

Project Name: City of Glendale Municipal Landfill North Cell Liner Phase II
Project No.: 232425
Amendment No: 1
Date:

This Amendment to that certain Standard Form Agreement dated _____ by and between the City of Glendale and Rummel Construction, Inc. (CM@Risk) for services, deliverables and work related to Project No. 232425, Project Name: City of Glendale Municipal Landfill North Cell Liner Phase II, (the “Agreement”) is made and entered into effective this _____ day of _____, 2024.

1. This Amendment #1 establishes a Guaranteed Maximum Price (“GMP”) and Construction Phase Fee for Construction Services and incorporates such terms into the Agreement, making the Agreement effective for Construction Phase Services:
 - a. The total fee for Construction Phase Services, which is included in the Guaranteed Maximum Price (GMP) as defined under the Agreement, shall be fixed at Two hundred seventy-six thousand six hundred and sixty-seven and 00/100 Dollars (\$276,667.00).
 - b. The Guaranteed Maximum Price (“GMP”) for Construction Services, as defined under the Agreement, shall be Two million four hundred twelve thousand seven hundred thirty-seven and 03/100 Dollars (\$2,412,737.03).
 - c. The total compensation under the Agreement, as amended by this Amendment, shall be:

	<u>Pre-Construction Phase</u>	<u>Construction Phase</u>	<u>Total</u>
Original Agreement:	\$4823.20	\$	\$4823.20
Previous Amendments:	\$	\$	\$
This Amendment:	\$	\$2,412,737.03	\$2,412,737.03
Total (including this Amendment):	\$4823.20	\$2,412,737.03	\$2,417,560.23

2. DELETE the blank template “Exhibit C – Cost of the Work – Schedule of Values” from the Agreement and ADD “Exhibit C – Rummel Construction, Inc. Cost of the Work – Schedule of Values” dated May 30, 2024 (43 Pages), attached herein.
3. ADD “Exhibit E – Construction Documents necessary to define Scope of Work and deliverables for the Construction Phase Services, including plans, designs, drawings, specifications and other required Contract Documents” dated May 30, 2024 (160 Pages), attached herein.
4. ADD “Exhibit F - Statement of All Clarifications and Assumptions” dated May 30, 2024 (1 Pages), attached herein.
5. ADD “Exhibit G – Schedule of Major Milestones” dated May 30, 2024 (1 Pages), attached herein.
6. CHANGE 180 Calendar days and January 28, 2025 for Article 5.3.1 Substantial Completion of the Work.
7. CHANGE February 28, 2025 for Article 5.4.1 Final Completion of the Work.
8. CHANGE one thousand seventy dollars (\$1,070.00) in Article 5.5 Liquidated Damages for substantial completion and final completion amounts.

9. All other provisions, terms and conditions of the Agreement shall remain unchanged and in full effect.

(Signature on following page)

IN WITNESS WHEREOF, the Parties hereto have duly executed this Amendment, effective as of the date first written above.

OWNER
City of Glendale
5850 W. Glendale Avenue
Glendale, AZ 85301

By: Its Authorized Representative:

Signature
Kevin R. Phelps

Printed Name
City Manager

Title

Date

ATTEST:

Julie K. Bower (SEAL)
City Clerk

APPROVED AS TO FORM:

Michael D. Bailey
City Attorney

DESIGN PROFESSIONAL

By Its Authorized Representative:

Signature (Reviewed in accordance with the "Agreement Between Owner and Design Professional" Section 4.8.1.14 of Exhibit A "Scope of Services for the Design Professional")

GARTH R. BOWERS, PE
Printed Name

PROJECT MANAGER
Title

6/18/2024
Date

CM@RISK
Rummel Construction, Inc.
7520 E Adobe DR
Scottsdale, AZ 85255

By Its Authorized Representative:

Signature
George Cabral

Printed Name
Sector Manager

Title

6/18/24

Date

EXHIBIT C

Cost of the Work

28 Pages

Rummel Construction, Inc.
CONSTRUCTION MANAGER AT RISK AGREEMENT - Exhibit C - Cost of the Work
City of Glendale Municipal Landfill North Cell Liner Phase II - Project No. 232425 - May 30, 2024

Exhibit C

DIRECT CONSTRUCTION COST						
Cost Code	Item of Work	GMP No. 1	GMP No. 2	GMP No. 3	GMP No. 4	Total GMP
	GENERAL CONDITIONS - PERSONNEL STAFFING	\$ 101,842.50				
	GENERAL CONDITIONS - SITE OPERATIONS	\$ 122,189.28				
	MOBILIZATION/DEMOBILIZATION	\$ 73,802.84				
	EXCAVATION/STOCKPILING	\$ 34,458.03				
	SURVEYING	\$ 10,900.00				
	AZPDES	\$ 14,126.97				
	ENGINEERED FILL	\$ 6,165.04				
	LINER SUBGRADE PREPARATION	\$ 79,358.42				
	OPERATIONS LAYER PLACEMENT	\$ 253,591.94				
	ANCHOR TRENCH-BENCH	\$ 11,884.50				
	BASE LINER TERMINATION	\$ 40,543.73				
	SIDE SLOPE LINER TERMINATION	\$ 27,627.28				
	BENCH LINER TERMINATION	\$ 57,313.52				
	BASE LINER TIE-IN	\$ 88,388.00				
	SIDESLOPE LINER TIE-IN	\$ 9,235.13				
	GCL	\$ 297,208.00				
	60-MIL GEOMEMBRANE	\$ 222,324.00				
	GEOCOMPOSITE	\$ 208,626.00				
	6" HDPE LCRS	\$ 91,204.98				
	6" HDPE RISER	\$ 11,054.50				
	12 OZ GEOTEXTILE	\$ 21,025.90				
	CONTINGENCIES					
	CONTRACTOR	\$ 50,000.00				
	OWNER	\$ 96,467.00				
SUBTOTAL DIRECT CONSTRUCTION COST (DCC)		\$ 1,929,337.56	\$ -			
CONSTRUCTION PHASE FEE						
FEE	FIXED FEE, EQUAL TO 14.34% OF DCC	\$ 276,667.00	\$ -			
	* Fee = 8.56% for Overhead and 5.78% for Profit					
SUBTOTAL CONSTRUCTION PHASE FEE		\$ 276,667.00	\$ -			
INDIRECT CONSTRUCTION COSTS (ICC)						
BONDS	CMR PERFORMANCE & PAYMENT BOND 1.5%	\$ 33,090.00	\$ -			
INSURANCE	CMR INSURANCES (WORKER'S COMP, GENERAL LIABILITY, AUTO LIABILITY, UMBRELLA) 1.2%	\$ 26,472.00	\$ -			
	BUILDER'S RISK 0.5%	\$ 11,030.00	\$ -			
TAXES	5.98% OF (DCC + FEE + BOND + INSURANCE)	\$ 136,140.47	\$ -			
SUBTOTAL INDIRECT CONSTRUCTION COST (ICC)		\$ 206,732.47	\$ -			
TOTAL GMP = DCC + FEE + ICC		\$ 2,412,737.03	\$ -			

Calculation for Rummel Construction Overhead & Profit (Fee Amount)

Audited Overhead (see attached)	9.76%
Deduct Insurance of 1.2% (from GMP line item)	<u>-1.20%</u>
Subtotal Overhead Cost	8.56%
Rummel Construction Profit	5.78%
Rummel Construction Overhead & Profit	14.34%

RUMMEL HOLDING GROUP, INC.
SCHEDULE OF GENERAL AND ADMINISTRATIVE
EXPENSES FOR RUMMEL CONSTRUCTION, INC.

Year Ended December 31, 2023

RUMMEL HOLDING GROUP, INC.
SCHEDULE OF GENERAL AND ADMINISTRATIVE
EXPENSES FOR RUMMEL CONSTRUCTION, INC.

Year Ended December 31, 2023

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Schedule of General and Administrative Expenses for Rummel Construction, Inc.	2



INDEPENDENT AUDITORS' REPORT ON SUPPLEMENTARY INFORMATION

To the Board of Directors and Shareholder of:

RUMMEL HOLDING GROUP, INC.

We have audited the consolidated financial statements of Rummel Holding Group, Inc. (the "Company"), as of and for the year ended December 31, 2023, and our report thereon dated March 1, 2024, which contained an unmodified opinion on those consolidated financial statements (collectively referred to as the "financial statements"). Our audit was conducted for the purpose of forming an opinion on the consolidated financial statements taken as a whole. The schedule of general and administrative expenses for Rummel Construction, Inc. (a wholly-owned subsidiary of the Company) on page 2 is presented for purposes of additional analysis and is not a required part of the consolidated financial statements. Such information is the responsibility of management and was derived from and relates directly to the underlying accounting and other records used to prepare the consolidated financial statements. The information has been subjected to the auditing procedures applied in the audit of the consolidated financial statements and certain additional procedures, including comparing and reconciling such information directly to the underlying accounting and other records used to prepare the consolidated financial statements or to the consolidated financial statements themselves, and other additional procedures in accordance with auditing standards generally accepted in the United States of America. In our opinion, the information is fairly stated in all material respects in relation to the consolidated financial statements as a whole.

This report is intended solely for the information and use of management of the Company and their customers for whom they perform work under construction contracts and is not intended to be and should not be used by anyone other than those specified parties.

Mayer Hoffman McCann P.C.

March 1, 2024

Mayer Hoffman McCann P.C.
An Independent CPA Firm
4722 N. 24th Street, Suite 300
Phoenix, AZ 85016

Phone: 602.264.6835
Fax: 602.265.7631
mhmcpa.com



RUMMEL HOLDING GROUP, INC.
CONSOLIDATED SCHEDULE OF GENERAL AND ADMINISTRATIVE
EXPENSES FOR RUMMEL CONSTRUCTION, INC.

Year Ended December 31, 2023

RUMMEL CONSTRUCTION, INC.

General and administrative expenses	\$ 18,476,943
Cost of revenues	\$ 189,270,458
General and administrative expense overhead rate	9.76%

See Independent Auditors' Report on Supplementary Information

Exhibit C Direct Cost Breakdown

Bid Item	Direct Cost Breakdown				Extended
	Description of Cost	QTY	UOM	Unit Cost	Direct Cost
1	MOBILIZATION/DEMOBILIZATION	1	LS	73,802.84	73,802.84
2	EXCAVATION/STOCKPILING	5,442	CY	6.33	34,458.03
3	SURVEYING	1	LS	10,900.00	10,900.00
4	AZPDES	1	LS	14,126.97	14,126.97
5	ENGINEERED FILL	1,562	CY	3.95	6,165.04
6	LINER SUBGRADE PREPARATION	9	AC	8,817.60	79,358.42
7	OPERATIONS LAYER PLACEMENT	27,077	CY	9.37	253,591.94
9	ANCHOR TRENCH-BENCH	442	LF	26.89	11,884.50
10	BASE LINER TERMINATION	1,530	LF	26.50	40,543.73
11	SIDE SLOPE LINER TERMINATION	419	LF	65.94	27,627.28
12	BENCH LINER TERMINATION	442	LF	129.67	57,313.52
13	BASE LINER TIE-IN	1,550	LF	57.02	88,388.00
14	SIDESLOPE LINER TIE-IN	390	LF	23.68	9,235.13
15	GCL	388,000	SF	0.77	297,208.00
16	60-MIL GEOMEMBRANE	388,000	SF	0.57	222,324.00
17	GEOCOMPOSITE	327,000	SF	0.64	208,626.00
18	6" HDPE LCRS	2,120	LF	43.02	91,204.98
19	6" HDPE RISER	320	LF	34.55	11,054.50
20	12 OZ GEOTEXTILE	61,300	SF	0.34	21,025.90
	TOTAL DIRECT COST				\$ 1,558,838.78

Exhibit C General Conditions

General Conditions Breakdown

Description of Cost	QTY	UOM	Unit Cost	Extended Direct Cost
GENERAL CONDITIONS - PERSONNEL STAFFING				
PROJECT SUPERVISION	3.5	MO	29,097.86	101,842.50
				101,842.50
GENERAL CONDITIONS - SITE OPERATIONS				
KLEIN TANKS/STORAGE CONTAINERS	3.0	MO	1,405.33	4,216.00
GPS EQUIPMENT	3.0	MO	6,800.00	20,400.00
SAFETY SUPPLIES/J-JOHNS/LATHE/ETC	3.0	MO	6,156.74	18,470.21
SITE SPECIFIC HEALTH & SAFETY PLAN	1	LS	2,457.61	2,457.61
ON-SITE FUEL STORAGE & CONTAINMENT	1	LS	1,749.68	1,749.68
LINER SUBCONTRACT SUPPORT	1	LS	74,895.78	74,895.78
SITE OPERATIONS				\$ 122,189.28

Exhibit C Contingencies

Direct Cost Contingencies

Description of Cost	QTY	UOM	Unit Cost	Extended Direct Cost
CONTRACTOR CONTINGENCIES				
GEOSYNTHETICS MATERIAL ESCALATION	1	AL	50,000.00	50,000.00
TOTAL CONTRACTOR CONTINGENCIES				50,000.00
OWNER CONTINGENCIES				
				-
OWNER CONTINGENCY 5% of DCC	1	AL	96,467.00	96,467.00
OWNER CONTINGENCIES				96,467.00
TOTAL CONTINGENCIES				146,467.00

Cost Detail Backup

1. Cost Report

Cost Report

Activity	Desc	Quantity	Unit	Unit	Perm	Constr	Equip	Sub-	Total
Resource		Pcs		Cost	Labor	Material	Matl/Exp	Ment Contract	

BID ITEM = 100 CLIENT# = 1 Land Item SCHEDULE: 1 100
 Description = MOBILIZATION/DEMOBILIZATION Unit = LS Takeoff Quan: 1.000 Engr Quan: 1.000

----- Mobilization Load Calculator -----

Legal Mobilization

Equipment	Qty	Trips	Total
Backhoes	1	2	2
D6 Dozer	2	2	4
308 Excavator	1	2	2
320 Excavator	0	1	0
950 Loader	1	2	2
966 Loader	2	2	4
Gannon Tractors	1	2	2
14 Motorgrader	2	2	4
140 Motorgrader	0	1	0
16 Motorgrader	0	1	0
160 Motorgrader	0	1	0
613 Scraper	0	1	0
Ag Tractor	1	2	2
Implements - Bee Gee, Discs	1	2	2
5K Waterpull	0	1	0
Water Truck - 2K	0	1	0
Water Truck - 4K	1	2	2
Hurricane Pumps	0	1	0
Klein Tank	1	2	2
Connex Boxes	2	2	4
HDPE Pipe	0	1	0
Attachments (from Heavy)	0	1	0
Misc.	10	2	20

Total Legal Loads 52

Oversize Mobilization

Equipment	Qty	Trips	Total
D8 Dozer	0	1	0
623 Scraper	2	2	4
627 Scraper	0	1	0
8K Waterpull	2	2	4
325 Excavator	1	2	2
740 / 475 Articulated Truck	1	2	2
Screening Plant	2	2	4
815 Compactor	0	1	0

Total Oversize Loads 16

Oversize Heavy Mobilization

Equipment	Qty	Number of one way trips	Total
D10 Dozer	0	1	0
D9 Dozer	1	2	2
657 Scraper	0	1	0
637 Scraper	0	1	0
631 Scraper	0	1	0
988 Loader	0	1	0
349 Excavator	0	1	0
374 Excavator	1	2	2
773 Rigid Frame Truck	0	1	0

Total Oversize Heavy Loads 4

Total Equipment Prep Hours 2
 Total Equipment Prep Cost \$394

----- End Assembly -----

Cost Report

Activity Resource	Desc	Pcs	Quantity Unit	Unit Cost	Labor	Perm Material	Constr Matl/Exp	Equip Ment	Sub- Contract	Total
BID ITEM = 100	CLIENT# = 1		Land Item	SCHEDULE: 1	100					
Description =	MOBILIZATION/DEMOBILIZATION		Unit =	LS	Takeoff	Quan:	1.000	Engr	Quan:	1.000
190-10-02	Mobilization - Legal Move		Quan:	52.00	LDS	Hrs/Shft:	8.00	Cal:	508	WC: NOUSE
										**Unreviewed
<u>MOBRUM</u>	Mobilization Rumco		260.00 CH	Prod:	5.0000	HU	Lab Pcs:	1.00	Eqp Pcs:	1.00
6MBRUM	RUMCO Mob Outside Esc	1.00	52.00 EA	25.000			1,300			1,300
8LBLB	Truck and Trailer	1.00	260.00 HR	76.435				19,873		19,873
DRTP	Driver, Transport Low Boy	1.00	260.00 MH	43.278	11,252					11,252
\$32,425.46	5.0000 MH/LDS		260.00 MH	[171.25]	11,252		1,300	19,873		32,425
190-10-03	Mobilization - Oversize Move		Quan:	16.00	LDS	Hrs/Shft:	8.00	Cal:	508	WC: NOUSE
										**Unreviewed
<u>MOBLGL</u>	Mobilization Legal		80.00 CH	Prod:	5.0000	HU	Lab Pcs:	1.00	Eqp Pcs:	2.00
6MBLGL	Legal Mob Outside Esc	1.00	16.00 EA	74.000			1,184			1,184
8LBJEEP	Jeep Trailer	1.00	80.00 HR	20.000				1,600		1,600
8LBLB	Truck and Trailer	1.00	80.00 HR	76.435				6,115		6,115
DRTP	Driver, Transport Low Boy	1.00	80.00 MH	43.278	3,462					3,462
\$12,361.06	5.0000 MH/LDS		80.00 MH	[171.25]	3,462		1,184	7,715		12,361
190-10-04	Mobilization - Oversize-Heavy Move		Quan:	4.00	LDS	Hrs/Shft:	8.00	Cal:	508	WC: NOUSE
										**Unreviewed
<u>MOBOVS</u>	Mobilization Oversize		24.00 CH	Prod:	6.0000	HU	Lab Pcs:	3.00	Eqp Pcs:	5.00
6MBOVR	Oversize Mob Outside Esc	1.00	4.00 EA	100.000			400			400
8LBBOOS	Booster Trailer	1.00	24.00 HR	15.000				360		360
8LBJEEP	Jeep Trailer	1.00	24.00 HR	20.000				480		480
8LBLB	Truck and Trailer	1.00	24.00 HR	76.435				1,834		1,834
8LBPILOT	Lowbed Pilot Car	2.00	48.00 HR	14.490				696		696
DRPI	Driver, Pilot Car	2.00	48.00 MH	34.117	1,638					1,638
DRTP	Driver, Transport Low Boy	1.00	24.00 MH	43.278	1,039					1,039
\$6,446.27	18.0000 MH/LDS		72.00 MH	[529.5]	2,676		400	3,370		6,446
190-10-07	Mobilization Equipment Setup/Takedown		Quan:	2.00	HRS	Hrs/Shft:	10.00	Cal:	510	WC: NOUSE
										**Unreviewed
<u>MECH</u>	Mech Transport Break		2.00 CH	Prod:	1.0000	HU	Lab Pcs:	3.00	Eqp Pcs:	2.00
8LD980	Cat 980 Wheel Loader (	1.00	2.00 HR	173.670				347		347
8ZMECHTRK	Mechanics Truck	1.00	2.00 HR	31.250				63		63
MECH	Mechanic	1.00	2.00 MH	47.955	96					96
MECHHELP	Mechanic Helper	1.00	2.00 MH	34.055	68					68
OPLDR	Operator, Loader	1.00	2.00 MH	42.395	85					85
\$658.65	3.0000 MH/HRS		6.00 MH	[98.45]	249			410		659
970-33	MOBILIZATION/DEMOBILIZATION		Quan:	1.00	LS	Hrs/Shft:	10.00	Cal:	510	WC: NOUSE
										**Unreviewed
4LINER	Liner Sub	1.00	1.00 LS	7,000.000					7,000	7,000
809-00	Punchlist & Demobe Prep		Quan:	5.00	S	Hrs/Shft:	8.00	Cal:	508	WC: NOUSE
										**Unreviewed
<u>MICU</u>	Clean Up / Miscellaneous		40.00 CH	Prod:	0.0000		Lab Pcs:	4.00	Eqp Pcs:	3.00
7SWEEP	Sweeping Services	1.00	40.00 HR	110.000			4,400			4,400
8LDGT	JD210 / Case 570 Ganno	1.00	40.00 HR	38.500				1,540		1,540
8TKPU	Foreman pickup	1.00	40.00 HR	14.250				570		570
8WTK4	4,000 gal Water Truck	1.00	40.00 HR	54.000				2,160		2,160
LACMN	Laborer, Common	1.00	40.00 MH	29.062	1,163					1,163
OPGEN	Operator, General	1.00	40.00 MH	37.592	1,504					1,504
OPWT	Operator, Water Truck	1.00	40.00 MH	38.539	1,542					1,542
ZFM1	General Foreman	1.00	40.00 MH	50.840	2,034					2,034
\$14,911.40	32.0000 MH/S		160.00 MH	[978]	6,241		4,400	4,270		14,911
====>	Item Totals:	100	- MOBILIZATION/DEMOBILIZATION							
\$73,802.84	578.0000 MH/LS		578.00 MH	[18849.9]	23,881		7,284	35,638	7,000	73,803

Cost Report

Activity Resource	Desc	Quantity Pcs	Unit	Unit Cost	Perm Labor	Constr Material	Equip Matl/Exp	Sub- Contract	Total
BID ITEM = 100	CLIENT# = 1		Land Item	SCHEDULE: 1	100				
Description =	MOBILIZATION/DEMOBILIZATION		Unit =	LS	Takeoff Quan:	1.000	Engr Quan:		1.000
73,802.840	1 LS			23,881.14		7,284.00	35,637.70	7,000.00	73,802.84

BID ITEM = 200	CLIENT# = 2		Land Item	SCHEDULE: 1	100				
Description =	EXCAVATION/STOCKPILING		Unit =	CY	Takeoff Quan:	5,442.000	Engr Quan:		5,442.000

203-00-22 Regrading Floor Quan: 3,614.00 CY Hrs/Shft: 10.00 Cal: 510 WC: NOUSE

**Unreviewed

1 blade is windrowing minor cuts. Average cut is 0.8'
 Hauling to north stockpile

<u>EXS232</u>	(Mod) Excavation Scraper 623-2	20.00	CH	Prod:	180.7000 UH	Lab Pcs:	6.00	Eqp Pcs:	6.00
8MG140	Cat 140 Motorgrader	2.00	40.00 HR	92.000			3,680		3,680
8SC623	Cat 623 Scraper	2.00	40.00 HR	146.500			5,860		5,860
8WP08K	8000 GAL WATER PULL	1.00	20.00 HR	122.000			2,440		2,440
8YGATOR	UTV Gator / Kubota	1.00	20.00 HR	6.000			120		120
LAGCK	Laborer, Grade Checker	1.00	20.00 MH	43.436	869				869
OPBLD	Operator, Finish Motorgrad	2.00	40.00 MH	51.637	2,065				2,065
OPSCR	Operator, Scraper	2.00	40.00 MH	43.853	1,754				1,754
OPWP	Operator, Waterpull	1.00	20.00 MH	41.143	823				823
\$17,611.20	0.0332 MH/CY	120.00	MH	[1.207]	5,511		12,100		17,611

203-01-01 Regrading Fat 2:1 slopes Quan: 1,828.00 CY Hrs/Shft: 10.00 Cal: 510 WC: NOUSE

**Unreviewed

This item is both cutting (average of 0.7') and finegrading (cut/on-grade) prior to rolling
 Approximately 6,458 SY either cut/on-grade
 6458/20= 323 SY/HR

623s hauling to north stockpile

<u>EXD6</u>	(Mod) Excavation D6 Dozer	20.00	CH	Prod:	91.4000 UH	Lab Pcs:	5.50	Eqp Pcs:	5.50
8DZ06	Cat D6/D6T/D6R2 Dozer	2.00	40.00 HR	106.500			4,260		4,260
8DZ09	Cat D9T Dozer (405 hp)	0.50	10.00 HR	220.000			2,200		2,200
8SC623	Cat 623 Scraper	1.00	20.00 HR	146.500			2,930		2,930
8WP08K	8000 GAL WATER PULL	1.00	20.00 HR	122.000			2,440		2,440
8YGATOR	UTV Gator / Kubota	1.00	20.00 HR	6.000			120		120
LAGCK	Laborer, Grade Checker	1.00	20.00 MH	43.436	869				869
OPDZR	Operator, Dozer	2.50	50.00 MH	46.563	2,328				2,328
OPSCR	Operator, Scraper	1.00	20.00 MH	43.853	877				877
OPWP	Operator, Waterpull	1.00	20.00 MH	41.143	823				823
\$16,846.83	0.0601 MH/CY	110.00	MH	[2.12]	4,897		11,950		16,847

====> **Item Totals: 200 - EXCAVATION/STOCKPILING**

\$34,458.03	0.0422 MH/CY	230.00	MH	[1.514]	10,408		24,050		34,458
6.332	5442 CY				1.91		4.42		6.33

BID ITEM = 300	CLIENT# = 3		Land Item	SCHEDULE: 1	100				
Description =	SURVEYING		Unit =	LS	Takeoff Quan:	1.000	Engr Quan:		1.000

970-46 SURVEYING Quan: 1.00 LS Hrs/Shft: 10.00 Cal: 510 WC: NOUSE

**Unreviewed

7SURVEY	Survey Sub	1.00	1.00 LS	10,900.000		10,900			10,900
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====> **Item Totals: 300 - SURVEYING**

\$10,900.00				[]		10,900			10,900
10,900.000	1 LS					10,900.00			10,900.00

Cost Report

Activity	Desc	Quantity	Unit	Unit	Perm	Constr	Equip	Sub-		
Resource		Pcs		Cost	Labor	Material	Matl/Exp	Ment	Contract	Total
BID ITEM = 400	CLIENT# = 4		Land Item	SCHEDULE: 1	100					
Description =	AZPDES		Unit =	LS	Takeoff	Quan:	1.000	Engr	Quan:	1.000
810-12	SWPPP Plans		Quan:	1.00 LS	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE		
6NOICG	Construction General - NOI	1.00	EA	499.000			499			**Unreviewed
8TKPUPE	==> Project Engineer Picku	1.00	40.00 HR	14.250				570		499
ZE10	==> Project Engineer	1.00	40.00 MH	42.758	1,710					570
\$2,779.32	40.0000 MH/LS		40.00 MH	[1312]	1,710		499	570		1,710
810-02	Silt Fence		Quan:	2,000.00 LF	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE		2,779
ECBALE	SWPPP Straw Bale Placement		30.00 CH	Prod:	66.6667 UH	Lab Pcs:	3.00	Eqp Pcs:		**Unreviewed
2ESF01	Std. Silt Fence W/stakes	1.00	2,000.00 LF	1.100	2,200					2.00
8LDGT	JD210 / Case 570 Ganno	1.00	30.00 HR	38.500				1,155		2,200
8TLFB	Trailer, Flat Bed	1.00	30.00 HR	10.000				300		1,155
LACMN	Laborer, Common	2.00	60.00 MH	31.969	1,918					300
OPGEN	Operator, General	1.00	30.00 MH	41.351	1,241					1,918
\$6,813.68	0.0450 MH/LF		90.00 MH	[1.25]	3,159	2,200		1,455		1,241
810-16	SWPPP Inspections Etc.		Quan:	3.00 MOS	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE		6,814
8TKPUPE	==> Project Engineer Picku	1.00	48.00 HR	14.250				684		**Unreviewed
ZE10	==> Project Engineer	1.00	48.00 MH	42.758	2,052					684
\$2,736.39	16.0000 MH/MOS		48.00 MH	[524.8]	2,052			684		2,052
810-17	Concrete Washout		Quan:	1.00 EA	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE		2,736
LA-SW1	SWPPP Concrete Washoul		10.00 CH	Prod:	1.0000 S	Lab Pcs:	4.00	Eqp Pcs:		**Unreviewed
8BH420	Cat 420 Backhoe	1.00	10.00 HR	42.500				425		1.00
LACMN	Laborer, Common	3.00	30.00 MH	31.969	959					425
OPBKH	Operator, Backhoe	1.00	10.00 MH	41.351	414					959
\$1,797.58	40.0000 MH/EA		40.00 MH	[1086.25]	1,373			425		414
====>	Item Totals:	400	- AZPDES							
\$14,126.97	218.0000 MH/LS		218.00 MH	[6472.4]	8,294	2,200	499	3,134		14,127
14,126.970	1 LS				8,293.97	2,200.00	499.00	3,134.00		14,126.97

