder.
 - 1. Apply seed, water, and 300 lb of cellulose fiber mulch (tracer) per acre.
- D. Do not seed during windy weather or when soil is saturated.
- E. Incorporate the seed into the soil by one of three methods:
 - 1. Cat-tracking by running the dozer up and down the slope creating continuous cleat tracks that run parallel with the contours.
 - 2. Hand raking the seed in ½ inch deep and along the contours of the slope.
 - 3. Slope chaining by pulling the chain along the contour until the seed is covered.

- F. Obtain approval from the Engineer that the seed has been adequately incorporated into the soil before applying rolled and hydraulic erosion control products or other topdressing.

3.05 TURF SEEDING

- A. Apply turf seed after seedbed preparation. Refer to this Section, Article 3.4, paragraph C.
- B. Roll seeded areas using a hand roller half filled with water.
- C. Lightly water and program the irrigation system to maintain a moist seedbed.
- D. Rope off newly seeded areas along walkways using bright plastic ribbon tape attached to stakes.

3.06 TURF SOD PLACEMENT

- A. Prepare sod bed and place sod with all edges and joints tightly butted.
 - 1. Do not stretch or overlap sod.
 - 2. Keep length seams in a straight line.
- B. Lay turf sod with staggered joints and trim off excess material along the edges.
- C. Roll sod immediately after placing using a hand roller half filled with water.
 - 1. Re-roll if depressions still remain.
 - 2. Thoroughly water with a fine spray to a depth sufficient that the underside of the new sod and soil immediately below the sod are thoroughly wet.

3.07 INSTALLATION

- A. General
 - 1. Install plants using the plan details.
 - 2. Water the plants within one hour of installation to saturate the rootball to a minimum of 4 inches below and around the plant hole.
 - i. Add more backfill if settling occurs.

3.08 CLEAN AND MAINTAIN

- A. Remove foreign materials from site such as containers, burlap, and twine collected during installation.
- B. Remove any tags, labels, or other items attached to the plant material after final plant inspection.
- C. Water and maintain the plants in a healthy condition until the final plant inspection.

END OF SECTION 32 90 00

SECTION 32 92 00

SITE RESTORATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Work covered under this Section includes providing all materials, equipment, and labor to restore all disturbed areas, and includes final grading, soil preparation, seeding, hydromulching, mulching, and all other work as may be necessary, all in accordance with the Contract Documents including, but not limited to:
 - 1. Restoring all areas disturbed as a result of Contractor's performance of the Work.
 - 2. Placing topsoil, seed, and mulch on all disturbed areas as specified herein.
 - 3. Restoring areas disturbed by Contractor for access purposes or used as laydown areas, all at Contractor's expense.
 - 4. Site cleanup.
- B. RELATED WORK
 - 1. Section 31 20 00 – Earthwork
 - 2. Section 32 90 00 – Planting

1.02 REFERENCES

- A. American Society for Testing and Materials International, Current Edition, hereafter referred to as ASTM.
- B. ANSI Z 60.1: AMERICAN STANDARD FOR NURSERY STOCK .
- C. Utah Department of Transportation Standard Specifications for Road and Bridge Construction, 2023 Edition, herein referred to as UDOT Standard Specifications.

1.03 SEQUENCING AND SCHEDULING

- A. Contractor to coordinate the seeding and planting work with topsoil and site grading work, with the goal of minimizing lag time between grading and restoration work.
- B. It is Contractor's responsibility to contact the local utility companies for verification of the location of all underground utility lines in the area of work.
- C. Notify Engineer when planting operations will occur, a minimum of three (3) days in advance.
- D. Continue erosion control methods and maintain previously installed materials, and to install where necessary additional protection to control erosion and sedimentation during their work on the site. Verify that conditions on the site are suitable to receive work prior to commencing. Contractor shall be responsible to repair all subsequent soil erosion after site condition verification extending for a period of three months after receipt of preliminary acceptance. Repair all erosion rills greater than one inch. Repair all eroded areas within 48 hours of receipt of notification from Engineer. Additional erosion control repairs and/or measures shall be considered incidental to the plant installation.



- E. Turf establishment (seed mixture and companion cover crop) shall conform to the seeding/planting season requirements of UDOT Standard Specifications; plant appropriate seed during dormant seasons or growing seasons.

1.04 SUBMITTALS

- A. Submit for information, a copy of the plant purchase order indicating plant names, sizes, quantities, and unit prices. Submit within 90 calendar days from the Notice to Proceed.
- B. Submit for information, plant substitutions
 - 1. Obtain a signed statement from three wholesale nurseries, noted for stocking the specified plants, indicating that the plants are unavailable.
 - 2. The signed statements and a written request indicating the size and species of the unavailable plants and their suggested replacements.
 - 3. Substitutions will not be approved after 120 calendar days from the Notice to Proceed.
- C. Submit for information, all necessary inspection certificates for each shipment of plants as required by Utah Laws and Regulations.

1.05 QUALITY ASSURANCE

- A. Verify all plants meet ANSI specifications.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Secure required plants at a nursery within 60 calendar days from the Notice to Proceed.
- B. Grow plants under full exposure to climatic conditions similar to those found on the project for a minimum of 60 calendar days.
- C. Notify the Engineer at least 14 calendar days before delivering the plants to the site.
- D. Deliver plant materials to the work site in covered vehicles just before placement.
- E. Maintain delivered plants in a healthy condition.
 - 1. Protect balled and burlapped rootballs from sun and wind by covering with soil or other suitable material if not planted immediately upon delivery.

1.07 SCHEDULE

- A. Install irrigated plants using the following schedule:

<u>Elevation</u>	<u>Planting Season</u>
Below 4,000 ft*	March 1 - December 1
4,000 to 6,000 ft	April 15 - October 15
Above 6,000 ft	May 1 - July 1

* No planting in July or August.

- B. Install non-irrigated plants in the fall after the plant is dormant and before the ground freezes.

PART 2 - PRODUCTS

2.01 TOPSOIL

- A. Topsoil shall be as specified in Section 31 20 00 Earthwork.



2.02 PLANTS

- A. Supply healthy plants of the species and size specified, true to form, free from disfiguring knots, sunscald, frost cracks, bark abrasions, and all forms of infestation and disease.
- B. Provide legible labels attached to all plants, flats, bundles, or other containers indicating botanical genus, species, and size.
- C. Supply trees with straight central leaders capable of standing upright without the support of stakes or guys.
- D. Supply containerized plants with root systems fully established in the container.
- E. Do not use balled and burlapped plants if the ball of earth surrounding roots has been cracked or broken or if the burlap is not secure.
- F. Use bare-root plant material only with approval.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify that the area prepared to receive plants is graded properly according to the plan, all work is completed in the area, and that topsoil has been placed. Refer to Section 02912.
- B. Install the irrigation system and have it fully operational before installing plants.
- C. Stake or delineate plant locations for approval before installation.

3.02 INSTALLATION

A. General

- 1. Install plants using the plan details.
- 2. Water the plants within one hour of installation to saturate the rootball to a minimum of 4 inches below and around the plant hole.
 - I. Add more backfill if settling occurs.

B. Containerized Plants

- 1. Excavate plant holes to twice the diameter and the same depth of the rootball.
- 2. Carefully remove the plant from its container, scarify the sides and bottom of the rootball if needed, and place it in the prepared hole.
- 3. Place excavated soil in 4-inch lifts around the rootball and eliminate voids by tamping the soil between each lift.

C. Balled and Burlapped Plants

- 1. Excavate plant holes to twice the diameter and the same depth of the rootball.
- 2. Gently place the plant in the prepared hole with burlap securely intact.
- 3. Do not mishandle or break root balls.

D. Carefully remove any wire baskets and the top half of the burlap without disturbing the root ball.

E. Tubelng Plants

- 1. Auger a hole the same size as the tube.



2. Gently place watered tubeling in the prepared plant pit immediately following excavation of the hole so that the roots are not tangled, compacted, or curled up at the ends.
3. Compress the soil at the base of the tubeling to eliminate voids between the rootball and existing soil.

3.03 CLEAN AND MAINTAIN

- A. Remove foreign materials from site such as containers, burlap, and twine collected during installation.
- B. Remove any tags, labels, or other items attached to the plant material after final plant inspection.
- C. Water and maintain the plants in a healthy condition until the final plant inspection.

3.04 CLEAN UP

- A. Clean up the entire area around planting operations and restore to its original condition. This work shall include replacement of sod damaged by Contractor's planting operations.

3.05 INSPECTION AND ACCEPTANCE

- A. Contractor to request an inspection by Engineer of completed work. Engineer will produce a punch list following the inspection. The punch list will note all repairs, replacements, or work completions which may appear at the time to be necessary in the judgment of Engineer. Engineer will deliver a copy of the punch list to Contractor. Upon completion of all work identified on the punch list, a second inspection will be made. Such procedure will continue until all items of the punch list are corrected. Upon completion of a satisfactory inspection, Engineer will recommend that Owner accept the work as complete, provided all requirements of the extended maintenance and guarantee are met.
- B. Performance Standards: Contractor shall be responsible for the satisfactory growth of plants on all areas seeded and/or planted under the Contract until final acceptance of the work that shall be:
 1. Stage 1: Installation Acceptance = 60 days for cover crop establishment (following last spring frost for fall plantings).
 2. Stage 2: Guarantee of Work Acceptance for Seeding = 12 months.
 3. Stage 3: 80% ground cover of acceptable species, including germination of desirable seed bank flora, and minimum 50% ground cover of species that were planted or seeded, the seeding work will receive acceptance of guaranteed work.
 - a. Where inspected seeding work does not comply with the requirements, replace rejected work until inspected again by Owner and found to be acceptable. Re-sow at half the original seeding rate within 2 weeks of Owner's notification.