BID ITEM = 500		CLIENT# = 5		Land Item	SCHEDULE: 1	100				
Description =	ENGINEERED FILL		Unit =	CY	Takeoff	Quan:	1,562.000	Engr Quan:	1,562.000	
203-41	Place Fill from Onsite Ex		Quan:	1,562.00 CY	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE		
PLFILL	(Mod) Place Fill from Onsite Ex	10.00	CH	Prod:	156.2000 UH	Lab Pcs:	5.00	Eqp Pcs:	5.00	**Unreviewed
8DZ06	Cat D6/D6T/D6R2 Dozer	1.00	10.00 HR		106.500			1,065		1,065
8RCVS	Cat CS54 Vib Steel Rol	1.00	10.00 HR		43.578			436		436
8TRDSK	Ag Tractor & Disc	1.00	10.00 HR		124.580			1,246		1,246
8WP08K	8000 GAL WATER PULL	1.00	10.00 HR		122.000			1,220		1,220
8YGATOR	UTV Gator / Kubota	1.00	10.00 HR		6.000			60		60
LAGCK	Laborer, Grade Checker	1.00	10.00 MH		43.436	434				434
OPDZR	Operator, Dozer	1.00	10.00 MH		46.564	466				466
OPGEN	Operator, General	2.00	20.00 MH		41.351	827				827
OPWP	Operator, Waterpull	1.00	10.00 MH		41.143	411				411
\$6,165.03	0.0320 MH/CY	50.00	MH	[1.083]	2,138			4,027		6,165
====>	Item Totals:	500	- ENGINEERED FILL							
\$6,165.03	0.0320 MH/CY	50.00	MH	[1.083]	2,138			4,027		6,165
3.947	1562 CY				1.37			2.58		3.95

Cost Report

Activity Resource	Desc	Quantity Pcs	Unit	Unit Cost	Perm Labor	Constr Material	Constr Matl/Exp	Equip Ment	Sub- Contract	Total
PARENT ITEM = 600 CLIENT# = 6										
Description =	LINER SUBGRADE PREPARATION		Unit =	AC	Takeoff Quan:		9.000	Engr Quan:		9.000
Listing of Sub-Biditems of Parent Item 600:										
BID ITEM = 625										
Description =	DETOURS/TRAFFIC		Land Item Unit =	SCHEDULE: 1 LS	100 Takeoff Quan:		1.000	Engr Quan:		0.000
930-02 Set-up Traffic Cones										
Quan:					1.00 LS	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE	
<u>ECBALE</u>	SWPPP Straw Bale Placement	10.00	CH	Prod:	1.0000 S	Lab Pcs:	3.00	Eqp Pcs:		**Unreviewed
8LDGT	JD210 / Case 570 Ganno	1.00	10.00 HR	38.500				385		385
8TLFB	Trailer, Flat Bed	1.00	10.00 HR	10.000				100		100
LACMN	Laborer, Common	2.00	20.00 MH	31.969	639					639
OPGEN	Operator, General	1.00	10.00 MH	41.351	414					414
\$1,537.89	30.0000 MH/LS	30.00	MH	[833.25]	1,053			485		1,538
930-03 Grade detoure & re-route traffic west										
Quan:					350.00 CY	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE	
<u>PLOPS</u>	(Mod) Place Operations Layer	5.00	CH	Prod:	70.0000 UH	Lab Pcs:	4.00	Eqp Pcs:		**Unreviewed
8MG14	Cat 14 Motorgrader	1.00	5.00 HR	108.500				542		542
8SC623	Cat 623 Scraper	1.00	5.00 HR	146.500				733		733
8WP08K	8000 GAL WATER PULL	1.00	5.00 HR	122.000				610		610
8YGATOR	UTV Gator / Kubota	1.00	5.00 HR	6.000				30		30
LAGCK	Laborer, Grade Checker	1.00	5.00 MH	43.438	217					217
OPBLD	Operator, Finish Motorgrad	1.00	5.00 MH	51.638	258					258
OPSCR	Operator, Scraper	1.00	5.00 MH	43.854	219					219
OPWP	Operator, Waterpull	1.00	5.00 MH	41.142	206					206
\$2,815.34	0.0571 MH/CY	20.00	MH	[2.036]	900			1,915		2,815
930-04 Re-set/Remove Traffic Cones										
Quan:					1.00 LS	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE	
<u>ECBALE</u>	SWPPP Straw Bale Placement	10.00	CH	Prod:	1.0000 S	Lab Pcs:	3.00	Eqp Pcs:		**Unreviewed
8LDGT	JD210 / Case 570 Ganno	1.00	10.00 HR	38.500				385		385
8TLFB	Trailer, Flat Bed	1.00	10.00 HR	10.000				100		100
LACMN	Laborer, Common	2.00	20.00 MH	31.969	639					639
OPGEN	Operator, General	1.00	10.00 MH	41.351	414					414
\$1,537.89	30.0000 MH/LS	30.00	MH	[833.25]	1,053			485		1,538
930-01 Construct Detour & push traffic to east										
Quan:					1.00 LS	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE	
<u>FIN140</u>	Finish Grade	10.00	CH	Prod:	1.0000 S	Lab Pcs:	4.00	Eqp Pcs:		**Unreviewed
8MG150	Cat 150 Motorgrader (I	1.00	10.00 HR	96.000				960		960
8SC623	Cat 623 Scraper	1.00	10.00 HR	146.500				1,465		1,465
8WP08K	8000 GAL WATER PULL	1.00	10.00 HR	122.000				1,220		1,220
8YGATOR	UTV Gator / Kubota	1.00	10.00 HR	6.000				60		60
LAGCK	Laborer, Grade Checker	1.00	10.00 MH	43.436	434					434
OPBLD	Operator, Finish Motorgrad	1.00	10.00 MH	51.637	516					516
OPSCR	Operator, Scraper	1.00	10.00 MH	43.853	439					439
OPWP	Operator, Waterpull	1.00	10.00 MH	41.143	411					411
\$5,505.69	40.0000 MH/LS	40.00	MH	[1425.05]	1,801			3,705		5,506
====> Item Totals: 625 - DETOURS/TRAFFIC										
\$11,396.81	120.0000 MH/LS	120.00	MH	[3804.09]	4,807			6,590		11,397
11,396.810	1 LS				4,806.83			6,589.98		11,396.81

BID ITEM = 650 Land Item SCHEDULE: 1 100
Description = FINISH LINER SUBGRADE Unit = SY Takeoff Quan: 43,111.000 Engr Quan: 0.000

Cost Report

Activity Resource	Desc	Quantity Pcs	Unit	Unit Cost	Perm Labor	Constr Material	Equip Matl/Exp	Sub- Contract	Total
BID ITEM = 650									
Description =	FINISH LINER SUBGRADE		Land Item Unit =	SCHEDULE: 1 SY	100 Takeoff Quan:	43,111.000	Engr Quan:		0.000
205-06	Finish Liner Subgrade - Flat			Quan: 36,653.00 SY	Hrs/Shft: 10.00	Cal: 510	WC: NOUSE		
									**Unreviewed
<u>FINLSG</u>	(Mod) Finish Liner Subgrade	50.00	CH	Prod: 733.0600 UH	Lab Pcs:	5.00	Eqp Pcs:	5.00	
8MG140	Cat 140 Motorgrader	1.00	50.00 HR	92.000		4,600		4,600	
8RCVS	Cat CS54 Vib Steel Rol	1.00	50.00 HR	43.578		2,179		2,179	
8SC623	Cat 623 Scraper	1.00	50.00 HR	146.500		7,325		7,325	
8WP08K	8000 GAL WATER PULL	1.00	50.00 HR	122.000		6,100		6,100	
8YGATOR	UTV Gator / Kubota	1.00	50.00 HR	6.000		300		300	
LAGCK	Laborer, Grade Checker	1.00	50.00 MH	43.436	2,172			2,172	
OPBLD	Operator, Finish Motorgrad	1.00	50.00 MH	51.637	2,582			2,582	
OPGEN	Operator, General	1.00	50.00 MH	41.351	2,068			2,068	
OPSCR	Operator, Scraper	1.00	50.00 MH	43.853	2,193			2,193	
OPWP	Operator, Waterpull	1.00	50.00 MH	41.142	2,057			2,057	
\$31,574.92	0.0068 MH/SY	250.00	MH	[0.239]	11,071		20,504	31,575	
205-07	Finish Liner Subgrade - Slope			Quan: 6,458.00 SY	Hrs/Shft: 10.00	Cal: 510	WC: NOUSE		
									**Unreviewed
Include 6 laborers rock picking as needed									
<u>EXD6</u>	(Mod) Excavation D6 Dozer	20.00	CH	Prod: 322.9000 UH	Lab Pcs:	10.00	Eqp Pcs:	4.00	
8DZ06	Cat D6/D6T/D6R2 Dozer	1.00	20.00 HR	106.500		2,130		2,130	
8SC623	Cat 623 Scraper	1.00	20.00 HR	146.500		2,930		2,930	
8WP08K	8000 GAL WATER PULL	1.00	20.00 HR	122.000		2,440		2,440	
8YGATOR	UTV Gator / Kubota	1.00	20.00 HR	6.000		120		120	
LACMN	Laborer, Common	6.00	120.00 MH	31.969	3,836			3,836	
LAGCK	Laborer, Grade Checker	1.00	20.00 MH	43.436	869			869	
OPDZR	Operator, Dozer	1.00	20.00 MH	46.563	931			931	
OPSCR	Operator, Scraper	1.00	20.00 MH	43.853	877			877	
OPWP	Operator, Waterpull	1.00	20.00 MH	41.143	823			823	
\$14,956.21	0.0309 MH/SY	200.00	MH	[0.899]	7,336		7,620	14,956	
205-13	Roll Slopes			Quan: 6,458.00 SY	Hrs/Shft: 10.00	Cal: 510	WC: NOUSE		
									**Unreviewed
walk-behind roller is the compactor attachment for the 374 excavator									
<u>EXE374</u>	(Mod) Excavation Excavator 374	50.00	CH	Prod: 129.1600 UH	Lab Pcs:	4.00	Eqp Pcs:	4.00	
8EX374	Cat 374 Excavator (157	1.00	50.00 HR	179.500		8,975		8,975	
8RCHR	Walk Behin Hand roller	1.00	50.00 HR	27.526		1,376		1,376	
8WTK4	4,000 gal Water Truck	1.00	50.00 HR	54.000		2,700		2,700	
8YGATOR	UTV Gator / Kubota	1.00	50.00 HR	6.000		300		300	
LACMN	Laborer, Common	1.00	50.00 MH	31.969	1,598			1,598	
LAGCK	Laborer, Grade Checker	1.00	50.00 MH	43.436	2,172			2,172	
OPEXC	Operator, Excavator	1.00	50.00 MH	43.783	2,189			2,189	
OPWT	Operator, Water Truck	1.00	50.00 MH	42.393	2,120			2,120	
\$21,430.45	0.0309 MH/SY	200.00	MH	[0.99]	8,079		13,351	21,430	
====>	Item Totals: 650 - FINISH LINER SUBGRADE								
\$67,961.58	0.0150 MH/SY	650.00	MH	[0.486]	26,486		41,475	67,962	
1.576	43111 SY				0.61		0.96	1.58	
Total of Above Sub-Biditems									
====>	Item Totals: 600 - LINER SUBGRADE PREPARATION								
\$79,358.39	85.5555 MH/AC	770.00	MH	[2751.682]	31,293		48,065	79,358	
8,817.599	9 AC				3,477.02		5,340.58	8,817.60	

Cost Report

Activity Resource	Desc	Quantity Pcs	Unit	Unit Cost	Perm Labor	Constr Material	Constr Matl/Exp	Equip Ment	Sub- Contract	Total
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PARENT ITEM = 700 CLIENT# = 7
 Description = OPERATIONS LAYER PLACEMENT

Unit = CY Takeoff Quan: 27,077.000 Engr Quan: 27,077.000

Listing of Sub-Biditems of Parent Item 700:

BID ITEM = 725 Land Item SCHEDULE: 1 100
 Description = SCREEN OPS Unit = CY Takeoff Quan: 29,852.000 Engr Quan: 0.000

203-14		Screen Operations Layer				Quan: 29,852.00 CY		Hrs/Shft: 10.00		Cal: 510 WC: NOUSE		
												**Unreviewed
<u>EXL966</u>	(Mod) Excavation Loader 966			240.00	CH	Prod:	124.3833	UH	Lab Pcs:	3.50	Eqp Pcs:	5.50
8CSCRNPT	Screen Plant - 8 X 10	1.00	240.00	HR		92.015				22,084		22,084
8CSRS	Radial Material Stacke	1.00	240.00	HR		46.656				11,198		11,198
8LD966	Cat 966 Wheel loader (	1.50	360.00	HR		97.000				34,920		34,920
8TKPU	Foreman pickup	1.00	240.00	HR		14.250				3,420		3,420
8WTK4	4,000 gal Water Truck	1.00	240.00	HR		54.000				12,960		12,960
OPLDR	Operator, Loader	1.50	360.00	MH		42.393	15,262					15,262
OPWT	Operator, Water Truck	1.00	240.00	MH		42.393	10,175					10,175
ZFM1	General Foreman	1.00	240.00	MH		40.672	9,761					9,761
\$119,778.73	0.0281 MH/CY		840.00	MH		[0.925]	35,198			84,581		119,779
====>	Item Totals:	725	- SCREEN OPS									
\$119,778.73	0.0281 MH/CY		840.00	MH		[0.925]	35,198			84,581		119,779
4.012		29852 CY					1.18			2.83		4.01

BID ITEM = 750 Land Item SCHEDULE: 1 100
 Description = PLACE OPS Unit = CY Takeoff Quan: 28,432.000 Engr Quan: 0.000

203-42	Place Operations Layer				Quan: 27,252.00 CY	Hrs/Shft: 10.00	Cal: 510	WC: NOUSE		
<u>PLOPS</u>	(Mod) Place Operations Layer		130.00	CH	Prod:	209.6308 UH	Lab Pcs:	6.00	Eqp Pcs:	6.00
8DZ06	Cat D6/D6T/D6R2 Dozer	1.00	130.00	HR	106.500			13,845		13,845
8MG140	Cat 140 Motorgrader	1.00	130.00	HR	92.000			11,960		11,960
8SC623	Cat 623 Scraper	2.00	260.00	HR	146.500			38,090		38,090
8WP08K	8000 GAL WATER PULL	1.00	130.00	HR	122.000			15,860		15,860
8YGATOR	UTV Gator / Kubota	1.00	130.00	HR	6.000			780		780
LAGCK	Laborer, Grade Checker	1.00	130.00	MH	43.436	5,647				5,647
OPBLD	Operator, Finish Motorgrad	1.00	130.00	MH	51.637	6,713				6,713
OPDZR	Operator, Dozer	1.00	130.00	MH	46.563	6,053				6,053
OPSCR	Operator, Scraper	2.00	260.00	MH	43.853	11,402				11,402
OPWP	Operator, Waterpull	1.00	130.00	MH	41.142	5,349				5,349
\$115,698.21	0.0286 MH/CY		780.00	MH	[1.021]	35,163		80,535		115,698

203-43	Place Operations Layer on benches				Quan: 1,180.00 CY	Hrs/Shft: 10.00	Cal: 510	WC: NOUSE				
**Unreviewed												
980 Loader packing approximately 400 feet average												
2 min rnd = 55/2 = 27.5 rnds/hr x 6 cy = 165 cy												
966 loading 740 = 4 min = 55/4 = 13.75 x 20 = 275 cy per hour												
<u>PLOPS</u>	(Mod) Place Operations Layer			20.00	CH	Prod:	59.0000	UH	Lab Pcs:	6.00	Eqp Pcs:	5.00
8DZ06	Cat D6/D6T/D6R2 Dozer	1.00	20.00	HR		106.500				2,130		2,130
8LD966	Cat 966 Wheel loader (	1.00	20.00	HR		97.000				1,940		1,940
8LD980	Cat 980 Wheel Loader (	1.00	20.00	HR		173.670				3,473		3,473
8RTK040RE	Cat 745 (45) Articulat	1.00	20.00	HR		159.028				3,181		3,181
8WP08K	8000 GAL WATER PULL	1.00	20.00	HR		122.000				2,440		2,440
LACMN	Laborer, Common	1.00	20.00	MH		31.969	639					639
OPDZR	Operator, Dozer	1.00	20.00	MH		46.563	931					931
OPLDR	Operator, Loader	2.00	40.00	MH		42.393	1,696					1,696
OPTRK	Operator, Truck Off Road	1.00	20.00	MH		43.089	862					862

Cost Report

Activity Resource	Desc	Pcs	Quantity Unit	Unit Cost	Labor	Perm Material	Constr Matl/Exp	Equip Ment	Sub- Contract	Total
BID ITEM = 750										
Description =	PLACE OPS			Land Item Unit =	SCHEDULE: 1 CY	100 Takeoff Quan:	28,432.000	Engr Quan:		0.000
OPWP	Operator, Waterpull	1.00	20.00 MH	41.143	823					823
\$18,114.98	0.1016 MH/CY		120.00 MH	[3.321]	4,951			13,164		18,115
====> Item Totals: 750 - PLACE OPS										
\$133,813.19	0.0316 MH/CY		900.00 MH	[1.117]	40,114			93,699		133,813
4.706	28432 CY				1.41			3.30		4.71

Total of Above Sub-Biditems

====> Item Totals: 700 - OPERATIONS LAYER PLACEMENT										
\$253,591.92	0.0642 MH/CY		1,740.00 MH	[2.192]	75,312			178,280		253,592
9.366	27077 CY				2.78			6.58		9.37

BID ITEM = 900	CLIENT# = 9			Land Item	SCHEDULE: 1	100				
Description =	ANCHOR TRENCH-BENCH			Unit =	LF	Takeoff Quan:	442.000	Engr Quan:		442.000

903-03 Place Engineered Fill - liner trench**Quan: 147.33 CY Hrs/Shft: 10.00 Cal: 510 WC: NOUSE**

**Unreviewed

980 packing material to 950 to backfill

<u>PLANCH</u>	(Mod) Anchor Trench Backfill		10.00 CH	Prod:	14.7330 UH	Lab Pcs:	7.00	Eqp Pcs:	4.00	
8LD950	Cat 950 Wheel Loader (	1.00	10.00 HR	72.000			720		720	
8LD980	Cat 980 Wheel Loader (	1.00	10.00 HR	173.670			1,737		1,737	
8RCPC	Plate Compactor	1.00	10.00 HR	12.000			120		120	
8WTK4	4,000 gal Water Truck	1.00	10.00 HR	54.000			540		540	
LACMN	Laborer, Common	3.00	30.00 MH	31.969	959				959	
LAGCK	Laborer, Grade Checker	1.00	10.00 MH	43.436	434				434	
OPLDR	Operator, Loader	2.00	20.00 MH	42.394	848				848	
OPWT	Operator, Water Truck	1.00	10.00 MH	42.394	424				424	
\$5,781.94	0.4751 MH/CY		70.00 MH	[14.317]	2,665		3,117		5,782	

930-01 Excavate Trenches**Quan: 442.00 LF Hrs/Shft: 10.00 Cal: 510 WC: NOUSE**

**Unreviewed

<u>EXE314</u>	Excavation Excavator 314		10.00 CH	Prod:	44.2000 UH	Lab Pcs:	3.00	Eqp Pcs:	3.00	
8EX314	Cat 314 Excavator (32,	1.00	10.00 HR	56.000			560		560	
8WTK4	4,000 gal Water Truck	1.00	10.00 HR	54.000			540		540	
8YGATOR	UTV Gator / Kubota	1.00	10.00 HR	6.000			60		60	
LAGCK	Laborer, Grade Checker	1.00	10.00 MH	43.436	434				434	
OPEXC	Operator, Excavator	1.00	10.00 MH	43.784	438				438	
OPWT	Operator, Water Truck	1.00	10.00 MH	42.394	424				424	
\$2,456.14	0.0678 MH/LF		30.00 MH	[2.321]	1,296		1,160		2,456	

930-02 Remove Trench Spoils**Quan: 147.33 CY Hrs/Shft: 10.00 Cal: 510 WC: NOUSE**

**Unreviewed

<u>EXS131</u>	(Mod) Excavation Scraper 613-1		10.00 CH	Prod:	14.7330 UH	Lab Pcs:	3.00	Eqp Pcs:	3.00	
8LD966	Cat 966 Wheel loader (	1.00	10.00 HR	97.000			970		970	
8SC613	Cat 613 Scraper	1.00	10.00 HR	85.000			850		850	
8WTK4	4,000 gal Water Truck	1.00	10.00 HR	54.000			540		540	
OPLDR	Operator, Loader	1.00	10.00 MH	42.394	424				424	
OPSCR	Operator, Scraper	1.00	10.00 MH	43.853	439				439	
OPWT	Operator, Water Truck	1.00	10.00 MH	42.394	424				424	
\$3,646.41	0.2036 MH/CY		30.00 MH	[6.91]	1,286		2,360		3,646	

Cost Report

Activity	Desc	Quantity	Unit	Unit	Perm	Constr	Equip	Sub-	Total
Resource		Pcs		Cost	Labor	Material	Matl/Exp	Ment	Contract
BID ITEM = 900	CLIENT# = 9		Land Item	SCHEDULE: 1	100				
Description =	ANCHOR TRENCH-BENCH		Unit =	LF	Takeoff	Quan:	442.000	Engr Quan:	442.000
====> Item Totals: 900 - ANCHOR TRENCH-BENCH									
\$11,884.49	0.2941 MH/LF	130.00	MH	[9.396]	5,248			6,637	11,884
26.888	442 LF				11.87			15.02	26.89

BID ITEM = 1000	CLIENT# = 10		Land Item	SCHEDULE: 1	100				
Description =	BASE LINER TERMINATION		Unit =	LF	Takeoff	Quan:	1,530.000	Engr Quan:	1,530.000

903-01	Excavate turndown ditch	Quan:	1,530.00 LF	Hrs/Shft:	10.00	Cal:	510	WC:	NOUSE
<u>EXE308</u>	(Mod) Excavation Excavator 308	30.00	CH	Prod:	51.0000 UH	Lab Pcs:	3.00	Eqp Pcs:	3.00
8EX308	Cat 308 Excavator (18,	1.00	30.00	HR	52.204		1,566		1,566
8WTK4	4,000 gal Water Truck	1.00	30.00	HR	54.000		1,620		1,620
8YGATOR	UTV Gator / Kubota	1.00	30.00	HR	6.000		180		180
LAGCK	Laborer, Grade Checker	1.00	30.00	MH	43.436	1,303			1,303
OPEXC	Operator, Excavator	1.00	30.00	MH	43.783	1,314			1,314
OPWT	Operator, Water Truck	1.00	30.00	MH	42.393	1,272			1,272
\$7,254.53	0.0588 MH/LF	90.00	MH	[2.011]	3,888		3,366		7,255

903-02	Backfill Turndown	Quan:	1,530.00 LF	Hrs/Shft:	10.00	Cal:	510	WC:	NOUSE
<u>FIN140</u>	(Mod) Finish Grade	25.00	CH	Prod:	2.5000 S	Lab Pcs:	2.00	Eqp Pcs:	1.00
8MG140	Cat 140 Motorgrader	1.00	25.00	HR	92.000		2,300		2,300
LACMN	Laborer, Common	1.00	25.00	MH	31.969	799			799
OPBLD	Operator, Finish Motorgrad	1.00	25.00	MH	51.637	1,291			1,291
\$4,390.15	0.0326 MH/LF	50.00	MH	[1.081]	2,090		2,300		4,390

930-10	Purchase & Place Plywood Term. Berm	Quan:	192.00 SHT	Hrs/Shft:	10.00	Cal:	510	WC:	NOUSE
<u>LA-PLY</u>	Place Plywood at Term Berm	30.00	CH	Prod:	6.4000 UH	Lab Pcs:	4.00	Eqp Pcs:	1.00
3LP05	Plywood 3/4"	1.00	192.00	SHT	50.000		9,600		9,600
8LD966	Cat 966 Wheel loader (	1.00	30.00	HR	97.000		2,910		2,910
LACMN	Laborer, Common	3.00	90.00	MH	31.969	2,877			2,877
OPLDR	Operator, Loader	1.00	30.00	MH	42.393	1,272			1,272
\$16,659.03	0.6250 MH/SHT	120.00	MH	[17.102]	4,149		9,600	2,910	16,659

970-33	BASE LINER TERMINATION	Quan:	1,530.00 LF	Hrs/Shft:	10.00	Cal:	510	WC:	NOUSE
4LINER	Liner Sub	1.00	1,530.00	LF	8.000			12,240	12,240
====> Item Totals: 1000 - BASE LINER TERMINATION									
\$40,543.71	0.1699 MH/LF	260.00	MH	[5.238]	10,128	9,600	8,576	12,240	40,544
26.499	1530 LF				6.62	6.27	5.61	8.00	26.50

BID ITEM = 1100	CLIENT# = 11		Land Item	SCHEDULE: 1	100				
Description =	SIDE SLOPE LINER TERMINATION		Unit =	LF	Takeoff	Quan:	419.000	Engr Quan:	419.000

903-01	Excavate turndown ditch	Quan:	419.00 LF	Hrs/Shft:	10.00	Cal:	510	WC:	NOUSE
<u>EXE308</u>	(Mod) Excavation Excavator 308	15.00	CH	Prod:	27.9333 UH	Lab Pcs:	3.00	Eqp Pcs:	3.00
8EX308	Cat 308 Excavator (18,	1.00	15.00	HR	52.204		783		783
8WTK4	4,000 gal Water Truck	1.00	15.00	HR	54.000		810		810
8YGATOR	UTV Gator / Kubota	1.00	15.00	HR	6.000		90		90
LAGCK	Laborer, Grade Checker	1.00	15.00	MH	43.436	652			652
OPEXC	Operator, Excavator	1.00	15.00	MH	43.784	657			657

Cost Report

Activity Resource	Desc	Pcs	Quantity Unit	Unit Cost	Labor	Perm Material	Constr Matl/Exp	Equip Ment	Sub- Contract	Total
BID ITEM = 1100	CLIENT# = 11		Land Item	SCHEDULE: 1 100						
Description =	SIDE SLOPE LINER TERMINATION		Unit =	LF	Takeoff Quan:	419.000	Engr Quan:	419.000		
OPWT	Operator, Water Truck	1.00	15.00 MH	42.394	636					636
\$3,627.27	0.1073 MH/LF		45.00 MH	[3.672]	1,944			1,683		3,627
970-68	Shotcrete backfill		Quan:	32.00 CY	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE		
4SHOTCRETE	Shotcrete Sub	1.00	32.00 CY	750.000				24,000		24,000
**Unreviewed										
====>	Item Totals:	1100	- SIDE SLOPE LINER TERMINATION							
\$27,627.27	0.1073 MH/LF		45.00 MH	[3.672]	1,944			1,683	24,000	27,627
65.936	419 LF				4.64			4.02	57.28	65.94

PARENT ITEM = 1200 CLIENT# = 12
 Description = BENCH LINER TERMINATION Unit = LF Takeoff Quan: 442.000 Engr Quan: 442.000

Listing of Sub-Biditems of Parent Item 1200:

BID ITEM = 1210 Land Item SCHEDULE: 1 100
 Description = EXCAVATE & GRADE FOR LINER ABOVE Unit = SY Takeoff Quan: 5,456.000 Engr Quan: 0.000

203-01-01 **Regrading Fat 2:1 slopes** **Quan:** **1,390.00 CY** **Hrs/Shft:** **10.00** **Cal: 510** **WC: NOUSE**

**Unreviewed

This item is both cutting (average of 0.7') and finegrading (cut/on-grade) prior to rolling
 Approximately 6,458 SY either cut/on-grade
 6458/20= 323 SY/HR

623s hauling to north stockpile

<u>EXD6</u>	(Mod) Excavation D6 Dozer	20.00	CH	Prod:	69.5000 UH	Lab Pcs:	5.50	Eqp Pcs:	5.50
8DZ06	Cat D6/D6T/D6R2 Dozer	2.00	40.00 HR	106.500			4,260		4,260
8DZ09	Cat D9T Dozer (405 hp)	0.50	10.00 HR	220.000			2,200		2,200
8SC623	Cat 623 Scraper	1.00	20.00 HR	146.500			2,930		2,930
8WP08K	8000 GAL WATER PULL	1.00	20.00 HR	122.000			2,440		2,440
8YGATOR	UTV Gator / Kubota	1.00	20.00 HR	6.000			120		120
LAGCK	Laborer, Grade Checker	1.00	20.00 MH	43.436	869				869
OPDZR	Operator, Dozer	2.50	50.00 MH	46.563	2,328				2,328
OPSCR	Operator, Scraper	1.00	20.00 MH	43.853	877				877
OPWP	Operator, Waterpull	1.00	20.00 MH	41.143	823				823
\$16,846.83	0.0791 MH/CY		110.00 MH	[2.788]	4,897		11,950		16,847

205-07 **Finish Liner Subgrade - Slope** **Quan:** **4,911.00 SY** **Hrs/Shft:** **10.00** **Cal: 510** **WC: NOUSE**

**Unreviewed

Include 6 laborers rock picking as needed

<u>EXD6</u>	(Mod) Excavation D6 Dozer	20.00	CH	Prod:	245.5500 UH	Lab Pcs:	10.00	Eqp Pcs:	4.00
8DZ06	Cat D6/D6T/D6R2 Dozer	1.00	20.00 HR	106.500			2,130		2,130
8SC623	Cat 623 Scraper	1.00	20.00 HR	146.500			2,930		2,930
8WP08K	8000 GAL WATER PULL	1.00	20.00 HR	122.000			2,440		2,440
8YGATOR	UTV Gator / Kubota	1.00	20.00 HR	6.000			120		120
LACMN	Laborer, Common	6.00	120.00 MH	31.969	3,836				3,836
LAGCK	Laborer, Grade Checker	1.00	20.00 MH	43.436	869				869
OPDZR	Operator, Dozer	1.00	20.00 MH	46.563	931				931
OPSCR	Operator, Scraper	1.00	20.00 MH	43.853	877				877
OPWP	Operator, Waterpull	1.00	20.00 MH	41.143	823				823
\$14,956.21	0.0407 MH/SY		200.00 MH	[1.182]	7,336		7,620		14,956

====> **Item Totals:** **1210** **- EXCAVATE & GRADE FOR LINER ABOVE**

\$31,803.04	0.0568 MH/SY		310.00 MH	[1.774]	12,233		19,570		31,803
5.829	5456 SY				2.24		3.59		5.83

Cost Report

Activity Resource	Desc	Quantity Pcs	Unit	Unit Cost	Perm Labor	Constr Material	Equip Matl/Exp	Sub- Contract	Total
BID ITEM = 1220									
Description =	INSTALL GCL								
			Land Item	SCHEDULE: 1	100				
			Unit =	SF	Takeoff Quan:	12,376.000	Engr Quan:		0.000
970-33	GCL			Quan: 12,376.00 SF	Hrs/Shft: 10.00	Cal: 510	WC: NOUSE		
4LINER	Liner Sub	1.00	12,376.00 SF	0.766				9,480	9,480
									**Unreviewed
BID ITEM = 1230									
Description =	INSTALL GEOMEMBRANE								
			Land Item	SCHEDULE: 1	100				
			Unit =	SF	Takeoff Quan:	12,376.000	Engr Quan:		0.000
970-33	60-MIL GEOMEMBRANE			Quan: 12,376.00 SF	Hrs/Shft: 10.00	Cal: 510	WC: NOUSE		
4LINER	Liner Sub	1.00	12,376.00 SF	0.573				7,091	7,091
									**Unreviewed
BID ITEM = 1240									
Description =	INSTALL TERMINATION PROTECTION								
			Land Item	SCHEDULE: 1	100				
			Unit =	LF	Takeoff Quan:	442.000	Engr Quan:		0.000
970-33	BENCH LINER TERMINATION			Quan: 442.00 LF	Hrs/Shft: 10.00	Cal: 510	WC: NOUSE		
4LINER	Liner Sub	1.00	442.00 LF	8.000				3,536	3,536
									**Unreviewed
BID ITEM = 1250									
Description =	PLYWOOD PROTECTION								
			Land Item	SCHEDULE: 1	100				
			Unit =	LF	Takeoff Quan:	442.000	Engr Quan:		0.000
930-10	Purchase & Place Plywood Term. Berm			Quan: 56.00 SHT	Hrs/Shft: 10.00	Cal: 510	WC: NOUSE		
									**Unreviewed
Added plywood & orange safety fence for future tie-in									
<u>LA-PLY</u>	Place Plywood at Term Berm		10.00 CH	Prod: 5.6000 UH	Lab Pcs:	4.00	Eqp Pcs:	1.00	
3LP05	Plywood 3/4"	1.00	56.00 SHT	50.000	2,800			2,800	
3OSF	Orange Safety Fence	1.00	500.00 LF	0.500	250			250	
8LD966	Cat 966 Wheel loader (	1.00	10.00 HR	97.000		970		970	
LACMN	Laborer, Common	3.00	30.00 MH	31.969	959			959	
OPLDR	Operator, Loader	1.00	10.00 MH	42.394	424			424	
\$5,403.01	0.7142 MH/SHT		40.00 MH	[19.545]	1,383	3,050	970	5,403	
====>	Item Totals: 1250 - PLYWOOD PROTECTION								
\$5,403.01	0.0904 MH/LF		40.00 MH	[2.476]	1,383	3,050	970	5,403	
12.224	442 LF				3.13	6.90	2.19	12.22	
Total of Above Sub-Biditems									
====>	Item Totals: 1200 - BENCH LINER TERMINATION								
\$57,313.52	0.7918 MH/LF		350.00 MH	[24.379]	13,616	3,050	20,540	20,107	57,314
129.669	442 LF				30.81	6.90	46.47	45.49	129.67

Cost Report

Activity Resource	Desc	Pcs	Quantity Unit	Unit Cost	Labor	Perm Material	Constr Matl/Exp	Equip Ment	Sub- Contract	Total
BID ITEM =	1300	CLIENT# =	13	Land Item	SCHEDULE:	1	100			
Description =	BASE LINER TIE-IN			Unit =	LF	Takeoff	Quan:	1,550.000	Engr Quan:	1,550.000
970-33	BASE LINER TIE-IN			Quan:	1,550.00 LF	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE	
4LINER	Liner Sub	1.00	1,550.00 LF		8.000				12,400	12,400
203-02-20	Remove Temporary Berm/plywood			Quan:	1,550.00 LF	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE	
EXE325	(Mod) Excavation Excavator 325		50.00 CH	Prod:	31.0000 UH	Lab Pcs:	7.00	Eqp Pcs:	4.00	**Unreviewed
8EX325	Cat 325 Excavator (57,	1.00	50.00 HR		66.500			3,325		3,325
8LD950	Cat 950 Wheel Loader (	1.00	50.00 HR		72.000			3,600		3,600
8WTK4	4,000 gal Water Truck	1.00	50.00 HR		54.000			2,700		2,700
8YGATOR	UTV Gator / Kubota	1.00	50.00 HR		6.000			300		300
LACMN	Laborer, Common	3.00	150.00 MH		31.969	4,795				4,795
LAGCK	Laborer, Grade Checker	1.00	50.00 MH		43.436	2,172				2,172
OPEXC	Operator, Excavator	1.00	50.00 MH		43.783	2,189				2,189
OPLDR	Operator, Loader	1.00	50.00 MH		42.393	2,120				2,120
OPWT	Operator, Water Truck	1.00	50.00 MH		42.393	2,120				2,120
\$23,320.74	0.2258 MH/LF		350.00 MH		[6.84]	13,396		9,925		23,321
930-05	Drain Rock Transition			Quan:	1,150.00 TON	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE	
[[Crew Notes: ***Copied***]]										
EXL950	(Mod) Excavation Small D6/950		10.00 CH	Prod:	115.0000 UH	Lab Pcs:	6.00	Eqp Pcs:	3.00	**Unreviewed
2ARDRAIN	#57 Rock	1.00	1,150.00 TON		41.700	47,955				47,955
8DZ06	Cat D6/D6T/D6R2 Dozer	1.00	10.00 HR		106.500			1,065		1,065
8LD950	Cat 950 Wheel Loader (	1.00	10.00 HR		72.000			720		720
8WTK4	4,000 gal Water Truck	1.00	10.00 HR		54.000			540		540
LACMN	Laborer, Common	2.00	20.00 MH		31.969	639				639
LAGCK	Laborer, Grade Checker	1.00	10.00 MH		43.436	434				434
OPDZR	Operator, Dozer	1.00	10.00 MH		46.564	466				466
OPLDR	Operator, Loader	1.00	10.00 MH		42.394	424				424
OPWT	Operator, Water Truck	1.00	10.00 MH		42.394	424				424
\$52,667.26	0.0521 MH/TON		60.00 MH		[1.643]	2,387	47,955	2,325		52,667
====>	Item Totals:	1300	- BASE LINER TIE-IN							
\$88,388.00	0.2645 MH/LF		410.00 MH		[8.058]	15,783	47,955	12,250	12,400	88,388
57.025	1550 LF					10.18	30.94	7.90	8.00	57.02

BID ITEM	=	1400	CLIENT# = 14		Land Item	SCHEDULE:	1	100				
Description =	SIDESLOPE LINER TIE-IN				Unit =	LF	Takeoff Quan:	390.000	Engr Quan:	390.000		
903-01	Remove ops				Quan:	390.00 LF	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE		
<u>EXE308</u>	(Mod) Excavation Excavator 308				20.00	CH	Prod:	19.5000 UH	Lab Pcs:	5.00	Eqp Pcs:	3.00
8EX308	Cat 308 Excavator (18,				1.00	20.00	HR	52.204		1,044		1,044
8WTK4	4,000 gal Water Truck				1.00	20.00	HR	54.000		1,080		1,080
8YGATOR	UTV Gator / Kubota				1.00	20.00	HR	6.000		120		120
LACMN	Laborer, Common				2.00	40.00	MH	31.969	1,279			1,279
LAGCK	Laborer, Grade Checker				1.00	20.00	MH	43.436	869			869
OPEXC	Operator, Excavator				1.00	20.00	MH	43.783	876			876
OPWT	Operator, Water Truck				1.00	20.00	MH	42.394	848			848
\$6,115.12	0.2564 MH/LF				100.00	MH	[7.855]	3,871		2,244		6,115
970-33	SIDESLOPE LINER TIE-IN				Quan:	390.00 LF	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE		
4LINER	Liner Sub				1.00	390.00	LF	8.000			3,120	3,120

Cost Report

Activity Resource	Desc	Quantity Pcs	Unit	Unit Cost	Perm Labor	Constr Material	Constr Matl/Exp	Equip Ment	Sub- Contract	Total
BID ITEM = 1400	CLIENT# = 14	Land Item	SCHEDULE: 1	100						
Description =	SIDESLOPE LINER TIE-IN	Unit =	LF	Takeoff Quan:	390.000	Engr Quan:	390.000			
====> Item Totals:	1400 - SIDESLOPE LINER TIE-IN									
\$9,235.12	0.2564 MH/LF	100.00 MH	[7.855]	3,871		2,244	3,120	9,235		
23.680	390 LF			9.93		5.75	8.00	23.68		
BID ITEM = 1500	CLIENT# = 15	Land Item	SCHEDULE: 1	100						
Description =	GCL	Unit =	SF	Takeoff Quan:	388,000.000	Engr Quan:	388,000.000			
970-33	GCL	Quan:	388,000.00 SF	Hrs/Shft:	10.00	Cal:	510	WC:	NOUSE	
4LINER	Liner Sub	1.00 388,000.00 SF	0.766			297,208	297,208			**Unreviewed
BID ITEM = 1600	CLIENT# = 16	Land Item	SCHEDULE: 1	100						
Description =	60-MIL GEOMEMBRANE	Unit =	SF	Takeoff Quan:	388,000.000	Engr Quan:	388,000.000			
970-33	60-MIL GEOMEMBRANE	Quan:	388,000.00 SF	Hrs/Shft:	10.00	Cal:	510	WC:	NOUSE	
4LINER	Liner Sub	1.00 388,000.00 SF	0.573			222,324	222,324			**Unreviewed
BID ITEM = 1700	CLIENT# = 17	Land Item	SCHEDULE: 1	100						
Description =	GEOCOMPOSITE	Unit =	SF	Takeoff Quan:	327,000.000	Engr Quan:	327,000.000			
970-33	GEOCOMPOSITE	Quan:	327,000.00 SF	Hrs/Shft:	10.00	Cal:	510	WC:	NOUSE	
4LINER	Liner Sub	1.00 327,000.00 SF	0.638			208,626	208,626			**Unreviewed
BID ITEM = 1800	CLIENT# = 18	Land Item	SCHEDULE: 1	100						
Description =	6" HDPE LCRS	Unit =	LF	Takeoff Quan:	2,120.000	Engr Quan:	2,120.000			
505-01	Fusing Pipe	Quan:	2,120.00 LF	Hrs/Shft:	10.00	Cal:	510	WC:	NOUSE	
PIPE10	10" Pipe Fusing	50.00 CH	Prod:	42.4000 UH	Lab Pcs:	5.00	Eqp Pcs:	3.00		**Unreviewed
8BH420	Cat 420 Backhoe	1.00 50.00 HR	42.500			2,125		2,125		
8FM0412	4" - 12" Fusing Machin	1.00 50.00 HR	32.500			1,625		1,625		
8TKPU	Foreman pickup	1.00 50.00 HR	14.250			713		713		
LACMN	Laborer, Common	3.00 150.00 MH	31.969	4,795				4,795		
OPBKH	Operator, Backhoe	1.00 50.00 MH	41.351	2,068				2,068		
ZFM1	General Foreman	1.00 50.00 MH	40.672	2,034				2,034		
\$13,359.05	0.1179 MH/LF	250.00 MH	[3.298]	8,897		4,463		13,359		
505-02	Gravel Wrap Bench Pipe	Quan:	850.00 LF	Hrs/Shft:	10.00	Cal:	510	WC:	NOUSE	
160 x 2 CF/LF /27 = 12 cy										**Unreviewed
170 x 7.5 = 1275 SF (fabric) 142 SY - 5000 sy										
325/80 = 4 cy per hour										
EXL950	(Mod) Excavation Small D6/950	30.00 CH	Prod:	28.3333 UH	Lab Pcs:	5.00	Eqp Pcs:	2.00		
2ARDRAIN	#57 Rock	1.00 127.50 TON	41.700	5,317				5,317		
2GF16OZ	16 oz Non-Woven Geofabri	1.00 2,656.26 SY	2.500	6,641				6,641		
8LD950	Cat 950 Wheel Loader (	1.00 30.00 HR	72.000			2,160		2,160		

Cost Report

Activity Resource	Desc	Pcs	Quantity Unit	Unit Cost	Labor	Perm Material	Constr Matl/Exp	Equip Ment	Sub- Contract	Total
BID ITEM = 1800 CLIENT# = 18 Land Item SCHEDULE: 1 100										
Description =	6" HDPE LCRS		Unit =	LF	Takeoff	Quan:	2,120.000	Engr	Quan:	2,120.000
8LD980	Cat 980 Wheel Loader (	1.00	30.00 HR	173.670				5,210		5,210
LACMN	Laborer, Common	3.00	90.00 MH	31.969	2,877					2,877
OPLDR	Operator, Loader	2.00	60.00 MH	42.393	2,544					2,544
\$24,748.34	0.1764 MH/LF		150.00 MH	[5.047]	5,421	11,957		7,370		24,748
505-03 Buy Pipe & Fittings Quan: 2,140.00 LF Hrs/Shft: 10.00 Cal: 510 WC: NOUSE										
2HD6FITLOT	6" Fittings	1.00	1.00 LOT	2,000.000		2,000				2,000
2HD6PERF	6" Perforated DR 11 HDPE	1.00	2,140.00 LF	7.250		15,515				15,515
\$17,515.00				[]		17,515				17,515
505-04 Gravel Wrap LCRS on floor Quan: 1,270.00 LF Hrs/Shft: 10.00 Cal: 510 WC: NOUSE										
1253 x 2 CF/LF /27 = 93 cy										
1253 x 16 = 20048 SF (fabric) 2227 SY - 3000 sy										
EXL950	(Mod) Excavation Small D6/950		30.00 CH	Prod:	42.3333 UH	Lab Pcs:	5.00	Eqp Pcs:	2.00	
2ARDRAIN	#57 Rock	1.00	190.50 TON	41.700	7,944					7,944
2GF16OZ	16 oz Non-Woven Geofabri	1.00	3,043.13 SY	2.500	7,608					7,608
8LD950	Cat 950 Wheel Loader (	1.00	30.00 HR	72.000				2,160		2,160
8LD980	Cat 980 Wheel Loader (	1.00	30.00 HR	173.670				5,210		5,210
LACMN	Laborer, Common	3.00	90.00 MH	31.969	2,877					2,877
OPLDR	Operator, Loader	2.00	60.00 MH	42.393	2,544					2,544
\$28,342.62	0.1181 MH/LF		150.00 MH	[3.378]	5,421	15,552		7,370		28,343
505-05 Trench through old ops Quan: 315.00 LF Hrs/Shft: 10.00 Cal: 510 WC: NOUSE										
EXE308	(Mod) Excavation Excavator 308		30.00 CH	Prod:	10.5000 UH	Lab Pcs:	5.00	Eqp Pcs:	2.00	
8EX308	Cat 308 Excavator (18,	1.00	30.00 HR	52.204				1,566		1,566
8YGATOR	UTV Gator / Kubota	1.00	30.00 HR	6.000				180		180
LACMN	Laborer, Common	3.00	90.00 MH	31.969	2,877					2,877
LAGCK	Laborer, Grade Checker	1.00	30.00 MH	43.436	1,303					1,303
OPEXC	Operator, Excavator	1.00	30.00 MH	43.783	1,314					1,314
\$7,239.94	0.4761 MH/LF		150.00 MH	[13.802]	5,494			1,746		7,240
====> Item Totals: 1800 - 6" HDPE LCRS										
\$91,204.95	0.3301 MH/LF		700.00 MH	[9.396]	25,232	45,024		20,949		91,205
43.021	2120 LF				11.90	21.24		9.88		43.02

BID ITEM = 1900 CLIENT# = 19 Land Item SCHEDULE: 1 100										
Description =	6" HDPE RISER		Unit =	LF	Takeoff	Quan:	320.000	Engr	Quan:	320.000
505-01 Fusing Pipe Quan: 320.00 LF Hrs/Shft: 10.00 Cal: 510 WC: NOUSE										
PIPE10	(Mod) 10" Pipe Fusing		30.00 CH	Prod:	10.6667 UH	Lab Pcs:	6.00	Eqp Pcs:	3.00	
3SANDBAGS	Sand bags to anchor pipe	1.00	32.00 EA	2.500		80				80
8BH420	Cat 420 Backhoe	1.00	30.00 HR	42.500				1,275		1,275
8FM0412	4" - 12" Fusing Machin	1.00	30.00 HR	32.500				975		975
8TKPU	Foreman pickup	1.00	30.00 HR	14.250				428		428
LACMN	Laborer, Common	4.00	120.00 MH	31.969	3,836					3,836
OPBKH	Operator, Backhoe	1.00	30.00 MH	41.351	1,241					1,241
ZFM1	General Foreman	1.00	30.00 MH	40.672	1,220					1,220
\$9,054.50	0.5625 MH/LF		180.00 MH	[15.48]	6,297		80	2,678		9,055
505-03 Buy Pipe & Fittings Quan: 320.00 LF Hrs/Shft: 10.00 Cal: 510 WC: NOUSE										
2HD6	6" DR 11 HDPE	1.00	320.00 LF	6.250		2,000				2,000

Cost Report

Activity Resource	Desc	Quantity Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Exp	Equip Ment	Sub- Contract	Total
BID ITEM = 1900	CLIENT# = 19		Land Item	SCHEDULE: 1	100					
Description = 6" HDPE RISER			Unit = LF	Takeoff Quan:		320.000		Engr Quan:		320.000
====> Item Totals: 1900 - 6" HDPE RISER										
\$11,054.50	0.5625 MH/LF	180.00 MH		[15.48]	6,297	2,000	80	2,678		11,055
34.545	320 LF				19.68	6.25	0.25	8.37		34.55
BID ITEM = 2000	CLIENT# = 20		Land Item	SCHEDULE: 1	100					
Description = 12 OZ GEOTEXTILE			Unit = SF	Takeoff Quan:		61,300.000		Engr Quan:		61,300.000
970-33	12 OZ GEOTEXTILE			Quan: 61,300.00 SF	Hrs/Shft: 10.00	Cal: 510	WC: NOUSE			
4LINER	Liner Sub	1.00	61,300.00 SF	0.343				21,026		21,026
										**Unreviewed
BID ITEM = 3000			Land Item	SCHEDULE: 1	100					
Description = CONTRACTOR'S CONTINGENCY			Unit = LS	Takeoff Quan:		1.000		Engr Quan:		1.000
980-10	contingency			Quan: 1.00 LS	Hrs/Shft: 10.00	Cal: 510	WC: NOUSE			
3CONT	Contingency	1.00	1.00 LS	50,000.000		50,000				50,000
										**Unreviewed
====> Item Totals: 3000 - CONTRACTOR'S CONTINGENCY										
\$50,000.00				[]		50,000				50,000
50,000.000	1 LS					50,000.00				50,000.00
BID ITEM = 3100			Land Item	SCHEDULE: 1	100					
Description = OWNER'S CONTINGENCY			Unit = LS	Takeoff Quan:		1.000		Engr Quan:		1.000
980-10	contingency			Quan: 1.00 LS	Hrs/Shft: 10.00	Cal: 510	WC: NOUSE			
3CONT	Contingency	1.00	1.00 LS	96,467.000		96,467				96,467
										**Unreviewed
====> Item Totals: 3100 - OWNER'S CONTINGENCY										
\$96,467.00				[]		96,467				96,467
96,467.000	1 LS					96,467.00				96,467.00
PARENT ITEM = 10000										
Description = PROJECT INDIRECT COSTS			Unit = LS	Takeoff Quan:		1.000		Engr Quan:		1.000
Listing of Sub-Biditems of Parent Item 10000:										
BID ITEM = 10010			Land Item	SCHEDULE: 1	100					
Description = TIME DEPENDENT			Unit = MO	Takeoff Quan:		3.000		Engr Quan:		0.000
140-00	Project Supervision			Quan: 78.00 S	Hrs/Shft: 8.00	Cal: 508	WC: NOUSE			
										**Unreviewed
<u>LA-SUP</u>	(Mod) Project Supervision		624.00 CH	Prod: 78.0000 S		Lab Pcs:	2.20	Eqp Pcs:		2.20
8TKPUPE	Project Engineer Picku	1.00	624.00 HR	14.250			8,892			8,892
8TKPUPM	Project Manager Pickup	0.20	124.80 HR	14.250			1,778			1,778
8TKPUS	Superintendent Pickup	1.00	624.00 HR	14.250			8,892			8,892
ZE10	Project Engineer	1.00	624.00 MH	53.447	33,351					33,351

Cost Report

Activity Resource	Desc	Pcs	Quantity Unit	Unit Cost	Labor	Perm Material	Constr Matl/Exp	Equip Ment	Sub- Contract	Total
BID ITEM = 10010										
Description =	TIME DEPENDENT		Land Item Unit =	SCHEDULE: 1 100 MO Takeoff Quan:			3.000	Engr Quan:		0.000
ZPM1	Project Manager	0.20	124.80 MH	77.564	9,680					9,680
ZS01	Superintendent	1.00	624.00 MH	62.898	39,249					39,249
\$101,842.50	17.6000 MH/S		1,372.80 MH	[809.2]	82,280			19,562		101,843
150-00 Misc. Equipment Costs										
				Quan:	68.00 S	Hrs/Shft:	8.00	Cal: 508	WC: NOUSE	
<u>MIKLEI</u>	Klein Tank / Conex		544.00 CH	Prod:	68.0000 S	Lab Pcs:	0.00	Eqp Pcs:		4.00
8YKLEIN	Klein Water Tower	1.00	544.00 HR	7.000				3,808		3,808
8YSC	Storage Containers	3.00	1,632.00 HR	0.250				408		408
\$4,216.00				[]				4,216		4,216
205-10 GPS Equipment										
				Quan:	68.00 S	Hrs/Shft:	8.00	Cal: 508	WC: NOUSE	
excavation duration + finish grade = total shifts										
<u>MIGPS</u>	(Mod) GPS Equipmnet		544.00 CH	Prod:	68.0000 S	Lab Pcs:	0.00	Eqp Pcs:		6.00
8SRVYBS	GPS Base Station	1.00	544.00 HR	4.000				2,176		2,176
8SRVYMC	GPS Machine Control	3.00	1,632.00 HR	8.500				13,872		13,872
8SRVYRV	GPS Rover	2.00	1,088.00 HR	4.000				4,352		4,352
\$20,400.00				[]				20,400		20,400
Item Totals: 10010 - TIME DEPENDENT										
\$126,458.50	457.6000 MH/MO		1,372.80 MH	[21039.2]	82,280			44,178		126,459
42,152.833	3 MO				27,426.70			14,726.13		42,152.83
BID ITEM = 10020										
Description =	NON TIME DEPENDENT		Land Item Unit =	SCHEDULE: 1 100 LS Takeoff Quan:			1.000	Engr Quan:		0.000
155-01 Fuel Storage Containment										
				Quan:	1.00 EA	Hrs/Shft:	8.00	Cal: 508	WC: NOUSE	
<u>ECFCLN</u>	Fuel Containment Liner		2.00 CH	Prod:	2.0000 HU	Lab Pcs:	5.00	Eqp Pcs:		1.00
3PFCLNR	Fuel Containment Liner	1.00	2,100.00 SF	0.650				1,365		1,365
8LDGT	JD210 / Case 570 Ganno	1.00	2.00 HR	38.500				77		77
LACMN	Laborer, Common	4.00	8.00 MH	29.062	233					233
OPGEN	Operator, General	1.00	2.00 MH	37.590	75					75
\$1,749.68	10.0000 MH/EA		10.00 MH	[243.5]	308			1,365	77	1,750
130-00 Safety and Supplies										
				Quan:	1.00 LS	Hrs/Shft:	8.00	Cal: 508	WC: NOUSE	
Rate updated 01/08/2024 Based on 2023 regular projects.										
6*TLB	Misc Supplies / Wireless JC	1.00	349,153.26 TLB\$	0.052				18,470		18,470
140-01 Site Specific Safety Plan										
				Quan:	1.00 WKS	Hrs/Shft:	10.00	Cal: 510	WC: NOUSE	
<u>LA-SSM</u>	Safety Management		40.00 CH	Prod:	40.0000 HU	Lab Pcs:	1.00	Eqp Pcs:		1.00
8TKPUSM	Safety Manager Pickup	1.00	40.00 HR	14.250				570		570
ZSM1	Safety Manager	1.00	40.00 MH	47.190	1,888					1,888
\$2,457.61	40.0000 MH/WKS		40.00 MH	[1448]	1,888			570		2,458
Item Totals: 10020 - NON TIME DEPENDENT										
\$22,677.50	50.0000 MH/LS		50.00 MH	[1691.5]	2,195			19,835	647	22,678
22,677.500	1 LS				2,195.29			19,835.21	647.00	22,677.50

Cost Report

Activity Resource	Desc	Pcs	Quantity Unit	Unit Cost	Perm Labor	Constr Material	Equip Matl/Exp	Sub- Contract	Total
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BID ITEM = 10030 Land Item SCHEDULE: 1 100
 Description = LINER SUBCONTRACT SUPPORT Unit = LS Takeoff Quan: 1.000 Engr Quan: 0.000

970-33A Unloading Geosynthetics Quan: 1.00 LS Hrs/Shft: 10.00 Cal: 510 WC: NOUSE

<u>LA-PLY</u>	(Mod) Place Plywood at Term Berm	100.00	CH	Prod:	10.0000 S	Lab Pcs:	4.00	Eqp Pcs:	1.00
3PROTGCL	Protection Measures for GC	1.00	LS	5,000.000		5,000			5,000
8LD930	Cat 930 Wheel Loader	1.00	HR	59.500			5,950		5,950
LACMN	Laborer, Common	3.00	MH	31.969	9,591				9,591
OPLDR	Operator, Loader	1.00	MH	42.393	4,239				4,239
\$24,780.10	400.0000 MH/LS	400.00	MH	[10945]	13,830	5,000	5,950		24,780

**Unreviewed

970-33B Roller / Dust Support Quan: 30.00 S Hrs/Shft: 10.00 Cal: 510 WC: NOUSE

Roller cost to cover rental during liner install. Foreman can jump on occasionally to remove any wrinkles in subgrade.