END OF SECTION 32 92 00



SECTION 33 90 00
LANDFILL SITE PIPING

PART 1: GENERAL

1.01 SECTION INCLUDES

- A. Installing corrugated polyethylene pipe (CPEP) for final cover subsurface drainage collection.
- B. Installing high density polyethylene (HDPE) outlet piping as part of the storm water management system.
- C. Installing reinforced concrete piping (RCP) outlet piping as part of the storm water management system.
- D. Installing corrugated metal pipe (CMP) for culverts as part of the storm water management system.

1.02 REFERENCES

- A. American Association of State Highway and Transportation Officials hereafter referred to as AASHTO.
- B. Utah Department of Transportation Standard Specifications for Road and Bridge Construction, 2023 Edition, hereafter referred to as UDOT Standard Specifications.

PART 2: PRODUCTS

2.01 POLYVINYL CHLORIDE (PCV) PIPE – AS SHOWN ON DRAWINGS

2.02 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

- A. HDPE pipe and fittings for the stormwater outlet piping shall be SDR17 fusion-weld materials in conformance with the requirements of ASTM D3261.

2.03 REINFORCED CONCRETE PIPE (RCP)

- A. Reinforced Concrete Pipe (RCP) shall be Class IV circular reinforced concrete pipe and shall meet the requirements of ASTM C76-16.
- B. Rubber Gaskets shall meet ASTM C443-12.

2.04 CORRUGATED METAL PIPE (CMP)

- A. CMP and fittings shall meet AASHTO M 36M.
- B. CMP dimensions as shown on the Drawings.
- C. Jointing band provided by CMP manufacturer and compatible with CMP material.

2.05 PIPE COVERING

- A. Removable pipe caps and/or covers for open pipes when not in use.

PART 3: EXECUTION

3.01 EXCAVATION

- A. Trenches shall be excavated to allow for proper jointing of the pipe, and thorough compaction of the bedding and backfill material under and around the pipe.
- B. The completed trench bottom shall be firm for its full length and width.



- C. The foundation for each type of bedding shall be adequate to furnish a uniform stable support. Where unstable material is encountered, it shall be removed to the depth directed by the Engineer and replaced with granular backfill. Rock, shale, or hardpan shall be removed to a depth 1 foot below the bedding elevation and replaced with granular backfill.

3.02 BEDDING

- A. See Specification 31 20 00 - Earthwork.

3.03 PVC INSTALLATION

- A. Install the PVC piping at the locations and grades as shown on the Drawings.

3.04 HDPE PIPE INSTALLATION

- A. Install the HDPE piping at the locations and grades as shown on the Drawings.
- B. HDPE pipe joints shall be fusion welded per manufacturer's recommendations.

3.05 RCP INSTALLATION

- A. Laying of pipe shall begin at the downstream end.
- B. The lower segment of the pipe shall be in contact with the shaped bedding throughout its full length.
- C. Bell or groove ends of rigid pipe shall be placed facing upstream.
- D. Rigid pipe may be of "bell and spigot" or "tongue and groove" design unless one type is specified. Pipe sections shall be joined so the ends are fully entered and the inner surfaces are flush and even.

3.06 CMP INSTALLATION

- A. Install the CMP piping at the locations and grades as shown on the Drawings.

3.07 PIPE COVERING

- A. Install removable pipe caps and/or covers for open pipes when not in use.

3.08 PIPE TRENCH BACKFILL AND COMPACTION

- A. See Specification 31 20 00 - Earthwork.

3.09 FIELD QUALITY CONTROL

- A. Pipe and pipe installations will be subject to rejection for any of the following reasons:
 1. Failure to conform to the specifications, particularly compaction under and around the pipe.
 2. Fractures or cracks passing through pipe wall.
 3. Chips or fractures on interior of pipes.
 4. Cracks which, in the opinion of Owner or Owner's On-site Representative, may impair strength, durability, or serviceability of pipe.
 5. Defects indicating improper proportioning, mixing, or molding.
 6. Damaged ends where such damage would prevent making a satisfactory joint.

END OF SECTION 33 90 00