<u>MICU</u>	(Mod) Clean Up / Miscellaneous	300.00	CH	Prod:	30.0000 S	Lab Pcs:	1.00	Eqp Pcs:	2.00
8RCVS	Cat CS54 Vib Steel Rol	1.00	HR	43.577			13,073		13,073
8WTK4	4,000 gal Water Truck	1.00	HR	54.000			16,200		16,200
OPWT	Operator, Water Truck	1.00	MH	42.393	12,718				12,718
\$41,991.51	10.0000 MH/S	300.00	MH	[335.5]	12,718		29,273		41,992

**Unreviewed

970-33C Dewatering Allowance Quan: 5.00 S Hrs/Shft: 10.00 Cal: 510 WC: NOUSE

2 days with loader to install/remove pump
 24/7 on pump and man during pumping

<u>LA-PLY</u>	(Mod) Place Plywood at Term Berm	50.00	CH	Prod:	5.0000 S	Lab Pcs:	2.80	Eqp Pcs:	3.40
8LD966	Cat 966 Wheel loader (	0.40	HR	97.000			1,940		1,940
8YPUMP03	Wacker 3" Trash Pump	3.00	HR	10.000			1,500		1,500
LACMN	Laborer, Common	2.40	MH	31.969	3,836				3,836
OPLDR	Operator, Loader	0.40	MH	42.394	848				848
\$8,124.17	28.0000 MH/S	140.00	MH	[741.4]	4,684		3,440		8,124

**Unreviewed

====> Item Totals: 10030 - LINER SUBCONTRACT SUPPORT									
\$74,895.78	840.0000 MH/LS	840.00	MH	[24717]	31,232	5,000	38,663		74,896
74,895.780	1 LS				31,232.40	5,000.00	38,663.38		74,895.78

Total of Above Sub-Biditems

====> Item Totals: 10000 - PROJECT INDIRECT COSTS									
\$224,031.78	2,262.8000 MH/LS	2,262.80	MH	[89526.1]	115,708	24,835	83,489		224,032
224,031.780	1 LS				115,707.79	24,835.21	83,488.78		224,031.78

\$1,929,337.42	*** Report Totals ***	8,023.80	MH		349,153	97,179	202,715	452,239	828,051	1,929,337
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>>> indicates Non Additive Activity

-----Report Notes:-----

The estimate was prepared with TAKEOFF Quantities.

This report shows TAKEOFF Quantities with the resources.

'Unreviewed' Activities are marked.

Actual Unit Cost is used, which includes taxes, escalation, etc.

Cost Report

Activity Resource	Desc	Quantity Pcs	Unit Unit	Unit Cost	Perm Labor	Constr Material	Equip Matl/Exp	Sub- Ment	Contract	Total
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BID ITEM = 10030 Land Item SCHEDULE: 1 100
Description = LINER SUBCONTRACT SUPPORT Unit = LS Takeoff Quan: 1.000 Engr Quan: 0.000
Bid Date: 01/05/24 Owner: GLENDALE Engineering Firm: TETRATECH
Estimator-In-Charge:

JOB NOTES

Labor Rates Updated 01/05/2024 Labor Burden updated 01/12/2024 Equipment Rates Updated 01/05/2024

*****Estimate created on: 04/25/2024 by User#: 103 - Mike Claflin

Source estimate used: J:\HCSS\HEAVYBID\MSTR_LIBEST\MASTEREST22

* on units of MH indicate average labor unit cost was used rather than base rate.

[] in the Unit Cost Column = Labor Unit Cost Without Labor Burdens

In equipment resources, rent % and EOE % not = 100% are represented as XXX%YYY where XXX=Rent% and YYY=EOE%

-----Calendar Codes-----

410	4 X 10 HR WEEK NO OT
508	5 X 8 HR WEEK
509	5 X 9 HR WEEK
510	5 x 10 HR WEEK (Default Calendar)
5E8	5 X 8 (Pay 9 - Work 8)
608	6 X 8 HR WEEK
610	6 X 10 HR WEEK
6E8	6 X 8 (Pay 9 - Work 8)

EXHIBIT E

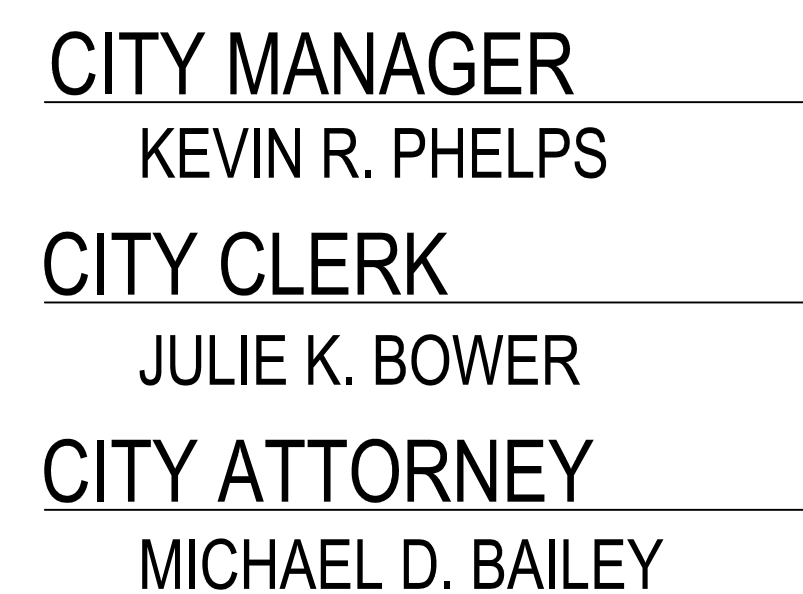
Sealed Construction Plans (EOR sealed / COG signed – 6pgs)

and

Specifications (EOR sealed – 154 pgs.)

160 pages total

Glendale Landfill North Cell Phase 2 Liner



SHT. #	
C-001	COVER SHEET
C-100	EXISTING CONDITIONS PLAN
C-101	LINER-LCRS PLAN
C-102	TOP OF OPERATIONS LAYER PLAN
C-501	LINER DETAILS
C-502	LCRS DETAILS

PLANS ACCEPTANCE

The City of Glendale accepts these plans for construction, as being in general compliance with plan preparation requirements of the City. Responsibility for the completeness and accuracy of the plans and related design resides with the Licensed Design Professional and Firm of Record which shall meet State of Arizona Board of Technical Registration requirements.

RECORD DRAWING

I certify that the locations, elevations, depths and record drawing comments accurately reflect the existing field conditions and materials actually used during construction. This certification is based on periodic field observations and the contractors representations of the facilities as constructed.

NAME _____ DATE _____

REGISTRATION NO. _____ EXP. DATE _____

REVD. BY: _____
TECHNICAL REGISTRANT

CITY ENGINEER

DATE _____

OK F

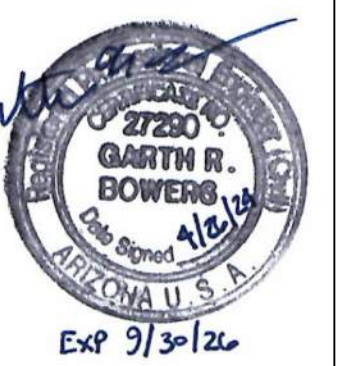
FIELD OPERATIONS DIRECTOR

5-30-2024

DATE _____



CITY OF GLENDALE
ENGINEERING DEPARTMENT
5850 W. GLENDALE AVE.
GLENDALE, ARIZONA 85301 (623) 930-3630



No.	Date	Description	Checked		GB/TL
			Drawn	ML/TL	
△					GB/TL
△					
△					
△					

001 COVER SHEET
Glendale Landfill
North Cell Phase 2 Liner

Scale AS SHOWN
Date

2 HOURS BEFORE START OF CONSTRUCTION
C.O.G. TRAFFIC CONTROL
623.930.2940

TWO WORKING DAYS BEFORE YOU DIG
CALL FOR THE BLUE STAKES
602.263.1100
BLUE STAKES CENTER
CALL COLLECT

$$\frac{1}{6}$$

FILE NAME: 2022 PLAN SHEET TEMPLATE

PLOTTING DATE: 12-08-22

REVISION DATE: 11-30-22

AUTOCAD VER.: 2018

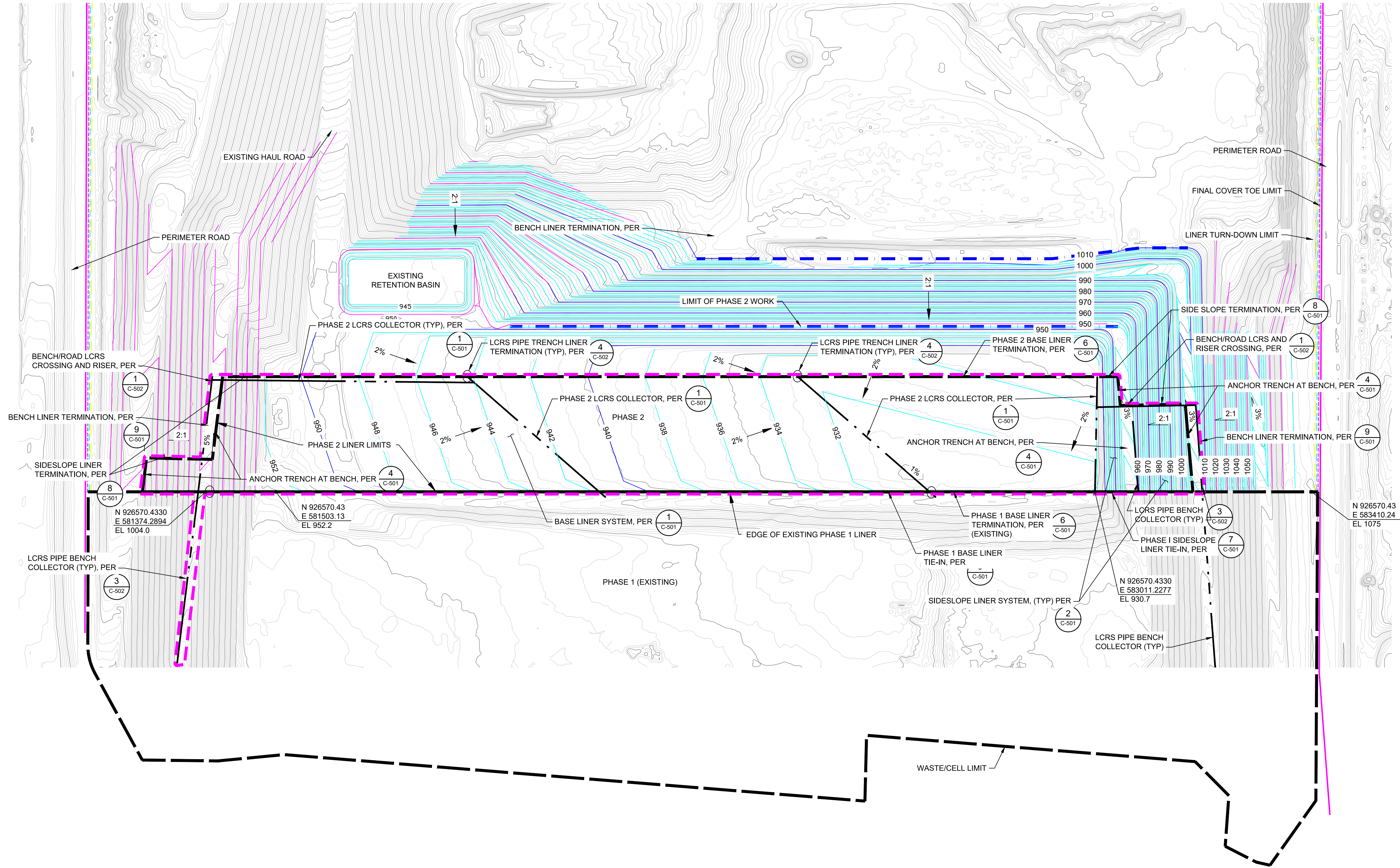


LEGEND

-  EXISTING 2023 INDEX CONTOUR (10FT)
 EXISTING 2023 INTERMEDIATE CONTOUR (2 FT)
 EXISTING 2024 INDEX CONTOUR (5FT)
 EXISTING 2024 INTERMEDIATE CONTOUR (1FT)
 LIMIT OF WORK

NOTES

1. TOPOGRAPHY PREPARED BY PHOTOGRAMMETRIC METHODS BY VERTICAL MAPPING RESOURCES, DATED JULY 3, 2023. CONTROL SURVEY PROVIDED BY TETRA TECH.
2. TOPOGRAPHY IN THE NORTH CELL IS THE PHASE 2B EXCAVATION AS-BUILT PREPARED BY SOUTHWEST SURVEY SOLUTIONS ON MARCH 18, 2024.
3. BASIS OF BEARING BASED ON ARIZONA STATE PLANE, CENTRAL ZONE, NAD 83.
4. BASIS OF ELEVATION BASED ON NAVD 88.
5. THE EXISTING UTILITIES SHOWN ON THESE DRAWINGS ARE APPROXIMATE, AND UTILITY LINES MAY EXIST WHERE NONE ARE SHOWN. SOME INFORMATION MAY HAVE BEEN DERIVED FROM INFORMATION PROVIDED TO THE ENGINEER BY OTHERS. SUCH INFORMATION MAY BE INCOMPLETE OR MAY BE OBSOLETE BY THE TIME CONSTRUCTION COMMENCES. CONTRACTOR SHALL STAKE AT 611 AND ANY NON-PARTICIPATING UTILITY COMPANIES AT LEAST 48 HOURS BEFORE CONSTRUCTION. THE CONTRACTOR SHALL EXCAVATE AND VERIFY THE HORIZONTAL AND VERTICAL LOCATIONS OF PERTINENT UTILITIES, LANDFILL LINERS, AND OTHER EXISTING FEATURES IN OR NEAR THE AREA OF WORK, WHETHER INDICATED ON THESE DRAWINGS OR NOT. SHOULD A CONFLICT EXIST, THE CONTRACTOR SHALL NOTIFY THE ENGINEER AS SOON AS POSSIBLE. THE CONTRACTOR SHALL EXERCISE DUE CARE TO AVOID DISTURBING ANY UNDERGROUND UTILITIES. THE CONTRACTOR SHALL COORDINATE ANY POTENTIAL DISRUPTIONS IN UTILITY SERVICE WITH THE UTILITY COMPANIES AFFECTED AT LEAST 24 HOURS PRIOR TO THE DISRUPTION. THE CONTRACTOR SHALL REPAIR DAMAGE TO EXISTING UTILITIES AT THE CONTRACTOR'S EXPENSE.



LEGEND

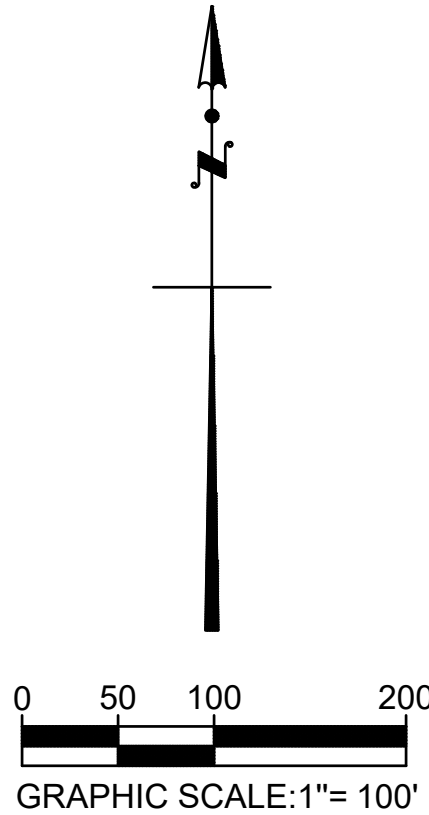
- EXISTING 2024 INDEX CONTOUR (5FT)
- EXISTING 2024 INTERMEDIATE CONTOUR (1FT)
- DESIGN INDEX CONTOUR (10FT)
- DESIGN INTERMEDIATE CONTOUR (2FT)
- LIMIT OF WORK
- PHASE LINER LIMIT
- LCRS PIPE

NOTES

- TOPOGRAPHY IN THE NORTH CELL IS THE PHASE 2B EXCAVATION AS-BUILT PREPARED BY SOUTHWEST SURVEY SOLUTIONS ON MARCH 18, 2024.
- BASIS OF BEARING BASED ON ARIZONA STATE PLANE, CENTRAL ZONE, NAD 83.
- BASIS OF ELEVATION BASED ON NAVD 88.

CONSTRUCTION NOTES

- 1 PROTECT IN PLACE



Designed	Drawn	Checked	REVISIONS	
No.	Date	Description	No.	Date
1				
2				
3				
4				

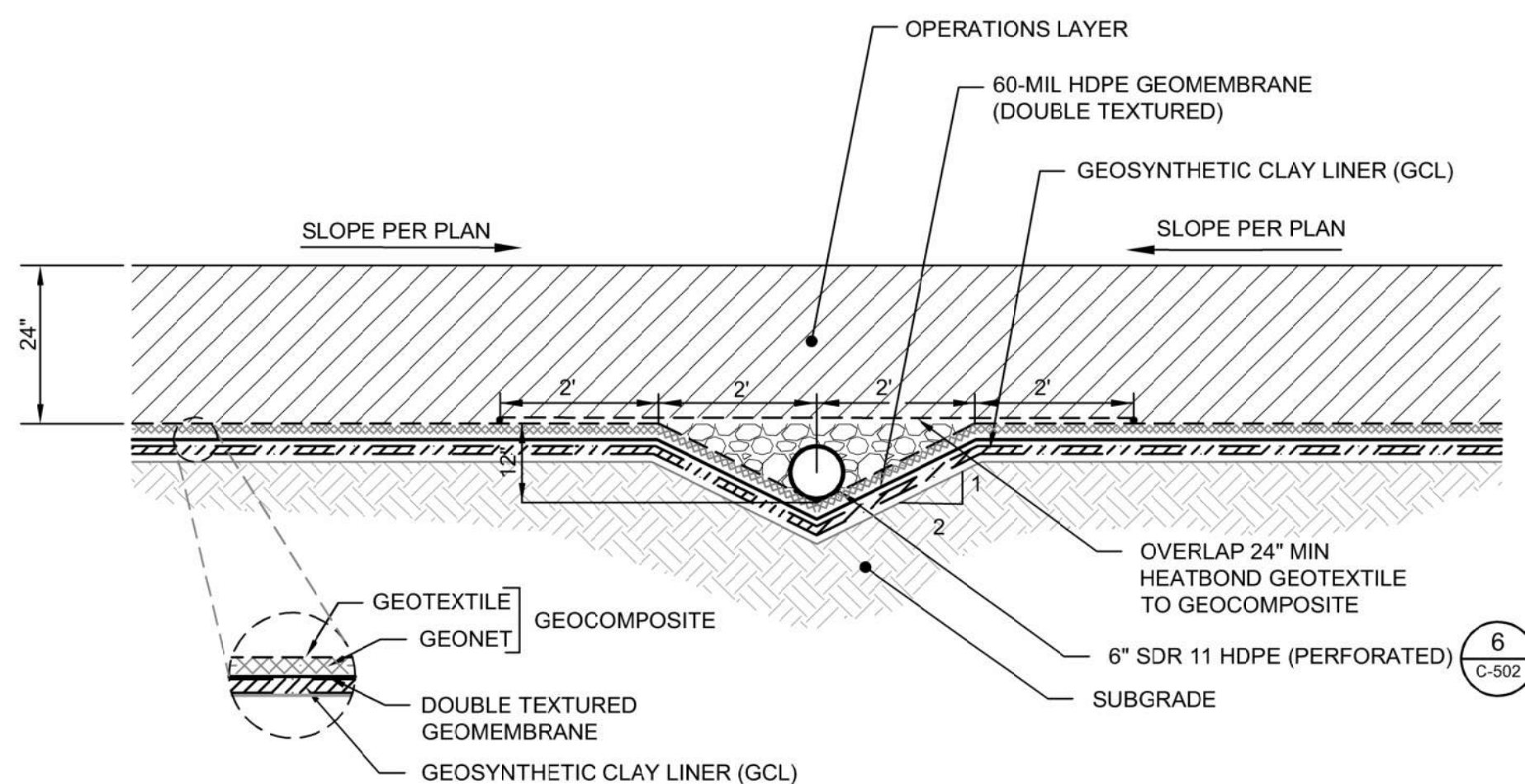
C-101 LINER-LCRS PLAN
Glendale Landfill
North Cell Phase 2 Liner

Scale AS SHOWN
Date

72 HOURS BEFORE START OF CONSTRUCTION
C.O.G. TRAFFIC CONTROL
623.930.2940

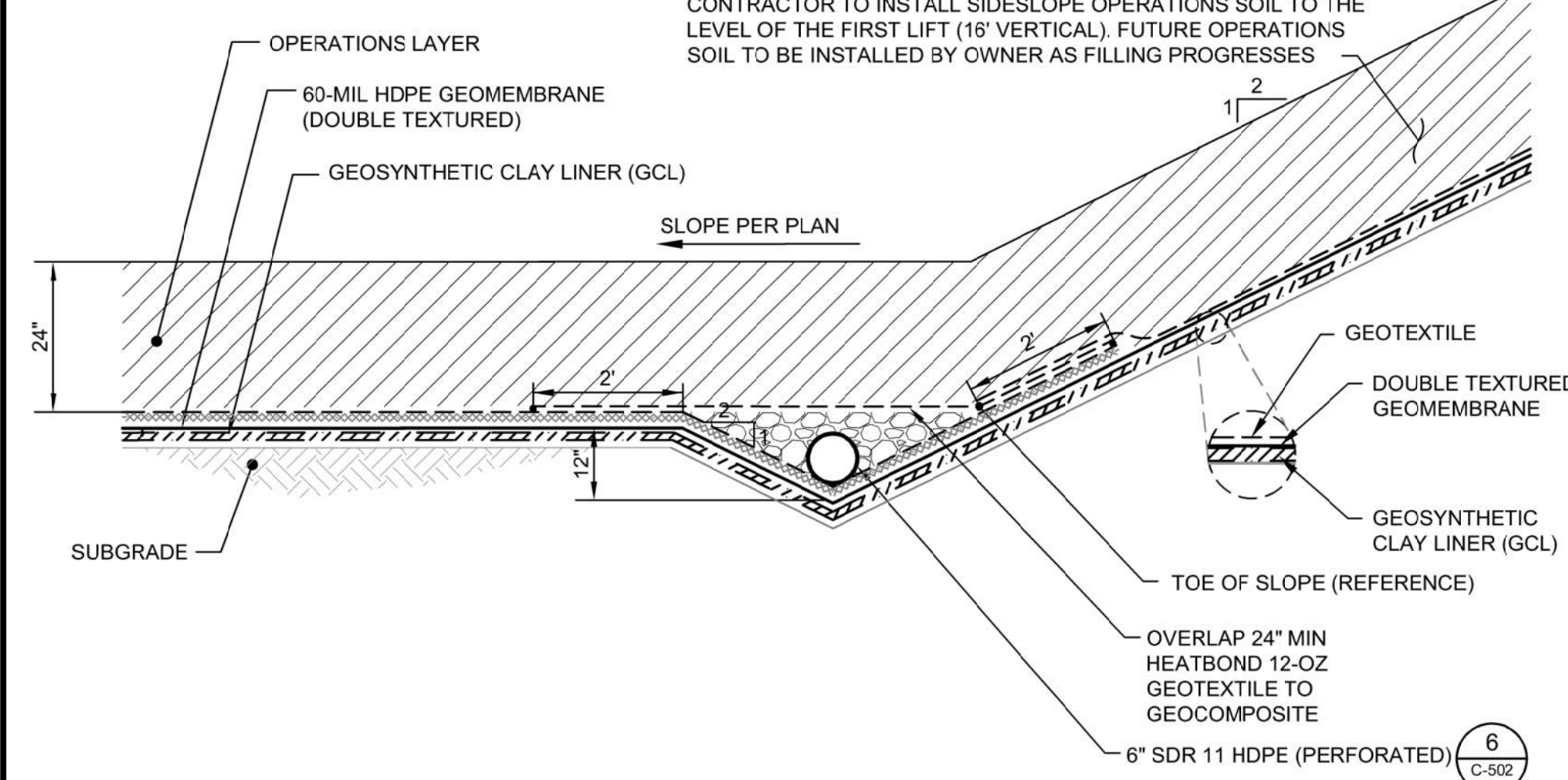
TWO WORKING DAYS BEFORE YOU DIG
CALL FOR THE BLUE STAKES
602.263.1100
BLUE STAKES CENTER
CALL COLLECT

SHT. **3**
OF **6**



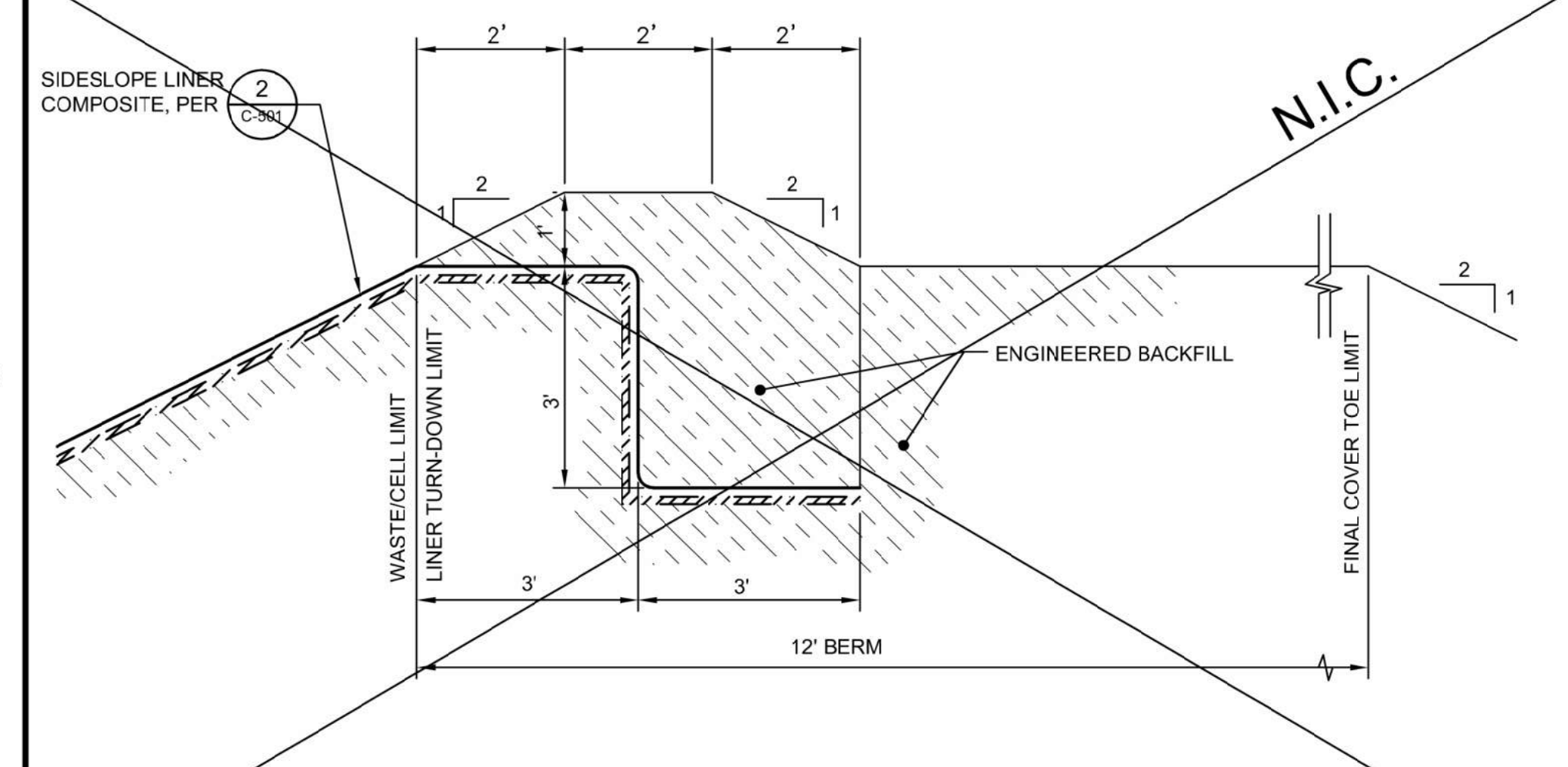
1	BASE LINER SYSTEM
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NTS	REFERENCE SHEET C-101
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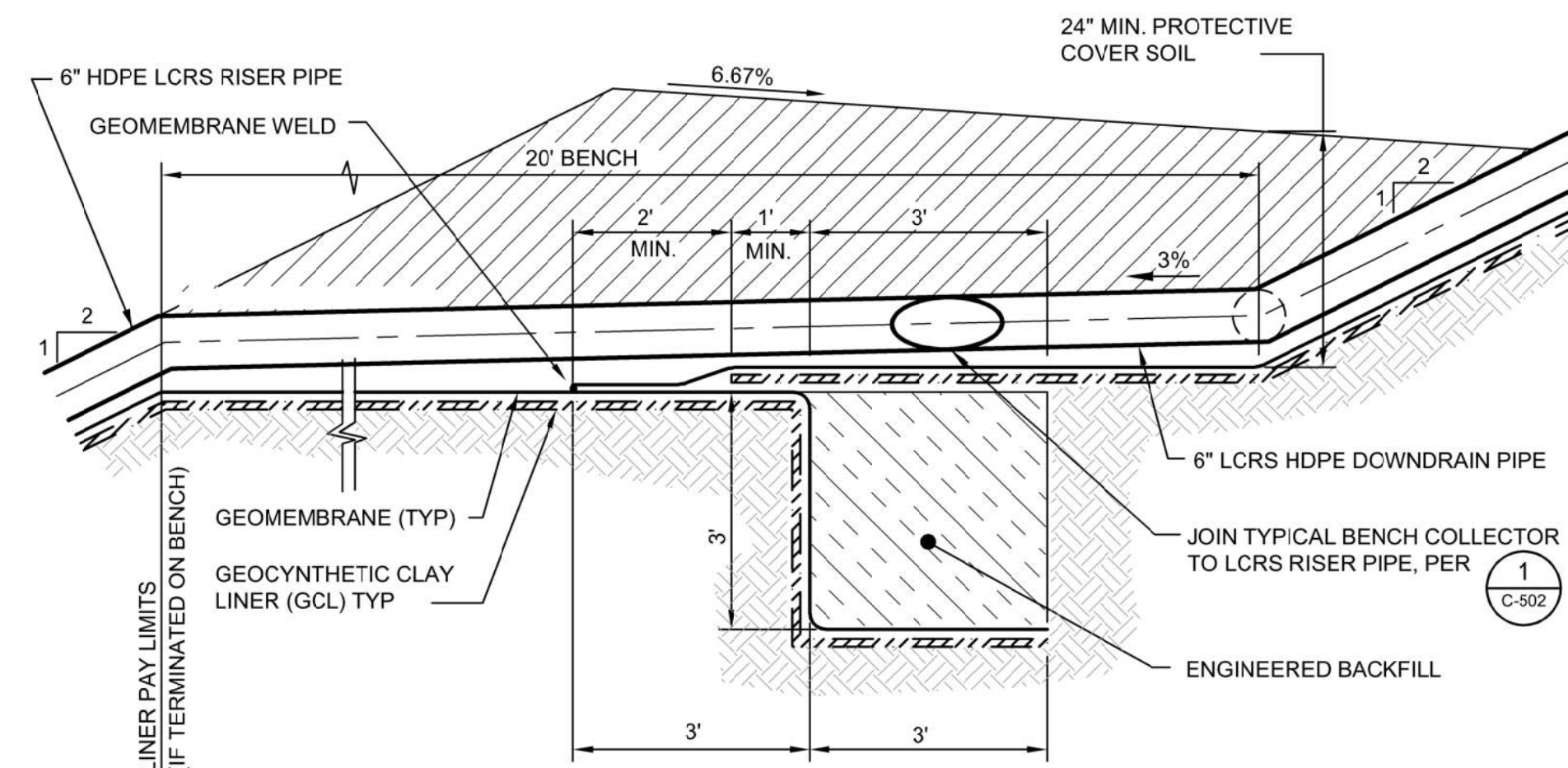
2	SIDESLOPE LINER SYSTEM
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NTS	REFERENCE SHEET C-101
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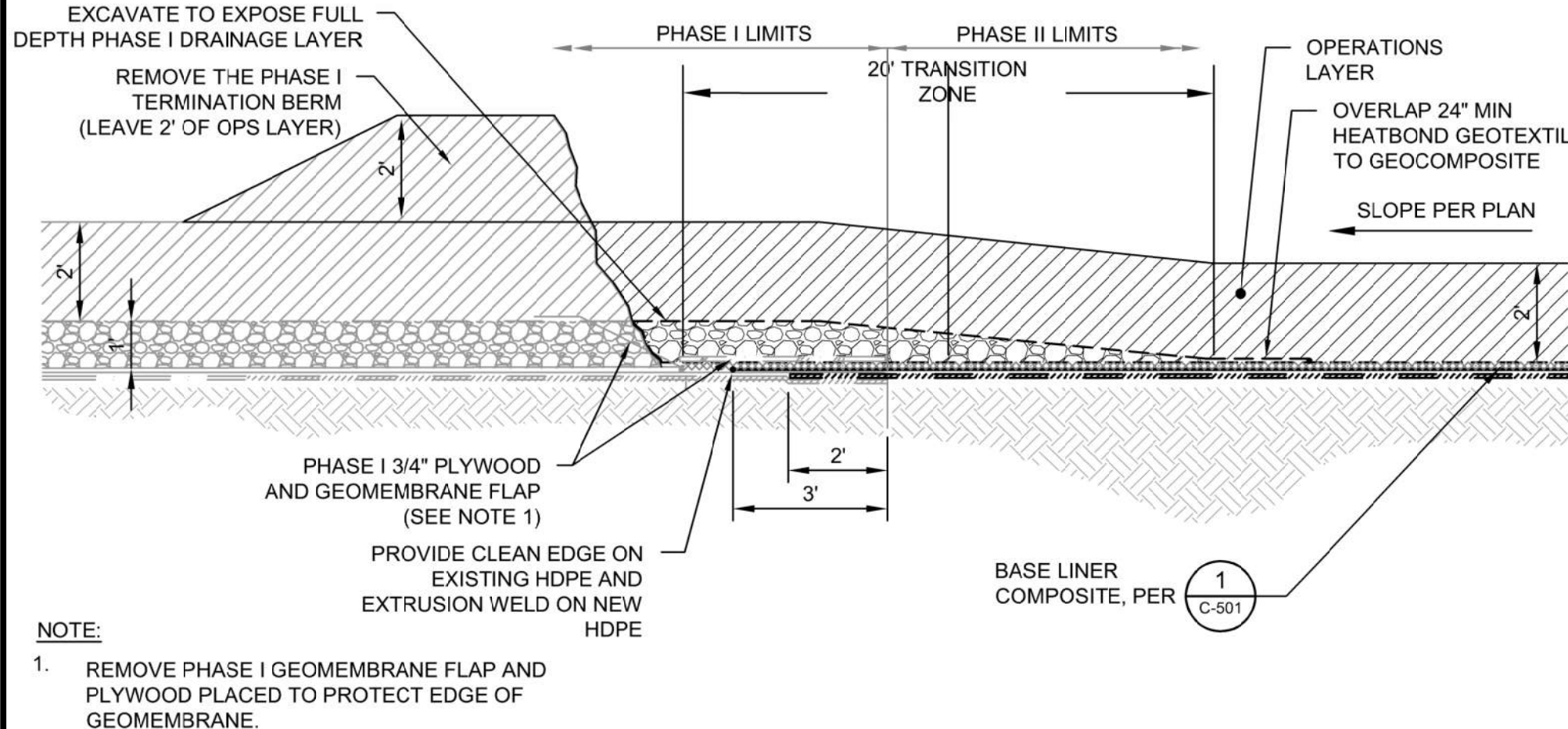
3	ANCHOR TRENCH (EAST & WEST)
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~~NTS~~	REFERENCE SHEET C-101
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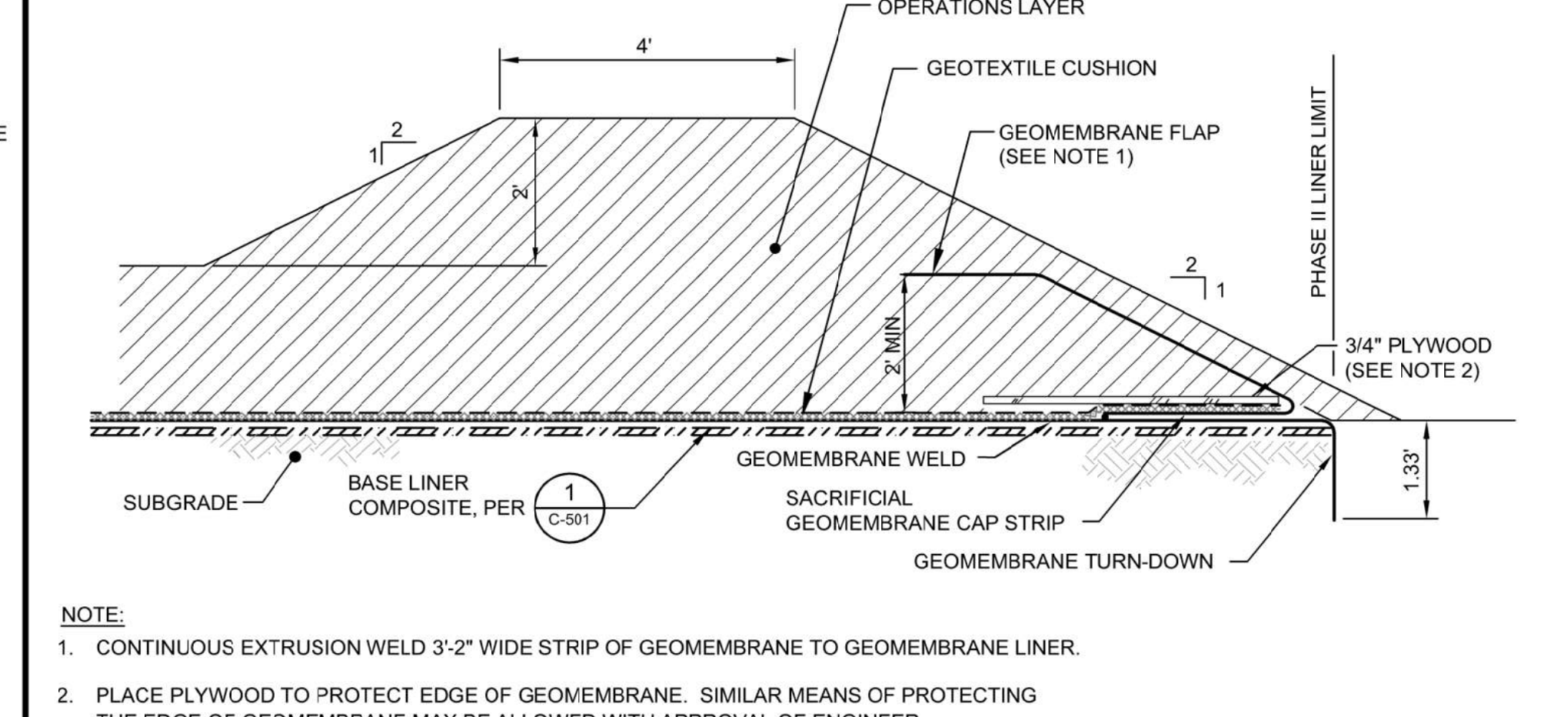
4	ANCHOR TRENCH AT BENCH
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NTS	REFERENCE SHEET C-101
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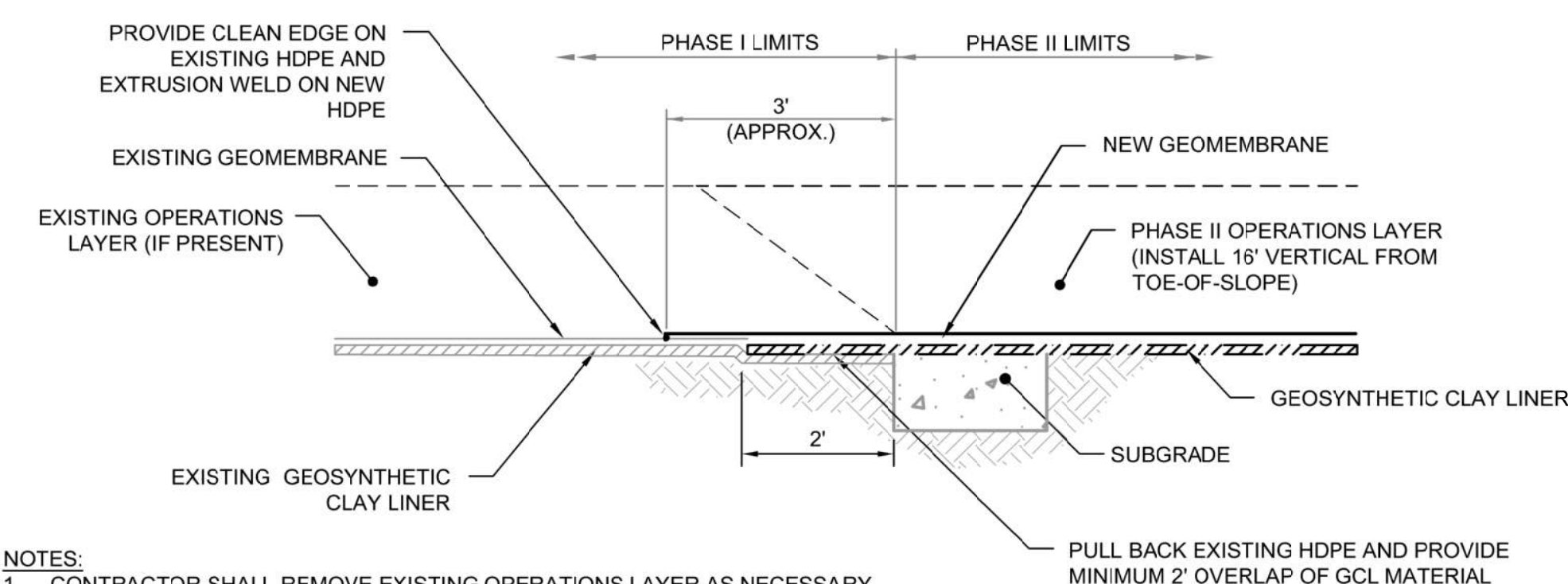
5	BASE LINER TIE-IN
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NTS	REFERENCE SHEET C-101
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6	BASE LINER TERMINATION
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NTS	REFERENCE SHEET C-103
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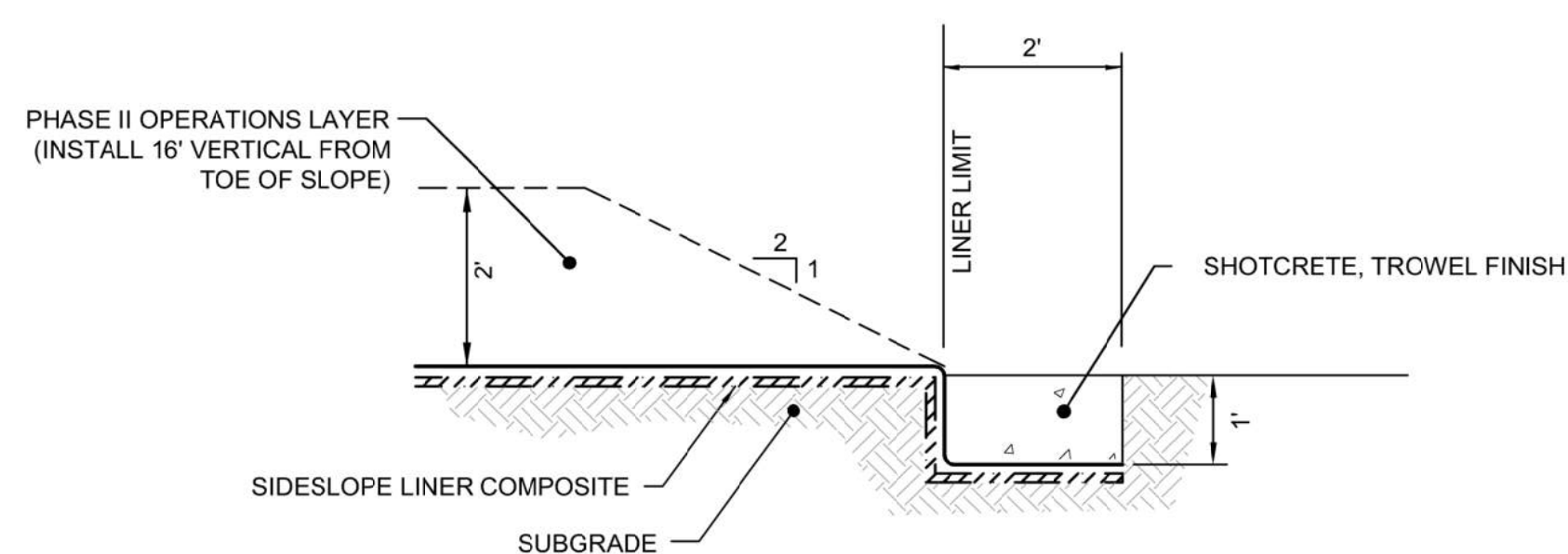


NOTES:

1. CONTRACTOR SHALL REMOVE EXISTING OPERATIONS LAYER AS NECESSARY TO EXPOSE SUFFICIENT EXISTING LINER TO ALLOW TIE-IN AS SHOWN.
2. CONTRACTOR SHALL TIE INTO EXISTING GEOMEMBRANE.

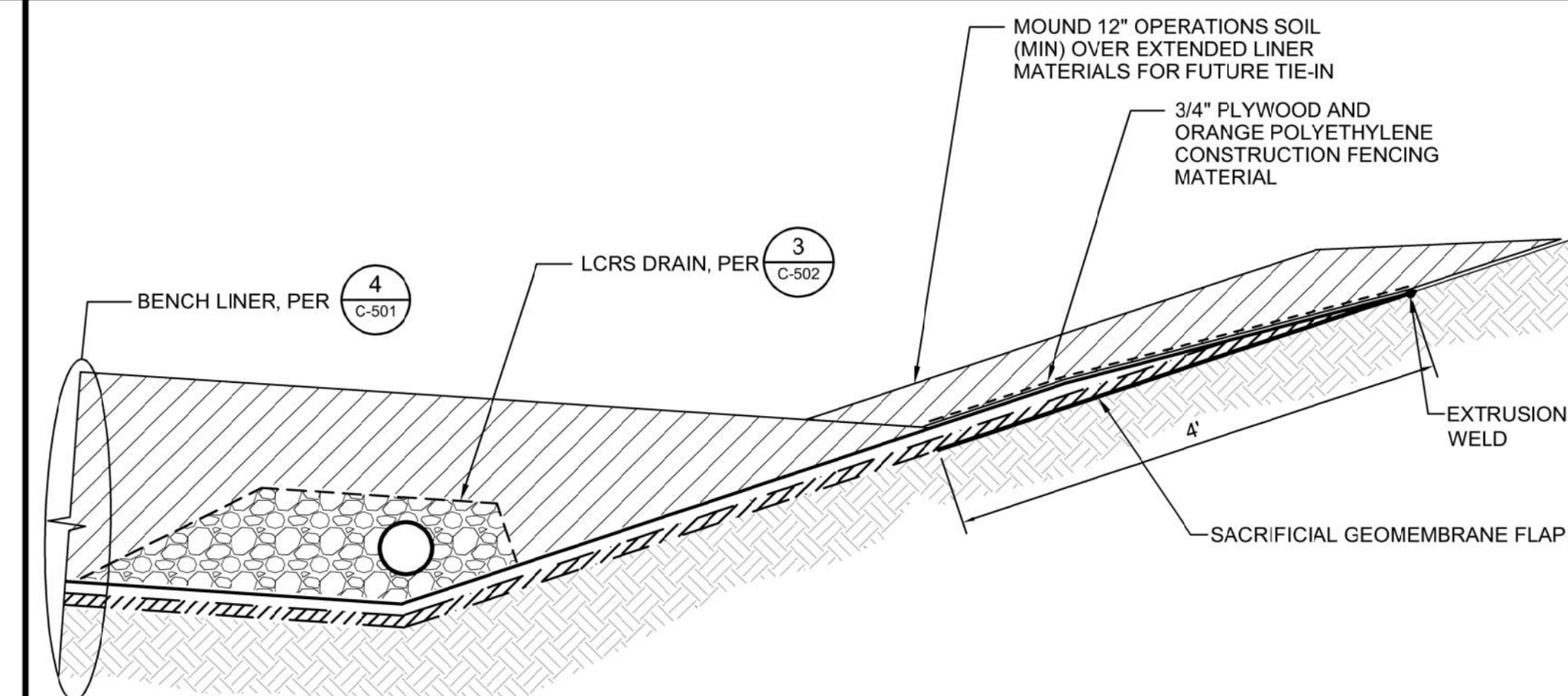
7	SIDESLOPE LINER TIE-IN
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NTS	REFERENCE SHEET C-101
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8	SIDESLOPE LINER TERMINATION
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NTS	REFERENCE SHEET C-101
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9	BENCH LINER TERMINATION
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NTS	REFERENCE SHEET C-101
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No.	Date	Description	REVISIONS	Designed
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△				Checked



City of Glendale, Arizona

Public Works Department

**PROJECT SPECIFICATIONS AND CONTRACT
DOCUMENTS**

**GLENDAL LANDFILL NORTH CELL PHASE 2
EARTHWORK & LINER CONSTRUCTION
PROJECT #232425.0**

**MAYOR
JERRY P. WEIERS**

CITY COUNCIL

**RAY MALNAR, SAHUARO DISTRICT
BART TURNER, BARREL DISTRICT
VACANT, OCOTILLO DISTRICT
LEANDRO BALDENEGRO, OCOTILLO
DISTRIC**

**IAN HUGH, CACTUS DISTRICT
LAUREN TOLMACHOFF, CHOLLA DISTRICT
VICE MAYOR JOYCE CLARK, YUCCA
DISTRICT**

CITY MANAGEMENT

**CITY MANAGER
CITY ENGINEER**

**KEVIN PHELPS
DAVID BEARD, P.E.**

April 2024

Technical Specifications
North Cell Phase 2 Earthwork and Liner Construction – Divisions 1 through 3
Glendale Landfill
Glendale, Arizona

The material and data in this report were prepared under the supervision and direction of the undersigned.

Tetra Tech, BAS Inc.



Todd Livermore, P.E., CFM
Project Manager



Garth R. Bowers, P.E.
Senior Operations Director

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DIVISION 1

GENERAL REQUIREMENTS

SECTION 01010 SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Contract Description
- B. Familiarization
- C. CONTRACTOR's Use of Premises
- D. Construction Water
- E. Description of Work
- F. Work Hours
- G. Permits
- H. CONTRACTOR's Work Scope

1.2 CONTRACT DESCRIPTION

- A. Contract Type: Per the Bid Documents, Standard Construction Agreement between OWNER and CONTRACTOR.
- B. Site Location: Glendale Landfill, 11480 Glendale Avenue, Glendale, Arizona, 85307.

1.3 FAMILIARIZATION

- A. Prior to implementing any work, the CONTRACTOR shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Project and the CQA Plan.
- B. Inspection
 - 1. If the CONTRACTOR has any concerns regarding the site, the CONTRACTOR shall notify the ENGINEER and the OWNER in writing within 48 hours of the bid submittal date. Failure to notify the OWNER or the ENGINEER prior to the bid submittal date shall be construed as CONTRACTOR's acceptance of the related work of all other Sections.
 - 2. The CONTRACTOR shall verify as-built conditions prior to placement and/or excavation of any material.

3. The CONTRACTOR shall be responsible for contacting Blue Stake and locating all underground utilities prior to excavation of any material.

1.4 CONTRACTOR'S USE OF PREMISES

- A. The CONTRACTOR should limit activities to the project area, as shown on the Drawings including stockpiles, staging area, and haul road as identified by the OWNER.
- B. CONTRACTOR shall coordinate use of the premises, for his material storage and construction activities, with OWNER and utility service companies.
- C. The full use of the premises for storage, the operations of workmen and for all other construction activities will not be available to CONTRACTOR. The Drawings define the area allocated to CONTRACTOR.
- D. It shall be understood that responsibility for protection and safe-keeping of equipment and materials on or near the site will be entirely that of CONTRACTOR and that no claim shall be made against the OWNER or his authorized representatives by reason of any act. It shall be further understood that should any occasion arise necessitating access to the sites occupied by these stored materials or equipment, the ENGINEER shall direct CONTRACTOR owning or responsible for the stored materials and equipment to immediately move the same. No materials or equipment may be placed upon the property of the OWNER, other than in the designated areas as shown on the Drawings, unless the ENGINEER has agreed to the location contemplated by CONTRACTOR to be used for storage. All stored materials shall be labeled according to the appropriate CONTRACTOR or Subcontractor with the manufacturer's label as well. Appropriate material safety data sheets (i.e., MSDS) shall be provided.
- E. CONTRACTOR shall be required to share use of the premises with other Contractors whose services the OWNER has obtained or will obtain for construction of other facilities on the site.

1.5 CONSTRUCTION WATER

- A. Construction water is available on-site at the existing waterline standpipe located north of the north cell excavation. The CONTRACTOR shall supply his own J-stand or overhead tank for construction water.
- B. CONTRACTOR shall utilize all means deemed necessary to store water in sufficient quantities to maintain dust control in conformance with Section 01560 and for compaction as required by the Division 2 specifications. This may mean installing overhead tanks at more than one supply location. The CONTRACTOR will not be allowed to utilize existing equipment (i.e., City of Glendale's stand tank) used for dust control water for the landfill operations.

- C. The OWNER will not charge a fee to the CONTRACTOR for the use of construction water; however, costs associated with installing overhead tanks and appurtenances, pumping, additional storage (if required), transport and/or conveyance, and utilization of construction water shall be included in the bid price for each item as identified in Section 01025.

1.6 DESCRIPTION OF WORK

- A. The work to be performed for this contract includes, but is not necessarily limited to:
- surveying,
 - North Cell Phase 2 (NC) finish grade excavation (mass excavation has been previously performed under separate contract),
 - subgrade preparation,
 - compacted soil fill (as needed for liner installation),
 - liner installation,
 - stockpiling daily cover in the northern portion of the North Cell,
 - screening/stockpiling future NC Phase 2 operations layer material,
 - operations layer placement.
- B. Upon completion of subgrade preparation and prior to the placement of the operations layer, the CONTRACTOR shall provide the necessary time on the project schedule for the geosynthetic material installer (included as part of this project) to construct all geosynthetic components of the base lining system.
- C. CONTRACTOR shall provide support to the liner installer by supplying the equipment and personnel required to offload and store all geosynthetic materials delivered to the site in preparation for installation by the liner installer. This shall be incidental to the project.
- D. All work must be carried out and maintained per the Drawings and Specifications subject to the approval of the Design ENGINEER and Quality Assurance/Quality Control consultant.

1.7 WORK HOURS

- A. Unless otherwise changed by the OWNER, construction activities and material deliveries to the facility shall be 24 hours/day 7 days/week. Noise and light abatement will be considered for all work activities between 7pm and 7am.

1.8 CONTRACTOR'S WORK SCOPE

- A. CONTRACTOR shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services required to complete the excavation, earth fills, channel and liner, and other construction described in these Specifications and the following Drawings;
 - 1. *North Cell Phase 2 Liner, Glendale Landfill, Glendale, Arizona,*
sealed by Garth R. Bowers, P.E., Tetra Tech BAS, Inc., on 04/26/2024.
- B. Unless otherwise specified in these specifications or the above-referenced drawings, all work shall be performed in conformance with the requirements of Standard Specifications for Public Works Construction, Maricopa Association of Governments (MAG), latest edition.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01016 HEALTH AND SAFETY CONSIDERATIONS

PART 1 GENERAL

1.9 SECTION INCLUDES

- A. Preparing project site specific health and safety plan.
- B. Implementing project site specific health and safety plan.

1.10 MEASUREMENT AND PAYMENT

- A. Section will be considered part of cost of all other items of work. OWNER will not make separate payment for this section.

1.11 OTHER

- A. The exact nature of materials and wastes disposed of at the landfill is unknown. The possibility exists of encountering gases and/or other substances during the Work that may be potentially hazardous to the safety and health of personnel, especially those working in the vicinity of open excavations and pipes venting gases.
- B. The CONTRACTOR is advised that decomposing refuse produces landfill gas which is approximately 50 percent methane (natural gas) by volume. Landfill gas is colorless, can be odorless, may contain hydrogen sulfide, toxic or hazardous material, is combustible, and may contain no oxygen. Landfill gas can also migrate through several thousand feet of soil adjacent to landfills. The CONTRACTOR is therefore advised of the need for precautions against fire, explosion and asphyxiation when working on the landfill and in or near excavations on the project site.

1.12 SUBMITTALS

- A. CONTRACTOR shall submit with bid documents, a general Health and Safety Plan to the OWNER, for informational purposes only.
- B. CONTRACTOR shall submit, after Notice of Award but prior to pre-construction meeting, a Site-Specific Health & Safety Plan to be approved by OWNER (See Section 01300). Acceptance of the plan by the OWNER does not release the CONTRACTOR of liability in the event of an accident or injury, nor does it place any liability on the OWNER.
- C. Submittals may be completed electronically.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 CONSTRUCTION

- A. CONTRACTOR shall be solely and completely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Take all necessary precautions for the safety of and provide the necessary protection to prevent injury or loss to all CONTRACTOR'S employees.
- B. CONTRACTOR shall comply with all applicable Arizona OSHA regulations. The CONTRACTOR'S Health and Safety Plan does not supersede or in any way relieve the CONTRACTOR of obligations under any applicable Occupational Safety and Health Agency (OSHA) regulations including (but not limited to) 29 CFR 1910: Occupational Safety and Health Standards and 29 CFR 1926: Health and Safety Regulations for Construction.
- C. CONTRACTOR shall be responsible for ensuring that all Subcontractors abide with the contents of this section.
- D. CONTRACTOR shall become familiar with potential hazardous health and safety conditions and risks associated with working in or near decomposing refuse at a landfill site and take the applicable precautions for work at the project site.
- E. CONTRACTOR shall be solely responsible for determining and providing an appropriate health and safety program, including monitoring, equipment, plans in event of problems and/or emergencies, and other related items as needed.

3.2 SITE RESTRICTIONS

- A. Reflective safety vests, hard hats and steel toed boots shall be worn by all personnel during work. Other personal protective equipment will be worn as necessary.
- B. CONTRACTOR shall adhere to the posted speed limit at all times. CONTRACTOR shall further limit vehicle speeds as necessary for safe operation based on road conditions and construction traffic.

3.3 SITE SPECIFIC HEALTH AND SAFETY PROGRAM

- A. Develop and implement a Health and Safety Program in accordance with all applicable Arizona Health and Safety regulations, Federal OSHA regulations, 29 CFR 1910 and 29 CFR 1926, and any other applicable federal, state, or local agency regulations or requirements. If any of these requirements are in conflict, the more stringent requirement shall apply. The CONTRACTOR'S failure to be thoroughly familiarized with the aforementioned safety and health provisions shall

not relieve the CONTRACTOR of responsibility for full compliance with the obligations and requirements set forth herein. The CONTRACTOR'S Health and Safety Plan shall include as appropriate, but shall not necessarily be limited to, the items required by OSHA 29 CFR 1910.120:

1. Organizational structure.
2. Comprehensive work plan.
3. Hazard analysis for each site task.
4. Employee training.
5. Personal protective equipment to be used for each task.
6. Medical surveillance.
7. Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used.
8. Site control measures.
9. Decontamination procedures.
10. Emergency response plan.
11. Confined space entry procedures (if part of scope of work).
12. Spill containment program.

B. Provide to the OWNER, prior to the start of any field activities, certification that requirements of this Section have been met. This certification shall include:

1. Documentation of the training required under OSHA 29 CFR 1910.120 for site personnel and supervisors.
2. Documentation of current first aid and CPR training for at least two employees per work shift.
3. Documentation of participation of all site personnel in a medical surveillance program in accordance with OSHA 29 CFR 1910.120.
4. Documentation that all site personnel expected to wear respiratory protection have been medically examined and approved for wearing such equipment and have been fit tested in accordance with OSHA regulations.

C. The CONTRACTOR shall maintain a copy of the plan at the site for the duration of work.

- D. If the OWNER observes any of the CONTRACTOR'S employees or Subcontractors engaging in an unsafe act or procedure that may result in serious injury or death to the person performing the act/procedure, or to any other person, the OWNER shall have the right, but not the duty, to stop the work until the condition is corrected. The CONTRACTOR shall be held responsible for any increased costs that result from this work stoppage.
- E. The CONTRACTOR shall be responsible for holding mandatory weekly safety meetings on the site. The OWNER shall be notified of the time and place for these meetings, so that they may attend if they desire. Meetings shall reiterate all safety measures to be taken and shall discuss any violations committed and preventive measures. The CONTRACTOR shall provide the OWNER with a copy of the minutes and the attendance upon request.
- F. The CONTRACTOR shall provide all personnel working on the project with required orientation and training on the potential hazards and the appropriate use of safety equipment.
- G. The CONTRACTOR shall meet applicable OSHA health and safety requirements at all times during drilling and excavations. The CONTRACTOR shall secure all work areas and close any open holes or excavations when not working by marking with ribbons and cones, and posting of signs indicating to the public to stay away due to the existence of deep open excavation.

END OF SECTION

SECTION 01019 CONTRACT CONSIDERATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. References and abbreviations of various industry associations, trade associations, societies, organizations, and regulatory agencies, as referenced in the Contract Documents.

1.2 DESCRIPTIONS

- A. The Contract Documents contain references to various standard Specifications, codes, practices, and requirements for materials, workmanship, installation inspections, and tests. Which references are published and issued by the organizations, societies, and associations listed below by abbreviation and name. Such references are hereby made a part of the Contract Documents to the extent cited.
- B. Any material, method, or procedure specified by reference to the number, symbol, or title of a specific Specification or standard, such as a Commercial Standard, American National Standard, Federal or State Specification, Industry or Government Code, a trade association code or standard, or other similar standard, shall comply with the requirements of the edition in effect on the date of Notice to Proceed.
- C. The code, specification, or standard referred to, except as modified in these Specifications, shall have full force and effect as though printed in these Specifications. These Specifications and standards are not furnished to bidders since manufacturers and trades involved are assumed to be familiar with their requirements. The OWNER will furnish, upon request, information as to how copies of the Specifications and standards referred to may be obtained.

1.3 ABBREVIATIONS

- A. Whenever in the Contract the following abbreviations are used, their meanings shall be as follows:

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASTM	ASTM International

AWWA	American Water Works Association
AZPDES	Arizona Pollution Discharge Elimination System
COG	City of Glendale
GRI	Geosynthetics Research Institute
FS	Federal Specifications
MAG	Maricopa Association of Governments
MAQD	Maricopa County Air Quality Department
MC/COG	Maricopa County/City of Glendale
MDES	Maricopa County Department of Environmental Services
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
PPI	Plastic Pipe Institute
SPCC	Spill Prevention, Control, and Countermeasures
SWPPP	Stormwater Pollution Prevention Plan

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01025 MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Measurement and payment methods for contract bid items.

1.2 MEASUREMENT OF QUANTITIES

- A. Performed according to United States Measures.
- B. Based on actual units installed or neat line dimensions of work completed.

1.3 CALCULATION OF QUANTITIES

- A. Progress Payment Quantities:
- B. CONTRACTOR will compute all quantities of Work performed, or of materials and equipment delivered to the site for progress payment purposes.
- C. OWNER may at any time verify quantities calculated by CONTRACTOR.
- D. Final Payment Quantities: CONTRACTOR will compute all quantities of Work performed, or of materials and equipment delivered and installed for final payment purposes. OWNER may perform an independent computation of all quantities of work performed, and of materials and equipment installed.

1.4 PAYMENT

- A. In accordance with lump sum, unit prices, or force account rates shown on the CONTRACTOR'S final negotiated Bid Schedule.
- B. Includes all costs for overhead and profit and for supplying materials, labor, equipment, and tools, and all applicable Federal, State, County, City, and local taxes, necessary to complete the Work in accordance with the Specifications, Drawings, and Contract Conditions.
- C. Earthwork quantities shall be based on the volume difference between the current rough grade contours and the final finish grade contours. Load counts shall not be used as a means of quantifying earthwork.
- D. Provide temporary power as necessary for the work at the CONTRACTOR'S expense. No permanent power is available at the project location.
- E. Bid amounts for each bid item shall constitute payment in full.

1.5 VALUES OF UNIT PRICES

- A. The number of units and quantities contained in the Bid Schedule are approximate only, and final payment will be made for the actual number of units and quantities incorporated in the work or made necessary to complete the project. All unit and lump prices shall include applicable Federal, State, County, City, and local taxes.
- B. In the event that work and materials or equipment are required to be furnished to a greater or lesser extent than is indicated by the Contract Documents, such work and materials or equipment shall be furnished in greater or lesser quantities.

1.6 CHANGES AND EXTRA WORK

- A. Changes and extra work will be measured and paid for in accordance with the requirements of this Section after an approved change order has been issued to the CONTRACTOR. The CONTRACTOR shall submit a Labor and Equipment Rate Schedule with the completed bid sheet.

1.7 REJECTED MATERIALS

- A. Quantities of material wasted or disposed in a manner not called for in the Specifications; rejected loads of material, including material rejected after it has been placed by reasons of the failure of CONTRACTOR to conform to the provisions of the Specifications; material not unloaded from the transporting vehicle; material placed outside the limits indicated by the Drawings or established by OWNER; or material remaining on hand after completion of the Work, will not be paid for, and such quantities will not be included in the final total quantities. No compensation will be made for loading, hauling, and disposing of rejected material.

1.8 FORCE ACCOUNT WORK

- A. Payment for Force Account work will be determined as follows:
- B. Labor.
 - 1. Payment for labor will be based on the Force Account Labor Rate Schedule submitted with the bid.
 - 2. Payment constitutes full compensation for labor including wages, benefits, overhead, and profit for each individual.
- C. Equipment.
 - 1. Payment for equipment will be based on the Force Account Equipment Rate Schedule submitted with the bid.

2. Payment constitutes full compensation for supplying equipment and includes all costs for maintenance, fuel, insurance, overhead, profit and any other costs necessary to provide and operate the equipment. Payment does not include operator labor cost.

D. Materials.

1. Payment for materials will be paid for at CONTRACTOR's invoiced cost plus 10 percent.
2. Payment will be based on invoices from suppliers documenting cost to CONTRACTOR.
3. Where invoices are not available a unit cost must be approved by the OWNER prior to use of the material.

1.9 FUEL COST ADJUSTMENT

A. General

1. The ENGINEER will adjust monthly progress payments up or down as appropriate for cost fluctuations in diesel fuel as determined in accordance with these special provisions.
2. A fuel cost adjustment will be made when fluctuations in the price of diesel fuel, in excess of 15 percent, occur throughout this contract. The ENGINEER will not provide such adjustments for fluctuations in the price of diesel fuel of 15 percent or less.
3. No adjustments will be made for fluctuations in the price of fuels other than diesel.

B. Measurement

1. The base index price of fuel will be determined by the ENGINEER from the selling prices of diesel fuel published by OPIS (Oil Price Information Service). The base index price to be used will be the price for Diesel fuel No. 2, Ultra Low Sulfur, PAD 5, City of Phoenix Rack. The reported average value for the Phoenix area will be used.
2. The base index price for each month will be the arithmetic average of the selling price for diesel fuel, as specified above, shown in the last four reports received prior to the last Wednesday of the month.
3. This price will be effective as of the last Wednesday of each month.
4. This price will be deemed to be the "initial cost" (IC) for diesel fuel on project during the following month.

5. The current index price for diesel fuel in subsequent months will be the base index price, determined as specified above, for the current month.
6. For example; an adjustment for diesel fuel used in May, if applicable, will be based on the "current price" (CP) for May as posted on the last Wednesday of May. The amount of adjustment per gallon will be the net difference between the "initial cost," adjusted by 15 percent, and the current index price. The monthly adjustment will be determined by the ENGINEER and included in the payment estimate as a fuel adjustment. For fluctuations in excess of 15 percent, fuel cost adjustments will only be made for current price index increases greater than 1.15 times the "initial cost" or for decreases less than 0.85 times the "initial cost." No calculation will be made for fluctuations in the current index price of 15 percent or less when compared to the "initial cost."
7. If the Fuel Cost Adjustment applies according to this Section A - GENERAL, then the number of gallons of diesel fuel used per month will be considered to equal 1.5 percent of the dollar amount of work reported by the CONTRACTOR for each month. Such dollar amount will not include revenue accrued in the previous month for fuel price adjustments.
8. A monthly adjustment, if applicable, will be made on this quantity, as shown below:

$$S = \frac{0.015 * (Q)}{IC} * (CP - AC)$$

Where:

S = Monetary amount of the adjustments (plus or minus) in dollars

Q = Dollar amount of work completed for the month

CP = Current index price in dollars per gallon

AC = Adjusted "initial cost" (1.15 or 0.85 times IC) in dollars per gallon

IC = "Initial cost" as determined above, dollars per gallon

9. If adjustments are made in the contract quantities, the CONTRACTOR shall accept any fuel adjustment as full compensation for increases or decreases in the price of fuel regardless of the amounts of overrun or underrun.
10. The value calculated above (plus or minus) will be adjusted to include sales tax and other taxes as applicable.
11. No additional compensation will be made for any additional charges, costs, expenses, etc., which the CONTRACTOR may have incurred since the time of bidding and which may be the result of any fluctuation in the base index price of diesel fuel.

12. No adjustments will be made for work performed after Substantial Completion, as defined in Section A01010 Subsection 1.09, has been achieved.

C. Payment

1. Price adjustments will be shown on the monthly progress estimate, but will not be included in the total cost of work for determination of progress or for extension of contract time.

1.10 PAY ITEMS

A. Mobilization/Demobilization (Bid Item 1)

1. Measurement by Lump Sum (LS), based on mobilizing of equipment and labor to perform work and demobilizing from and cleaning the site after all work and testing has been performed and accepted by the OWNER.
2. Bid Item 1 includes any and all temporary facilities and utilities, safety plans, and construction equipment required for this project. Payment for this work will be made on a lump sum basis. Twenty five (25) percent of the lump sum price bid will be paid with the first payment request following satisfactory evidence of mobilization of sufficient labor, equipment and material to adequately progress the work of this contract. Twenty-five (25) percent of the lump sum price bid will be paid with the second payment request. Fifty (50) percent of the lump sum price bid will be paid with the Final Payment request. The price bid in the proposal for this item shall not exceed five (5) percent of the original amount.

B. Excavation/Stockpiling (Bid Item 2)

1. Measured by the bank Cubic Yard (CY). Measurement of excavation will be made by comparing pre-construction topography of the landfill cell construction as depicted on the Drawings with post-excavation topography. Pre-construction topography will be established by field survey of existing grades. Survey will establish existing grades at a maximum 50-foot grid and establish major grade breaks. Post-construction topography will be established by similar survey at a maximum 50-foot grid and also establish major grade breaks. Post construction survey will not be performed until all earthwork on the project is complete. Earthwork post construction survey shall be completed prior to the installation of any overlying aggregate base, riprap, concrete, or other improvements. Calculations will be made on an average end area basis vertically by 2-foot contour interval.

2. Payment includes all costs to excavate soil (both native and stockpiled/placed by previous activities at the site) within and around the cell area, load, haul, and place in a stockpile or load and transport to areas of fill, as described in Sections 02221 and 02222, and as shown on the Drawings. No additional payment will be made for load and haul of excavated material that is stockpiled and later relocated for use as fill. Also includes all clearing and stripping costs per Section 02100.

C. Surveying (Bid Item 3)

1. Measured by Lump Sum (LS).
2. Payment as follows: 40 percent of lump sum amount upon completion of 10 percent of the work, and 50 percent at Substantial Completion, and 10 percent upon acceptance of all as-built documents. Payment includes all costs to perform construction control and slope staking, surveys to compute quantities (i.e., pre- and post- construction), surveys to document as-built conditions of the Cell, and the preparation of Record Drawings as described in Section 01050 and 01052.

D. AZPDES (Bid Item 4)

1. Measured by Lump Sum (LS).
2. Payment includes all costs to prepare and submit the Construction Notice of Intent and Notice of Termination to the State and to prepare and implement the Storm Water Pollution Prevention Plan (SWPPP) for the site in accordance with the requirements of Section 01560.

E. Engineered Fill (Bid Item 5)

1. Measured by in-place Cubic Yard (CY). Measurement of in-place engineered fill will be made by comparing pre-construction topography with post-subgrade construction topography. Pre-construction topography will be established by field survey of existing grades. Survey will establish existing grades at a maximum 50-foot grid and establish major grade breaks. Post-construction topography will be established by similar survey at a maximum 50-foot grid and also establish major grade breaks. Calculations will be made on an average end area basis vertically by 2-foot contour interval.
2. Payment will be made by the Cubic Yard (CY). Payment includes all costs to load, haul, place, moisture condition and compact as described in Sections 02221 and 02222, and as shown on the Drawings. Also includes all clearing and stripping costs per Section 02100.

- F. Liner Subgrade Preparation (Bid Item 6)
1. Measured by the acre (AC). Measurement based on perimeter survey; sloped areas will be equated based on actual area, not plan area.
 2. Payment includes all costs to complete subgrade preparation for the landfill liner as described in Section 02223.
- G. Operations Layer Placement (Bid Item 7)
1. Measurement will be based on the surveyed area multiplied by the specified neat line thickness for the Operations Layer Material meeting the gradation requirements of Section 02222 and as shown on the Drawings. CONTRACTOR will be responsible for verifying specified thickness by survey methods. No adjustments will be made in the area for uneven contours.
 2. Payment will be by the Cubic Yard (CY) in-place. Payment includes all costs to furnish equipment and labor to load, haul and place on-site supplied material as shown on the Drawings and as described in Section 02222.
- H. Anchor Trench – East/West (Bid Item 8)
1. Measurement by the Lineal Foot (LF) of Anchor Trench installed along the top of the east and west side of the NC area.
 2. Payment will be by Lineal Foot (LF). Payment includes all costs for geosynthetic materials beyond the waste/cell limit detailed on the Drawings and to locate, excavate, construct soil berm, prepare, shape, backfill and compact the Anchor Trench as shown on the Drawings and described in Section 02222.
- I. Anchor Trench - Bench (Bid Item 9)
1. Measurement by the Lineal Foot (LF) of Anchor Trench installed along the drainage benches of the NC area.
 2. Payment will be by Lineal Foot (LF). Payment includes all costs for overlapping geosynthetic materials within the anchor trench as detailed on the Drawings and to locate, excavate, construct soil berm, prepare, shape, backfill and compact the Anchor Trench as shown on the Drawings and described in Section 02222.
- J. Base Liner Termination (Bid Item 10)
1. Measurement by the Lineal Foot (LF) of Liner Termination installed along the north side of the NC area.

2. Payment includes all costs to construct the liner termination as detailed on the Drawings and includes plywood, excavation for temporary turndowns, additional geomembrane and backfilling the temporary turndowns, installing the separation berm and furnishing and installing the sacrificial geomembrane cap strip.

K. Side Slope Liner Termination (Bid Item 11)

1. Measurement by the Lineal Foot (LF) of Liner Termination installed along the north side of the NC area.
2. Payment includes all costs to construct the liner termination, including shotcrete and additional geosynthetic materials beyond the liner limit as detailed on the Drawings.

L. Bench Liner Termination (Bid Item 12)

1. Measurement by the Lineal Foot (LF) of Liner Termination installed along the east and west sides of the NC area.
2. Payment includes all costs to construct the liner termination, including additional geosynthetic materials beyond the pay limit of liner shown on Detail 4/C-501 and cover/ballast beyond the liner limit at the bench anchor trench as detailed on the Drawings.

M. Base Liner Tie-In (Bid Item 13)

1. Measurement by the Lineal Foot (LF) of tie-in installed along the south edge of the bottom liner of the North Cell Phase 2 area.
2. Payment will be by Lineal Foot (LF). Payment includes all costs to locate, excavate, remove plywood, and expose tie-in and install gravel for the drainage layer transition as shown on the Drawings and described in Sections 02225, 02771, 02778, and 02779.

N. Sideslope Liner Tie-In (Bid Item 14)

1. Measurement by the Lineal Foot (LF) of tie-in uncovered, based on the perimeter survey performed along the south edge of the sideslope liner of the North Cell Phase 2 area.
2. Payment will be by Lineal Foot (LF). Payment includes all costs to locate, excavate, and expose tie-in, as shown on the Drawings and described in Sections 02778 and 02779.

O. Geosynthetic Clay Liner (GCL) (Bid Item 15)

1. Measurement by area installed excluding anchor trenches, measured by the slope-corrected square foot (SF) based on a perimeter survey of the completed installation. No adjustment will be made for uneven contours or for overlap at seams or wastage. No measurement will be made for geosynthetic clay liner lost due to damage resulting from either the fault or the negligence of the CONTRACTOR. The perimeter is defined as the neat line dimension of the liner/cell limit shown on the anchor trench and termination details.
2. Payment will be by the square foot (SF). Payment includes all costs to on the Drawings and described in Section 02779.
3. This item will also include all Construction Quality Control testing of the GCL.

P. 60-mil, double-sided textured Geomembrane Liner (Bid Item 16)

1. Measurement by area installed excluding anchor trenches, measured by the slope-corrected square foot (SF) based on a perimeter survey of the completed installation. No adjustment will be made for uneven contours or for overlap at seams, or wastage. No measurement will be made for geomembrane lost due to damage resulting from either the fault or the negligence of the CONTRACTOR. The perimeter is defined as the neat line dimension of the liner/cell limits shown on the anchor trench and termination details.
2. Payment will be by the Square Foot (SF). Includes all costs to install geomembrane as shown on the Drawings and described in Section 02778.
3. This item will also include all Construction Quality Control testing of the Geomembrane Liner.

Q. Geocomposite LCRS Drainage Layer (Bid Item 17)

1. Measurement by area installed, measured by the slope-corrected square foot (SF) based on a perimeter survey of the completed installation. No adjustment will be made for uneven contours or for overlap at seams, or wastage. The perimeter is defined as the neat line dimension of the floor liner limit and perimeter details.
2. Payment will be by the Square Foot (SF). Includes all costs to install OWNER-supplied Geocomposite, fasten Geocomposite, and repair Geocomposite as shown on the drawing and described in Section 02225.

3. This item will also include all Construction Quality Control testing of the Geocomposite LCRS Drainage Layer.
- R. 6" HDPE Leachate Collection Drain (Bid Item 18)
1. Measurement based on actual length installed based on survey performed by CONTRACTOR.
 2. Payment will be by Lineal Foot (LF). Payment includes all costs to furnish the equipment and labor necessary to install Leachate Collection Drains, including those on benches, but not limited to geotextile, perforated HDPE pipe, fittings, and gravel fill. CONTRACTOR shall furnish gravel fill. CONTRACTOR must provide OWNER with purchase quantities of pipe and geotextile.
 3. This item will also include all Construction Quality Control testing of the Leachate Collection Drain.
- S. 6" HDPE Leachate Riser Pipe - Solid (Bid Item 19)
1. Measurement based on actual length installed based on survey performed by CONTRACTOR.
 2. Payment will be by Lineal Foot (LF). Payment includes all costs to furnish the equipment and labor necessary to install Leachate Riser Pipe, including, but not limited to, HDPE pipe and fittings.
 3. This item will also include all Construction Quality Control testing of the Leachate Riser Pipe.
- T. Geotextile (12 oz.) (Bid Item 20)
1. Measurement by area installed on side slopes from toe of side slope to the neat-line top edge of deployed operations layer, measured by the slope-corrected square foot (SF) based on a perimeter survey of the completed installation. No adjustment will be made for uneven contours or for overlap at seams, or wastage. No measurement will be made for geotextile installed as separator or cushion layer incidental to other bid items including Base Liner Termination, Base Liner Tie-in, or 6" HDPE Leachate Collection Drain.
 2. Payment will be by the Square Foot (SF). Includes all costs to install geotextile as shown on the Drawings and described in Section 02771.
 3. This item will also include all Construction Quality Control testing of the Geotextile.

U. Haul Daily Cover to North Cell Stockpile (Bid Item 21)

Note: The CONTRACTOR shall place the soil stockpiles in the •North Cell at the direction of the OWNER.

1. However, all, some, none, or more of the excavated soil may be hauled to the stockpile location, as directed by the OWNER. The CONTRACTOR shall adhere to the project scheduling listed in Section 01310 – Construction Schedule, which includes schedule milestones and minimum and maximum annual volume excavation amounts.
2. Measured by in-place Cubic Yard (CY). The CONTRACTOR shall provide a base line survey for the OWNER'S review and acceptance prior to beginning excavation. Measurement of excavation will be made by comparing pre-construction base line topography with the monthly surveyed topography. Survey will establish existing grades at a maximum 100-foot grid and establish major grade breaks. Calculations will be made by AutoCAD comparison between base line topography and surveyor provided monthly topography. Required construction water and fine grading of fill shall be considered incidental to this item. No load counts will be used for payment. The CONTRACTOR shall provide all survey data used for volume calculations to the OWNER and ENGINEER.
3. Payment will be made by the Cubic Yard excavated. Payment includes The cost shall include moisture conditioning, material processing and segregation, excavation, hauling, grading/shaping, compaction, vehicles, labor, and all other items necessary to complete the Work. The overall quantity to be excavated will be based on the difference between the current north area topography (base line) and the final elevations shown on the Contract Drawings. The CONTRACTOR must independently verify and agree to the cubic yardage quantity to be excavated prior to bid submittal. The cost per cubic yard excavated will be the sole means of payment, including moisture conditioning, material processing and segregation, excavation, hauling, grading/shaping, compaction, vehicles, labor, and all other items necessary to complete the Work.

V. Operations Layer Material Screening/Stockpiling (Bid Item 22)

1. Measurement will be based on the surveyed area multiplied by the specified neat line thickness for the Operations Layer Stockpile meeting the gradation requirements of Section 02222 and as shown on the Drawings. CONTRACTOR will be responsible for verifying specified thickness by survey methods. No adjustments will be made in the area for uneven contours.

2. Payment will be by the Cubic Yard (CY) in-place. Payment includes all costs to furnish equipment and labor to load, haul, screen, provide dust control, and place on-site supplied material in stockpile at location(s) to be determined by owner.

W. Payment and Performance Bonds (Bid Item 23)

1. Measured by Lump Sum (LS).
2. Payment includes all costs to procure and provide payment and performance bonds in accordance with the City of Glendale contract requirements.

X. Construction Taxes (Bid Item 24)

1. Measured by incurred cost.
2. Payment includes all costs assessed for Federal, State, County, City taxes. CONTRACTOR shall provide invoices or similar documentation of the assessed tax amount from each taxing authority to the OWNER verifying the actual amount paid. Taxes under this item will be paid at the actual amount assessed, without markup, and will not be subject to the early payment discount provision to this contract.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01030 SPECIAL INSTRUCTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Smoking Policy.
- B. Special Clean-up.
- C. Limiting Public Access.
- D. Materials Delivery.
- E. Emergencies.
- F. General Safety.
- G. Storm Damage.
- H. Equipment Fueling and Maintenance.

1.2 SMOKING POLICY

- A. Smoking is not allowed at the City of Glendale Landfill. The smoking prohibition will be strictly enforced on this project due to the explosive nature of landfill gas.

1.3 SPECIAL CLEAN-UP

- A. Any trash generated on the project site by the CONTRACTOR, or his employees, will be cleaned up daily by the CONTRACTOR for disposal on site (active face of the landfill). Mud and dirt tracked off site by the CONTRACTOR, his equipment, or his employees will be cleaned up daily by the CONTRACTOR. Facility access roads and any other off-site roads will be scraped clean daily and washed down at least once per week.

1.4 LIMITING PUBLIC ACCESS

- A. All necessary precautions including barricades and/or traffic cones will be used to prevent the public from entering the working area. The CONTRACTOR is reminded that the landfill is a hazardous area containing heavy equipment and explosive gases.

1.5 MATERIALS DELIVERY

- A. The CONTRACTOR is to have all materials delivered to his work site and/or staging area. The OWNER or ENGINEER will not accept delivery of materials.

1.6 EMERGENCIES

- A. The CONTRACTOR will provide the ENGINEER with the phone numbers of at least two individuals who may be contacted in an emergency on a 24-hour, 7-day per week basis, including holidays. To prepare for emergencies, the CONTRACTOR will ensure that his employees know the location of appropriate fire and first aid equipment and emergency phone numbers. In the event of an emergency, such as damage or rupture of an existing gas pipeline, the CONTRACTOR shall immediately notify the ENGINEER and/or the Operator. Should such an emergency occur after hours, the CONTRACTOR shall notify the ENGINEER. This is in addition to the CONTRACTOR taking any appropriate immediate emergency response to correct the problem.

1.7 GENERAL SAFETY

- A. The CONTRACTOR shall be responsible for maintaining safety on the project site in accordance with the provisions of the contract and including OSHA and NFPA regulations. In addition, the CONTRACTOR shall supply all necessary safety equipment for his employees and any site visitors. Tool box safety meetings shall be performed a minimum of once per week for all site personnel.

1.8 STORM DAMAGE

- A. The CONTRACTOR shall be responsible for the repair of any storm damage to the Work prior to the Final Acceptance by the ENGINEER and OWNER. Storm damage of Stockpiled materials will also be responsibility of the CONTRACTOR. Prompt repair of any Storm damage shall be the responsibility of the CONTRACTOR, at no cost to the OWNER.

1.9 EQUIPMENT FUELING AND MAINTENANCE

- A. The CONTRACTOR shall fuel and maintain equipment in designated areas of the site as directed by the ENGINEER. The CONTRACTOR shall furnish and use drip pans for the fueling of vehicles or equipment. Any fuel spills will be immediately cleaned up, and the contaminated soil removed from the site by the CONTRACTOR at the CONTRACTOR's expense. The CONTRACTOR will not be allowed to place a temporary fuel tank on site.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01035 MODIFICATION PROCEDURES

PART 1 GENERAL

1.10 SECTION INCLUDES

- A. Field Orders.
- B. Work Directive Changes.
- C. Change Orders.

1.11 CHANGE PROCEDURES

- A. OWNER will issue Field Orders for minor changes in the Work not involving an adjustment to Contract Price or Contract Time.
- B. OWNER may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required, and the period of time during which the requested price will be considered valid. CONTRACTOR shall prepare and submit a Proposal with estimate within 5 days.
- C. CONTRACTOR may request a change by submitting a Proposal to OWNER, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, the effect on the Contract Price and Contract Time, and a statement describing the effect on Work by separate or other contractors in accordance with Section 00675 within the Project Manual. The CONTRACTOR shall not proceed with the work until an approved and fully executed change order is received.
- D. OWNER may issue a Work Change Directive for any change which, if not processed expeditiously, might delay the Project. This is not a Change Order, but only a directive to proceed with Work that may be included in a subsequent Change Order.
- E. Changes affecting Contract Price or Contract Time, resulting under paragraphs 1.2 B, C, and D of this Section, will be processed as a Change Order. Change orders shall also list the number of additional days added to the construction schedule.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01050 FIELD ENGINEERING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General requirements for survey work to be performed by CONTRACTOR to layout Work under this Contract.
- B. Before commencing any surveys, CONTRACTOR will give OWNER two working days advance notice so that OWNER may witness such work.

1.2 RELATED SECTIONS:

- A. Section 01025 - Measurement and Payment.

1.3 DESCRIPTION

- A. Reference points: Reference points to be provided by OWNER pursuant to the General Conditions will include referenced monuments and elevation benchmarks in the vicinity of the Project. If displaced by CONTRACTOR, replacement of these reference points will be at the expense of CONTRACTOR. All surveys for record drawings shall tie to a minimum of three of these reference points and shall use the site coordinate system previously established by the OWNER's survey and utilized in the design Drawings.
- B. CONTRACTOR will furnish all necessary detail surveys including all lines, grades, and elevation appropriate to control construction. At a minimum, construction surveys are required for top of subgrade and top of final surface.
- C. Use by OWNER: OWNER may at any time use line and grade points and markers established by CONTRACTOR. CONTRACTOR's surveys are a part of the Work and may be checked by OWNER at any time. CONTRACTOR is responsible for any lines, grades, or measurements which do not comply with specified or proper tolerances, or which are otherwise defective, and for any resultant defects in the Work. CONTRACTOR will be required to conduct re-surveys or check surveys to correct errors indicated by review of the field notebooks or otherwise detected.

1.4 SURVEYS FOR MEASUREMENT FOR PAYMENT

- A. When the Specifications or OWNER require Bid Schedule items of work to be measured by surveying methods, CONTRACTOR will perform the surveys. All such surveys, including control surveys for establishing the measurement reference lines, will be performed by a duly qualified and licensed surveyor in the presence of CONTRACTOR who will provide notice so OWNER may witness the surveying operation. OWNER may independently check calculations of final

quantities for payment purposes. A duplicate of the note reductions and calculations will be given to OWNER. All calculated quantities shall be certified by surveyor as to accuracy.

1.5 SURVEYING ACCURACY AND TOLERANCES IN SETTING OF SURVEY STAKES

- A. Perform control traverse field surveys and computations to an accuracy of at least 1:10,000.
- B. The tolerances applicable in setting survey stakes are as set forth below. Such tolerances cannot supersede stricter tolerances required by the Drawings or Specifications, and cannot otherwise relieve the CONTRACTOR of responsibility for measurements in compliance therewith.

<u>Type of Mark</u>	<u>Horizontal Position</u>	<u>Elevation</u>
Permanent reference points	1 in 10,000	±.01 ft.
General excavation and earthwork	1 in 2,000	±.10 ft.

- C. Tolerances for designed thickness shown on Drawings and for elevations shown on the Drawings are ±0.10 foot unless otherwise specified.
- D. Surveyor must be licensed in the State of Arizona.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01052 LAYOUT OF WORK AND SURVEYS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes requirements for survey work to be provided by the CONTRACTOR for the following:
- B. Setting offset stakes, slope stakes, and grade stakes for field layout of features for performance of the Work.
- C. Surveys for measurement of quantities for payment.
- D. Record Drawings.

1.2 DESCRIPTION

- A. Reference Points. The reference points provided by the OWNER include monuments and elevation bench marks in the vicinity of the Project. If displaced during the project, replacement of these reference points will be at the expense of the CONTRACTOR. All surveys for record drawings shall tie to a minimum of three of these reference points and shall use the site coordinate system previously established by the OWNER's survey and utilized in the Design Plan Drawings.
- B. The OWNER reserves the right to perform any desired checking and correction of the CONTRACTOR's layout work relative to OWNER's surveys but this does not relieve the CONTRACTOR of the responsibility for adequate performance of their Work.
- C. Equipment and Personnel. Provide instruments and other survey equipment that are accurate, suitable for the surveys required in accordance with recognized professional standards, and in proper condition and adjustment at all times. Perform surveys under the direct supervision of a licensed surveyor.
- D. Field Notes and Records. Record surveys in field notebooks.
- E. Use by the OWNER. The OWNER may at any time use line and grade points and markers established by the OWNER or CONTRACTOR. The CONTRACTOR's surveys are a part of the Work and may be checked by the OWNER or representatives of the OWNER at any time.

1.3 RELATED SECTIONS

- A. Section 01025 – Measurement and Payment

B. Section 01050 – Field Engineering

1.4 SURVEYS FOR LAYOUT AND PERFORMANCE OF WORK

- A. CONTRACTOR will perform all surveys for layout of the Work, reduce the field notes, make necessary calculations, and prepare drawings necessary to carry out such work. CONTRACTOR's layout work will include the following:
1. Slope staking for excavations at 25-foot grid, and grade breaks.
 2. Blue top for subgrade at 25-foot grid and grade breaks.
 3. All as-built surveys specified in Section 01052.
 4. Surveys to measure completed units of work specified in Section 01025.
- B. CONTRACTOR must perform all additional slope staking, off-setting and other control staking necessary to perform the Work.

1.5 SURVEYS FOR RECORD DRAWINGS AND MEASUREMENT FOR PAYMENT

- A. When the Specifications require items of work to be measured by surveying methods, the CONTRACTOR will perform the surveys and perform necessary calculations to determine payment quantities. The ENGINEER may perform independent checks.
- B. Items requiring surveys for determining pay quantities are given in Section 01025, Measurement and Payment.
- C. The Surveyor shall prepare drawings for each layer of the lining system (subgrade, top of compacted soil, and top of protective soil layer). Points shall provide a comparison of the design elevation against the actual elevation at each point. Points shall be established on a 50-foot maximum grid. Additionally, points shall be established at major changes in grade, changes in alignment, along flow lines, and at any specific points shown in the Drawings. The difference in design versus constructed elevation for each point shall not exceed the tolerance described in Section 01050 paragraph 1.5.
- D. Provide the OWNER with Record (As-Built) Drawings. Separate and distinct sheets shall be provided depicting existing conditions, top of subgrade/finished earth surface, top of containment system, and top of protective cover. Sheets shall include the following items:
1. Topography that depicts North Cell (NC) Earthwork grading at the start of construction and following excavation and fills. In the event the

CONTRACTOR must excavate below the design subgrade as required by these specifications or to remove unsuitable material (at the direction and approval of the ENGINEER or OWNER), CONTRACTOR shall provide as-built survey of the final excavated limits and grades, the limits of fill and grades after placement of engineered fill to establish subgrade and the final grade.

2. Staking points, grade breaks and limit lines of earthwork as shown in the Design Drawings.

3. Staking points, grade breaks and limits of liner as shown in the Design Drawings. Where not coincident, limits shall be provided for geomembrane, GCL, and geotextile, including anchor trench alignment and temporary liner terminations (special attention to be given to specific as-built points as required in the Construction Drawings).

4. Staking points, grade breaks and limits of operations layer as shown in the Design Drawings.

5. Limits and Grades of earthwork in the termination berm. Include staking points, grade breaks, and points of change in surface material.

6. Miscellaneous Items - CONTRACTOR'S Surveyor shall include the following as-built information on one of the sheets identified above (as appropriate) or shall provide additional sheets, as needed. The specific sheet for each element shall be as approved by the OWNER.

- a. Location, invert elevations, and alignment of buried utilities and buried culverts, including leachate collection piping.
- b. Initial and finish grades for storm water control features.
- c. Limits of temporary or permanent access roads.
- d. Subgrade and finished grade of temporary or permanent access roads.
- e. Stockpile limits and grades (pre- and post-construction).
- f. Final site as-builts showing contours and any other miscellaneous constructions including fence, wells, probes, electrical, etc.
- g. OWNER-provided reference points shall be shown on all applicable as-built drawing sheets.

E. Surveyor shall provide a Text/ASCII file containing all collected as-built locations. As-built drawings shall depict all collected locations with an associated

point reference number such that points in the provided Text/ASCII file can be referenced on the drawings.

- F. Surveyor shall submit certified top of subgrade as-built point drawings within 2 days of completion of the subgrade. Where applicable, Surveyor shall provide certified top of compacted soil as-built point drawings within 2 days of completion of this layer. These submittals must be approved by the OWNER before installation of the next liner component begins. In order to avoid project delays, the Surveyor may provide submittals for portions of each completed surface for approval; however, a final consolidated drawing of each surface shall be provided at the completion of each surface.
- G. All final as-built topographic survey drawings are due within 10 days after Substantial Completion date.
- H. Provide sealed as-built survey drawings on a 22" x 34" bond print at same horizontal and vertical scale, same coordinate system, same stationing, and same orientation for each element as shown on the design drawings. Provide as-built survey information and associated point data on the same datum and coordinate basis as design drawings. All point data must have clear, easy to understand descriptions. Provide all point data in Text/ASCII format, printed and on compact disk (CD) or DVD along with list of descriptor abbreviations. All information provided must be accompanied with a letter explaining what is being submitted and a list of what information is given in each CD/DVD. Submit all survey information of any layer to the OWNER before that layer is covered.
- I. Surveyor shall provide all drawings in electronic format. Provide information in AutoCAD 2018 or higher format in accordance with OWNER'S drafting standards. Surveyor shall also provide documents in Adobe .pdf format.
- J. Submit survey information for items listed above to the OWNER before the items are covered.
- K. Provide surveys to measure the following items:
 - 1. Volume of Excavation;
 - 2. Volume of Engineered Fill;
 - 3. Volume of Unsuitable Material removed from the NC area below the design subgrade and replaced with Engineered Fill;
 - 4. Area of Liner Subgrade Preparation;
 - 5. Volume of Operations Layer placement;
 - 6. Length of Anchor Trench (each type);

7. Length of Liner Tie-In (each type);
8. Length of Liner Termination (each type);
9. Area of GCL, HDPE Liner, Geocomposite and geotextile placement. Area will be to the hinge point/limit of waste as shown on the drawings only and will not include the material in the run-out or anchor trench itself; and
10. Length of HDPE Leachate Collection Drain and Risers, for each material (perforated or solid).

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01200 PROJECT MEETINGS

PART 1 GENERAL

1.1 REQUIREMENTS INCLUDED

- A. Representatives of CONTRACTOR, subcontractors, and suppliers attending meetings must be authorized to act on behalf of organizations they represent.

1.2 PRE-CONSTRUCTION MEETING

- A. Meeting will be held at a location selected by OWNER.
- B. Attendance:
 - 1. CONTRACTOR's Office Representative.
 - 2. CONTRACTOR's On-Site Field Superintendent.
 - 3. Any Subcontractors or Supplier's representatives whom CONTRACTOR may desire to invite or OWNER may request.
 - 4. ENGINEER's Representatives.
 - 5. OWNER's Representatives. (Includes Design ENGINEER and CQA Personnel)
- C. A suggested format would include, but not be limited to, the following subjects:
 - 1. Presentation of a proposed construction progress schedule and submittals as required by the Contract Documents.
 - 2. Required bonds and insurance certifications prior to Notice to Proceed.
 - 3. Liquidated Damages.
 - 4. Procedures for handling submittals.
 - 5. Direction of correspondence, and coordinating responsibility between CONTRACTOR and OWNER.
 - 6. Request or scheduling of a weekly job meeting for all involved.
 - 7. Laboratory testing of construction materials.
 - 8. Applications for payment, and progress payment procedures.

9. Change Order procedures.
 10. OWNER's site regulations.
- D. The meeting will be documented by the OWNER or person designated by the OWNER. Copies of the minutes and relevant documents will be provided to all parties.

1.3 WEEKLY PROGRESS MEETINGS

- A. OWNER'S Representative will schedule and administer progress meetings at a minimum of once per week and such additional meetings as required, or as requested by OWNER.
- B. Attendance:
1. OWNER'S Representative.
 2. ENGINEER, if requested by OWNER'S Representative.
 3. CQA Officer
 4. CONTRACTOR's superintendent.
 5. Subcontractors as appropriate to agenda.
 6. Suppliers as appropriate to agenda.
- C. Meeting requirements:
1. OWNER'S Representative will administer the following general requirements for progress meetings:
 - a. Prepare agenda for meetings.
 - b. Make physical arrangements for meetings.
 - c. Preside at meetings.
 - d. Record significant proceedings and decisions of meeting.
 - e. Reproduce and distribute copies of meeting record within seven days after each meeting to participants in meeting and to parties affected by decisions made at meeting. Furnish one copy of minutes to participants. Revise and distribute revisions to meeting minutes as necessary.
 2. CONTRACTOR will administer the following general requirements for progress meetings:

- a. Review meeting minutes and provide comments to OWNER's representative prior to the next meeting.
- b. Provide information to the OWNER's representative required for the meeting agenda such as progress quantities, fuel usage and water usage records.

D. Suggested Agenda:

- 1. Review of safety and any related issues or incidents since last meeting.
- 2. Review and approval of record of previous meeting.
- 3. Review of Work progress since previous meeting.
- 4. Field observations, problems, and conflicts.
- 5. Problems which impede Work Schedule.
- 6. Review of off-site delivery schedules.
- 7. Corrective measures and procedures to regain projected schedule if a review of the schedule deems it necessary.
- 8. Revisions to Construction Progress Schedule.
- 9. Coordination of schedules between contractors.
- 10. Review submittal schedules; expedite as required.
- 11. Maintenance of quality and safety standards.
- 12. Pending changes and substitutions.
- 13. Review proposed changes for effect on construction schedule and completion date, and on other contracts of projects.
- 14. Review of drawings and specifications that govern the next two weeks of work.
- 15. Review of bid item quantities relative to original estimates.
- 16. Review and update of as-built drawings.
- 17. Other business.

1.4 DAILY PROGRESS MEETINGS

- A. An informal daily progress meeting will be held on-site at a convenient location. At a minimum, this meeting will be attended by CONTRACTOR's Project Manager or Job Foreman. The purpose of this meeting is to:

1. Safety – review status and issues, if any.
2. Review scheduled work activities.
3. Discuss problems and resolutions.
4. Review test data.
5. Discuss the CONTRACTOR's personnel and equipment traffic patterns for the day.
6. Review the previous day's activities and accomplishments.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01300 SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Submittal procedures;
- B. Construction progress schedules;
- C. Proposed products list;
- D. Shop drawings;
- E. Product data;
- F. Samples;
- G. Manufacturers' installation instructions;
- H. Manufacturers' certificates; and
- I. As-built documentation.

1.2 RELATED SECTIONS

- A. Section 01310 - Construction Schedule
- B. Section 01400 - Quality Control: Manufacturers' field services and reports.
- C. Section 01700 - Contract Closeout: Contract warranties, bonds, manufacturers' certificates, and closeout submittals.

1.3 SUBMITTAL PROCEDURES

- A. Transmit each submittal with a transmittal form. Submittals shall be provided electronically and be submitted to the OWNER and ENGINEER.
- B. Sequentially number the transmittal form. For revised submittals add an alphabetic suffix to the original number.
- C. Identify Project, CONTRACTOR, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate.
- D. Apply CONTRACTOR's stamp, signed or initialed certifying review, verification of Products required, field dimensions, adjacent construction Work, and

- coordination of information, is in accordance with the requirements of the Work and Contract Documents.
- E. Schedule submittals to expedite review by the OWNER and delivery in the time frame specified. Coordinate submission of related items.
 - F. Allow 7 calendar days review time for each submittal excluding delivery time to and from the CONTRACTOR.
 - G. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
 - H. Provide space for CONTRACTOR, OWNER and/or OWNER's Representative review stamps.
 - I. If revisions and re-submittals are required, identify all changes made since previous submission.
 - J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with provisions.
 - K. Submittals not requested will not be recognized or processed.

1.4 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial schedule in duplicate within 5 days after date of Agreement.
- B. Revise and resubmit as required but no less than every 7 days. The revised schedule must show the original target schedule.
- C. Submit revised schedules during weekly progress meetings. If revisions to the schedule affect work by others, the OWNER must be notified two weeks prior to the change. No changes may be initiated without the written approval of the OWNER.
- D. Submit a computer-generated schedule with separate line for each item of Work or operation identifying first work day of each week.
- E. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the critical path, start, and finish, float dates, and duration.
- F. Indicate estimated percentage of completion for each item of Work at each submission.
- G. Indicate submittal dates and review periods required for shop drawings, product data, samples, and product delivery dates, including those furnished by OWNER.

1.5 PROPOSED PRODUCTS LIST

- A. Within 5 days after date of OWNER-CONTRACTOR Agreement, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.6 SHOP DRAWINGS

- A. Submit the number of opaque reproductions which CONTRACTOR requires, plus 2 copies which will be retained by OWNER.
- B. Shop Drawings: Submit for review. After review, produce copies and distribute in accordance with the SUBMITTAL PROCEDURES article above and for record documents purposes described in Section 01700 - CONTRACT CLOSEOUT.

1.7 PRODUCT DATA

- A. Submit the number of copies which the CONTRACTOR requires, plus submit an electronic copy to the OWNER.
- B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.
- C. After review, distribute in accordance with the Submittal Procedures article above and provide copies for record documents described in Section 01700 - CONTRACT CLOSEOUT.

1.8 SAMPLES

- A. Submit a sample of any imported soil material that represents the specified product(s). Samples must be submitted to the ENGINEER at least two weeks prior to the start of construction and before any materials are delivered to the jobsite.
- B. For the soil samples, submit each sample in an air-tight sealed bucket and provide at least 50 pounds, unless otherwise stated in the individual specification sections.
- C. Include identification on each sample including source identification and full project information.
- D. Submit the number of samples specified in individual specification sections. The OWNER may retain all or a portion of each sample as a record of the submittal.

1.9 MANUFACTURER INSTALLATION INSTRUCTIONS

- A. When specified in individual specification sections, submit two paper copies and one electronic copy of instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing to the OWNER.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.10 MANUFACTURER CERTIFICATES

- A. When specified in individual specification sections, submit manufacturer's certificates in specified quantities.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting data, affidavits, certifications, and quality control testing.
- C. Certificates must be specific to the material or product delivered to the site.

1.11 AS-BUILT DOCUMENTATION

- A. Perform and submit all record surveys necessary to show compliance with the Drawings and Specifications.
- B. Record and submit all red-line mark-ups showing changes to the Drawings, Details, and Specifications.
- C. Submit all results of testing performed during and in conjunction with construction.
- D. Submit all documentation as described in Section 01700 Contract Closeout.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01310 CONSTRUCTION SCHEDULE

PART 1 GENERAL

1.1 PRELIMINARY WORK PLAN AND SCHEDULE

- A. Prepare and submit at the pre-construction meeting, a Work Plan and construction schedule.
- B. The ENGINEER will review the preliminary Work Plan and construction schedule prior to the commencement of construction activities.
- C. The CONTRACTOR may be interviewed by the ENGINEER to determine the CONTRACTOR'S understanding of the project, and ability to complete the work in a timely and efficient manner.
- D. Submit copy of Arizona Pollutant Discharge Elimination System (AZPDES) and earthmoving permit at Pre-construction meeting.

1.2 CONTRACTOR'S WORK PLAN CONTENTS

- A. Include with Work Plan a drawing detailing various work areas, CONTRACTOR'S utilities, phasing of work, excavation, testing, and any other information related to proposed operations.
- B. Describe personnel, equipment, and procedures required to accomplish specific items of work, including:
 - 1. Method of coordinating Subcontractors, if any, and maintaining project schedule.
 - 2. Methods and routes for maintaining access to the Phase 1 landfill area throughout Phase 2 liner construction, including coordination with the OWNER, and moving and stockpiling materials on site. Include detailed drawings showing haul routes and logistics.
 - 3. Methods for reducing or increasing the moisture content of wet or dry soils prior to using them for constructing engineered fills during construction.
 - 4. Methods and equipment for excavating, hauling, and placing materials.
 - 5. Dewatering methods, equipment and schedules.
 - 6. Site drainage during construction.

7. Methods and equipment for site clearing.
8. Methods for erosion prevention and sediment control.
9. Plans for maintaining as-built information.
10. Health and Safety Plan.
11. Project Schedule.
12. List of Personnel and equipment.
13. List of Subcontractors and Subconsultants.
14. List and organizational chart of project personnel responsibility.
15. Other information required in technical specifications.
16. Emergency action plan and contacts' telephone numbers.
17. Spill Prevention Control and Countermeasures (SPCC) Plan, if required based on quantity of petroleum products stored.
18. Stormwater Pollution Prevention Plan (SWPPP).

1.3 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Prepare a critical path method (CPM) schedule as described in Section 01300.
- B. Coordinate schedule with the OWNER for the OWNER supplied materials.
- C. Coordinate schedule with Work Plan.

1.4 PROJECT MEETINGS

- A. Construction Meetings:
 1. The ENGINEER will conduct construction meetings involving:
 - a. CONTRACTOR's Project Manager.
 - b. CONTRACTOR's Project Superintendent.
 - c. OWNER's designated representative(s).
 - d. ENGINEER's designated representative(s).
 - e. CONTRACTOR's subcontractors as appropriate to the work in progress.

f. OWNER's Construction Quality Assurance Consultant.

1. Meetings will be conducted every week.
2. The ENGINEER will take meeting minutes and submit copies of meeting minutes to participants and designated recipients identified at the Preconstruction Conference.

g. Corrections, additions, or deletions to the minutes shall be noted and addressed at the following meeting.

1. The ENGINEER will schedule meetings for most convenient time frame.
2. The ENGINEER will have available at each meeting full chronological files of all previous meeting minutes.
3. The CONTRACTOR shall have available at each meeting up-to-date record drawings.

B. Pre-Installation Conferences:

1. Coordinate and schedule with ENGINEER for each material, product, or system specified. Conferences to be held prior to initiating installation, but not more than two (2) weeks before scheduled initiation of construction.
 - a. Conferences may be combined if installation schedule of multiple components occurs with the same two (2) week interval.
 - b. Review manufacturers' recommendations and Contract Documents Specifications.
 1. CONTRACTOR's Superintendent and individual who will actually act as foreman of the installation crew (installer), if other than the Superintendent, shall attend.

1.5 VIDEO RECORDING

- A. Provide full access to OWNER or OWNER's authorized representative to perform video recording of construction activities, training sessions, start-up, trouble shooting, etc.

1.6 CORRESPONDENCE

- A. The CONTRACTOR shall provide a correspondence matrix identifying requirements for submitting and sharing correspondence among the parties involved in the Project.

1.7 SPECIAL CONSIDERATIONS

- A. CONTRACTOR shall be responsible for negotiations of any waivers or alternate arrangements required to enable transportation of materials to the site.
- B. Maintain conditions of access road to site such that access is not hindered as the result of construction-related deterioration.

1.8 PROJECT PHOTOGRAPHS

- A. ENGINEER will provide digital photographs of construction process.
 - 1. Photographs will be provided with nomenclature and description for easy identification of photo location and subject matter.
 - 2. Submit photographs in electronic format.

1.9 FINAL WORK PLAN

- A. Resubmit the Work Plan to incorporate the information discussed during the pre-construction meeting.
- B. Work Plan and Schedule Revisions.
 - 1. Revise Work Plan as necessary to reflect changes in scope of work, but no less than once per month.
 - 2. Show changes occurring since previous submittal.
 - a. Major changes in scope.
 - b. Activities modified since previous submittal.
 - c. Other identifiable changes.
 - 3. Submit to the ENGINEER.

1.10 DELAYS AND RECOVERY

- A. If, at any time during Project, CONTRACTOR fails to complete an activity by its latest scheduled completion date, CONTRACTOR must submit within two working days a written statement as to how and when CONTRACTOR will reorganize work force to return to current construction schedule.
- B. Whenever it becomes apparent from progress evaluation and updated schedule data that milestone completion dates and/or contract completion dates will not be met, some or all of the following actions must be taken:

1. Increase construction staffing in such quantities and crafts to substantially eliminate backlog of work.
 2. Increase number of working hours per shift, shifts per work day, work days per week, or amount of construction equipment, or combination of foregoing to substantially eliminate backlog of work.
 3. Reschedule work items to achieve concurrence of accomplishment.
- C. Under no circumstances will addition of equipment or construction forces, increasing working hours or any other method, manner or procedure to return to current Construction Progress Schedule be considered justification for contract modification or treated as an acceleration.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01400 QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Acceptance or quality assurance testing by OWNER.
- B. Quality control testing by CONTRACTOR
- C. Certificates of compliance.

1.2 RELATED SECTIONS

- A. Section 01300 – Submittals.

1.3 SOURCE OF MATERIALS

- A. CONTRACTOR must notify OWNER in writing of the sources from which it proposes to obtain material requiring approval, certification, or testing. Such notification must be made as soon as possible after award of Contract but no later than 5 days after receipt of the Notice to Proceed.

1.4 ACCEPTANCE TESTING OR QUALITY ASSURANCE TESTING

- A. Acceptance testing is the testing of materials prior to their use in the Work and also any testing deemed necessary by OWNER for acceptance of the completed Work. OWNER will perform acceptance testing of materials and workmanship in accordance with the Contract Documents and reserves the right to perform additional testing at any time to determine conformance with the requirements of the Contract Documents.
- B. Acceptance testing by OWNER is not to be considered as a replacement for control testing conducted by CONTRACTOR or a manufacturer producing materials for CONTRACTOR. Acceptance testing will be at the expense of OWNER.

1.5 QUALITY CONTROL TESTING

- A. Quality control testing is the testing of materials prior to their delivery from a manufacturer, or during construction, such as geomembrane liner seam testing, soil density testing, riprap gradation, and such other tests as are specified in the various sections of the Specifications to ensure compliance with the Contract Documents. CONTRACTOR must assume full responsibility for control testing and give sufficient notice to OWNER to permit it to witness the tests. Control testing is at the expense of CONTRACTOR and where specifically required, performed by an independent testing firm.

- B. Submit the name, address, and qualifications, together with the scope of proposed services, of the proposed testing firm(s) submit to OWNER for approval at least 5 days prior to the scheduled commencement of any work involving such testing.
- C. Within five days after completion of testing performed by or for CONTRACTOR, submit test results to OWNER. Identify test reports with the information specified for samples in Section 01300 and additionally, the name and address of the organization performing the test, and the date of the tests.
- D. Quality Control testing performed under this section is primarily intended to allow the CONTRACTOR to determine that manufacturing and construction techniques are sufficient to provide a work product that is fully compliant with these specifications. It is independent from Quality Assurance testing, which is performed by the CQA organization, and which is primarily intended to confirm that the work product, as constructed, conforms to the specifications. The CONTRACTOR may need to perform Quality Control testing at frequencies greater than those specified in various sections of the specifications, or for items for which no Quality Control testing is specified, if, in their opinion, such testing is necessary to determine that their methods are sufficient to construct a compliant work product.
- E. No separate payment will be made for Quality Control testing performed per this subpart. The cost for Quality Control testing is incidental to the unit price bid for each applicable bid item.

1.6 CERTIFICATES OF COMPLIANCE

- A. CONTRACTOR may use certificates of compliance for certain materials and products in lieu of the specified sampling and testing procedures. Submit certificates required to demonstrate proof of materials compliance with specification requirements. Submit certificates in duplicate with each lot of material delivered to the Work or prior to delivery as required by the Contract. The lots so certified must be clearly identified by the certificate. Certificates must be signed by an authorized representative of the producer or manufacturer, and state that the material complies in all respects with the requirements of the Contract Documents. In the case of multiple shipments, each shipment must be accompanied or preceded by a Certificate of Compliance.
- B. The Certificate of Compliance must be accompanied by a certified copy of tests results or state that such test results are on file with the producer or manufacturer and must be furnished to OWNER on request. The certificate must give the information specified for samples in Section 01300, the name and address of the organization performing the tests, the date of the tests, and the quantity of material shipped.
- C. Materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The fact that material is used on the basis of a Certificate of

Compliance does not relieve CONTRACTOR of responsibility for incorporating material in the Work which conforms to the requirements of the Contract. Any such material not conforming to such requirements will be subject to rejection, whether in place or not.

- D. OWNER reserves the right to refuse to permit the use of certain materials on the basis of a Certificate of Compliance.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01500 CONSTRUCTION FACILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Construction facilities required for the construction of the permanent facilities specified under the Scope of Work of this Contract.
- B. Construction facilities include furnishing of all equipment, materials, tools, accessories, incidentals, labor, and performing all work for the installation of equipment and for construction of facilities, including their maintenance, operation, and removal, if required, at the completion of the Work under the Contract. The work under this section is incidental to the unit price bid item for excavation.

1.2 RELATED SECTIONS

- A. Section 01560 - Temporary Controls.

1.3 DEFINITION

- A. Construction facilities include, but are not be limited to, the following temporary offices, utilities, equipment, materials, facilities, areas, and services:
 - 1. Field Office;
 - 2. Parking Areas;
 - 3. Temporary Roads;
 - 4. Storage of Materials and Equipment;
 - 5. Construction Equipment;
 - 6. Temporary Sanitary Facilities;
 - 7. Temporary Electric Power;
 - 8. Temporary Water;
 - 9. First Aid Facilities; and
 - 10. Security.

1.4 REFERENCES

- A. Construct/install, maintain and operate construction facilities in accordance with the applicable federal, state, and local laws, rules, and regulations.

1.5 GENERAL REQUIREMENTS

- A. CONTRACTOR is responsible for furnishing, installing, constructing, operating, maintaining, removing and disposing of the construction related facilities, as specified in this Specification, and as required by OWNER for the completion of the Work under the Contract.
- B. Locate and maintain construction facilities in a clean, safe and sanitary condition at all times until completion of the Contract.
- C. The requirements specified herein are in addition to any requirements specified elsewhere in the Contract Documents. Construction facilities must meet the requirements for all-weather service.
- D. Minimize land disturbances related to the construction facilities to the greatest extent possible and restore land to the extent reasonable and practical, to its original contours by grading to provide positive drainage and by seeding the area to match with existing vegetation, or as specified elsewhere. All debris or other disturbances resulting from the CONTRACTOR's actions shall be removed by the CONTRACTOR to the satisfaction of the OWNER.
- E. Design and construct utilities to provide uninterrupted service.

1.6 DUST CONTROL

- A. Dust control is absolutely critical on this project. Due to residences and institutions in close proximity to this landfill, its operations are under public scrutiny at all times. Under Maricopa County's requirements for an Earthmoving Permit, the CONTRACTOR must place a sign for public viewing, with a telephone number that can be used by the public to make complaints to the Maricopa County Environmental Services Department. Such a call will result in a visit to the site by the County Dust Enforcement personnel and may result in a Notice of Violation. Notices of Violation are issued to the holder of the Earthmoving Permit (the CONTRACTOR), but they reflect unfavorably on the OWNER.
- B. The CONTRACTOR shall be prepared to spend as much time as required to keep dust controlled in accordance with regulatory requirements. The air contaminant emission at the work area shall not exceed 20 percent opacity during the contract period. Local regulatory requirements may be more stringent than the maximum allowable stated above. The CONTRACTOR is responsible for identifying and complying with all applicable regulatory levels. If dust clouds can be seen by the naked eye, rising from the operation, the CONTRACTOR is in violation of these specifications. If the CONTRACTOR fails to provide the necessary dust control,

to the ENGINEER's satisfaction, the project will be shut down, at the CONTRACTOR's expense, until the CONTRACTOR presents satisfactory evidence to the ENGINEER that they can continue work and prevent dust as required.

- C. The CONTRACTOR shall provide continuous positive methods and apply dust control water to prevent rising dust from construction operations, and provide positive means to prevent airborne dust from dispersing into the atmosphere. Chemical dust suppressant shall not be used. Dust suppressants shall be approved by the ENGINEER prior to use.

1.7 NOISE CONTROL

- A. CONTRACTOR's vehicles and equipment shall be such as to minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards and in no case will noise levels be permitted which interfere with the Work of the OWNER or others.

1.8 FIELD OFFICE

- A. CONTRACTOR may provide an office for their own staff and for the purpose of conducting meetings in support of the project. If provided, then the office shall have electricity and air conditioning sufficient to comfortably conduct productive meetings.
- B. The location of the office must be approved by OWNER.

1.9 PARKING AREAS

- A. OWNER will provide parking area for maintenance and delivery vehicles, the OWNER's, ENGINEER's, and CONTRACTOR's representatives, and other authorized visitors.

1.10 TEMPORARY ROADS

- A. General.
 - 1. Temporary roads are existing roads that are improved, or new roads constructed by CONTRACTOR for convenience of CONTRACTOR in the performance of the Work under the Contract.
 - 2. Coordinate construction with OWNER.
 - 3. If applicable, coordinate all road construction activities with local utilities, fire and police departments.
 - 4. Keep erosion to a minimum and maintain suitable grade and radii of curves to facilitate ease of movement of vehicles and equipment.

5. Furnish and install longitudinal and cross drainage facilities including, but not limited to, the ditches, structures, pipes and the like.
6. Clean equipment so that mud or dirt is not carried onto public roads. Clean any mud or dirt transported by equipment onto paved roads both on site and off site.

1.11 STORAGE OF MATERIALS AND EQUIPMENT

- A. Make arrangements for storage areas for materials and equipment. Locations and configurations of such facilities are subject to the acceptance of OWNER.
- B. Confine all operations, including storage of materials, to approved area. CONTRACTOR is liable for any and all damage caused during such use of property of the OWNER or others. Store materials in accordance with manufacturer's instructions when applicable.
- C. Store construction materials and equipment within boundaries of designated areas. Storage of gasoline or similar fuels must conform to federal, state, and local regulations and be limited to the areas approved for this purpose by the OWNER.

1.12 CONSTRUCTION EQUIPMENT

- A. Erect, equip, and maintain all construction equipment in accordance with all applicable statutes, laws, ordinances, rules, and regulations of OWNER or other authority having jurisdiction.
- B. Provide and maintain scaffolding, staging, runways, hoists, barricades, and similar equipment required for performance of the Contract. Provide hoists or similar equipment with operators and signals, as required.
- C. Provide, maintain, and remove upon completion of the Work, all temporary rigging, scaffolding, hoisting equipment, debris boxes, barricades around openings and excavations, fences, ladders, and all other temporary work, as required for all work hereunder unless otherwise directed by OWNER.
- D. Construction equipment and temporary work must conform to all the requirements of state, county, local authorities, OSHA, and underwriters which pertain to operation, safety, and fire hazard. Furnish and install all items necessary for conformity with such requirements, whether or not called for under separate sections of these Specifications.

1.13 TEMPORARY SANITARY FACILITIES

- A. Provide temporary sanitary facilities for use by all employees and persons engaged in the work, including subcontractors, their employees and authorized visitors.

- B. Sanitary facilities include enclosed chemical toilets and washing facilities. These facilities must meet the requirements of local public health standards. Open pit or trench latrines are not permitted.
- C. Locate sanitary facilities as approved by OWNER, and maintain in a sanitary condition during the entire course of the work.

1.14 TEMPORARY ELECTRIC POWER

- A. Provide and maintain during the course and progress of the Work all electrical power and wiring requirements to facilitate the work of all trades and services associated with the work. Make arrangements with the applicable serving utility company or provide generators and pay all charges for providing and maintaining electrical service including usage costs at the site unless otherwise approved by the OWNER. Furnish all temporary wiring, feeders, and connections.
- B. Routing of temporary conductors, including welding leads, must not create a safety hazard nor interfere with operation and maintenance of existing facilities.
- C. Install all temporary wiring in accordance with the applicable requirements of the local electrical code.
- D. Provide power and lighting to field office, and for Work as required, at no extra cost to OWNER.

1.15 TEMPORARY WATER

- A. Potable water is not available on-site. CONTRACTOR must supply their own potable water for employees. For construction water, refer to Section 01010.
- B. Make all arrangements for water needs from an off-site supplier for emergencies.

1.16 FIRST AID FACILITIES

- A. Provide first aid equipment and supplies to serve all CONTRACTOR personnel at the site.

1.17 SECURITY

- A. Make all necessary provisions and be responsible for the security of the Work and the site until final inspection and acceptance of the Work unless otherwise approved by the OWNER. In no case shall the OWNER be responsible for the security of the CONTRACTOR's supplies, property, or equipment.

1.18 SHUT-DOWN TIME OF SERVICES

- A. Do not disconnect or shut down any part of existing utilities and services, except by express permission of OWNER.

1.19 MAINTENANCE

- A. Maintain all construction facilities, utilities, temporary roads, services to office, and the like in good working condition as required by OWNER during the term of the Contract.

1.20 STATUS AT COMPLETION

- A. Upon completion of the Work, or prior thereto, when so required by OWNER:
1. Repair damage to roads caused by or resulting from the CONTRACTOR's work.
 2. Remove and dispose of all construction facilities including office trailers, and other facilities and utilities including all concrete foundations. Similarly, return all areas utilized for temporary facilities to substantially their near original, natural state, or as otherwise indicated or directed.
- B. Obliterate temporary roads built for CONTRACTOR's convenience and restore the area to near original conditions to the extent practicable unless otherwise approved by the OWNER.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01560 TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Temporary controls required during the term of the Contract for the protection of the environment and the health and safety of workers and general public.
- B. Furnishing all equipment, materials, tools, accessories, incidentals, and labor, and performing all work for the installation of equipment and construction of facilities, including their maintenance and operation during the term of the Contract.
- C. Temporary controls include, but are not limited, to the following:
 - 1. Dust Control
 - 2. Pollution Control
 - 3. Traffic and Safety Controls
- D. Perform work as specified in this Specification and as required by OWNER. Maintain equipment and accessories in clean, safe and sanitary condition at all times until completion of the Contract.

1.1 RELATED SECTIONS

- A. Section 01500 — Construction Facilities.

1.2 DUST CONTROL

- A. The CONTRACTOR shall obtain a Maricopa County Earthmoving Permit and a project sign shall be placed at a conspicuous place in the project area. The sign shall contain the following information:

CITY OF GLENDALE

GLENDALE LANDFILL

Responsible Project Individuals:

Contact, Joe CONTRACTOR (NNN-NNN-NNNN)

DUST COMPLAINTS?

Call the Maricopa County Environmental Services Department Complaint
Phone Line at: (602) 506-6616

- B. The sign shall be a minimum of 4 feet wide and 4 feet high, white with black 4-inch high block letters, on $\frac{3}{4}$ -inch smooth faced exterior plywood. The CONTRACTOR shall maintain the sign in its original condition for the length of the project.
1. Copies of these permits and notices must be provided to the City's Project Manager prior to starting the permitted activity.
 2. **CONTRACTOR RESPONSIBILITY** – The CONTRACTOR will be responsible for all permits and review fees. The CONTRACTOR shall arrange for construction water. The CONTRACTOR is specifically reminded of the need to obtain the necessary environmental permits or file the necessary environmental notices. This provision does not constitute an assumption by the City of an obligation of any kind for violation of said permit or notice requirements.
 3. Dust control consists of transporting water, furnishing required equipment, additives, accessories and incidentals, carrying out proper and efficient measures wherever and as often as necessary to reduce dust nuisance, and to prevent dust originating from construction operations throughout the duration of the Contract, as required by OWNER.
 4. Apply water by means of pressure-type distributors or pipelines equipped with a spray system or hoses with nozzles that will insure a uniform application of water.
 5. Provide all equipment used for the application of water with a positive means of shut-off.
 6. Unless otherwise permitted by OWNER or unless all the water is applied by means of pipelines, provide at least one operations mobile unit with a minimum capacity of 3,500 gallons for applying water at the site during construction.

1.3 POLLUTION CONTROL

- A. **Erosion Control:** Control sediment transport on sloped surfaces. Submit a NOI as required by AZDPES regulations. CONTRACTOR shall maintain and implement a Storm Water Pollution Prevention Plan (SWPPP) which complies with all requirements of the applicable stormwater AZDPES permit for construction activities.
- B. **Pollution of Waterways:** Perform work using methods that prevent entrance or accidental spillage of solid or liquid matter, contaminants, debris and other objectionable pollutants and wastes into streams, watercourses, flowing or dry, and underground water sources. Such pollutants and wastes will include, but will

not be restricted to refuse, earth and earth products, garbage, cement, concrete, sewage effluent, industrial waste, radioactive substances, hazardous chemicals, oil and other petroleum products, aggregate processing tailings, and mineral salts. Dispose of pollutants and wastes in accordance with applicable permit provisions or in a manner acceptable to and approved by the OWNER.

C. Storage and Disposal of Petroleum Products:

1. Petroleum products covered by this section include gasoline, diesel fuel, lubricants, heating oils, and refined and used oil. During project construction, store all petroleum products in such a way as to prevent contamination of all ground and surface waters.
2. Lubricating oil may be brought into the project area in steel drums or other means, as CONTRACTOR elects. Store used lubricating oil in steel drums, or other approved means, and return to the supplier for disposal. Do not burn or otherwise dispose of at the project area.
3. If the total capacity volume of stored petroleum products is greater than 1,320 gallons in total and these products are stored above ground, CONTRACTOR shall prepare and adhere to a Spill Prevention Control and Countermeasure Plan (SPCC Plan) in accordance with applicable EPA and other state regulations.

- D. All chemicals stored on-site must be appropriately labeled as to its content and hazard rating.

1.4 TRAFFIC AND SAFETY CONTROLS

- A. Use existing haul roads between excavation location and stockpile location. Avoid crossing roads used by the public as part of landfill operations.
- B. Post construction areas and roads with traffic control signs or devices used for protection of workmen, the public and equipment. The signs or devices must conform to the United States Department of Transportation, Federal Highway Administration, Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways.
- C. Remove signs or traffic control devices as soon as they have served their purpose. It is particularly important to remove any markings on road surfaces which under conditions of poor visibility could cause a driver to turn off the road or into traffic moving in the opposite direction.
- D. Barricades for protection of employees must conform to the portions of the U.S. Department of Transportation, Federal Highway Administration, Manual on Uniform Traffic Control Devices for Streets and Highways, relating to barricades.

- E. Material Haul on Public Roads: Follow all requirements stated in the permits for using public roads for hauling materials to the site.
- F. Provide flag persons, properly equipped with International Orange or High-Visibility Yellow protective clothing and flags, as necessary, to direct or divert pedestrian or vehicular traffic.
- G. Construct and maintain fences, planking, barricades, lights, shoring, and warning signs as required by local authorities, federal and state safety ordinances, and as required to protect OWNER's property from injury or loss, and as necessary for the protection of the public, and provide walks around any obstructions made in a public place for carrying on the Work covered in this Contract. Leave all such protection in place and maintained until removal is authorized.
- H. Guard and protect all workers, pedestrians, and the public from excavations, blasting operations, construction equipment, all obstructions, and other dangerous items or areas by means of adequate railings, guard rails, temporary walks, barricades, warning signs, sirens, directional signs, overhead protection, planking, decking, danger lights, etc.

1.5 MAINTENANCE

- A. Maintain all temporary controls in good working conditions during the term of the Contract for the safe and efficient transport of equipment and supplies, and for construction of permanent works, as required by OWNER.

1.6 STATUS AT COMPLETION

- A. Upon completion of the Work, or prior thereto, when so required by OWNER, remove all temporary controls and restore disturbed areas as required by OWNER.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01600 MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Products.
- B. Transportation and handling.
- C. Storage and protection.

1.2 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.
- B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
- C. Provide interchangeable components of the same manufacturer, for similar components.

1.3 TRANSPORTATION AND HANDLING

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, and/or damage.
- D. Any damaged materials, whether as originally shipped or as a result of handling, shall be replaced at no additional cost to the OWNER and with no extension of contract time.

1.4 STORAGE AND PROTECTION

- A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.

- B. For exterior storage of fabricated products, place aboveground on sloped supports, if in accord with manufacturer's handling instructions.
- C. Place delivered GCL material rolls on storage pad without damaging the protective wrap around each roll and cover with a CONTRACTOR-supplied watertight tarp to provide sufficient protection from weather conditions including rain and wind. Ballast tarp with sandbags or approved equal to prevent wind uplift.
- D. Provide off-site storage and protection when site does not permit on-site storage or protection.
- E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
- F. Store loose granular materials on solid flat surfaces in a well-drained area.
- G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- H. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.
- I. Any products that become damaged during storage shall be replaced at no additional cost to the OWNER and with no extension of contract time.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01630 PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section describes CONTRACTOR procedures for securing approval of proposed product options and substitutions.

1.2 PRODUCT OPTIONS

- A. The Contract is based on standards of quality established in the Contract Documents.
 - 1. In agreeing to the terms and conditions of the Contract, the CONTRACTOR has accepted a responsibility to verify that the specified products will be available and to place orders for all required materials in such a timely manner as is needed to meet the agreed upon construction schedule.
 - 2. The OWNER does not agree to the substitution of materials or methods called for in the Contract Documents, except as they may specifically otherwise state in writing.
- B. Materials and/or methods specified by name:
 - 1. Where materials and/or methods are specified by naming one single manufacturer and/or model number, without stating that equal products will be considered, only the material and/or method named is approved for incorporation into the Work.
 - 2. Should the CONTRACTOR demonstrate to the approval of the OWNER that a specified material or method was ordered in a timely manner and will not be available in time for incorporation into this Work, the CONTRACTOR shall submit to the OWNER such data on proposed substitute materials and/or methods as are needed to help the OWNER determine suitability of the proposed substitution.
- C. Where materials and/or methods are specified by name and/or model number, followed by the words "or an equal approved in advance by the OWNER" or similar wording:
 - 1. The material and/or method specified by name establishes the required standard of quality;

2. Materials and/or methods proposed by the CONTRACTOR to be used in lieu of materials and/or methods so specified by name must in all ways be equal or exceed the qualities of the named materials and/or methods;
- D. The following products do not require further approval except for interface within the Work:
1. Products specified by reference to standard specifications such as ASTM International (ASTM) and similar standards;
 2. Products specified by manufacturer's name and catalog model number.
- E. Where the phrase "or equal," or "or equal as approved by the OWNER," occurs in the Contract Documents, do not assume that the materials, equipment, or methods will be approved as equal unless the item has been specifically so approved in writing for this Work by the OWNER.
- F. The decision of the OWNER shall be final.

1.3 DELAYS

- A. Delays in construction arising by virtue of the non-availability of a specified material and/or method will not be considered by the OWNER as justifying of an extension of the agreed Time of Completion.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01700 CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparation, maintenance, completion, and submission of all project record drawings, specifications and related documents.

1.2 RELATED SECTIONS

- A. Section 01300 — Submittals.
- B. Section 01560 — Temporary Controls.

1.3 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintain at the job site one copy of the following Project or Contract Documents for record purposes:
 - 1. Drawings;
 - 2. Specifications;
 - 3. Addenda;
 - 4. Change Orders and Work Change Directives;
 - 5. Field Orders;
 - 6. Reviewed Shop Drawings;
 - 7. Clarifications or Explanatory Drawings and Specifications;
 - 8. Inspection Reports;
 - 9. Laboratory Test Records; and
 - 10. Field Test Records.
- B. Store documents used for record purposes in the field office or other approved location, apart from documents used for construction.
- C. File documents in accordance with the Construction Specification sections.
- D. Maintain documents in clean, dry, legible condition.

- E. Do not use record documents for construction purposes.
- F. Make documents available at all times for inspection by the OWNER and their authorized representatives.

1.4 RECORD DRAWINGS

A. Project Drawings:

1. Maintain record drawings of all work and subcontracts continuously as the job progresses. Keep a separate set of prints, for this purpose only and at the job site at all times.
2. Keep these drawings up-to-date.
3. During the course of construction identify on the drawings, the actual locations for all runs of mechanical and electrical work, including all site utilities and services installed underground or otherwise concealed. Show deviations from the drawings in detail. Locate all main runs, whether piping, or drain lines by dimension and elevation.
4. During the course of the construction record as-built information outlined in Section 01052.
5. Deliver the final and record set of "as-built" drawings to the OWNER prior to the OWNER's acceptance of the Project. The final set of as-built drawings shall be sealed by the CONTRACTOR'S surveyor and provided to the OWNER in hard copy or PDF format and in an electronic (AutoCAD .dwg) format.

B. Addenda and Change Orders:

1. Incorporate changes to the Drawings affected by Addenda, Change Orders, or Field Orders. Identify change by Addendum, Change Order, or Field Order number and effective date.
2. When revised drawings are issued as the basis of or along with addenda or change order, incorporate these revised drawings into the record set with appropriate annotation.

C. Shop Drawings:

1. Collect and maintain one complete set of reviewed shop drawings, including manufacturer's printed catalog cuts and data, for record purposes.
2. Shop drawings must be filed and maintained separate from project drawings. Shop drawings must be filed in 9 inch by 12 inch file

folders to the greatest extent possible and be indexed in accordance with the format as herein specified.

1.5 RECORD SPECIFICATIONS

A. Project Specifications:

1. Information, changes, and notes must be recorded in the specifications in blank areas, such as page margins or the backs of opposite pages, or on separate sheets inserted in the binder. All such information, changes, and notes must be recorded in red.
2. In each section, in an appropriate location, record the manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
3. The record specifications book must be complete and include all documents and forms listed under Bidding Requirements, Contract Forms, Contract Conditions, and Specifications.

B. Addenda, Change Orders, Work Change Directives, and Field Orders

1. All Addenda, Change Orders, Work Change Directives, and Field Orders must be incorporated into the front of the specifications book in reverse chronological order. Use appropriate page dividers to identify addenda, change orders, and to separate addenda from the specifications.
2. In addition, the changes to the specifications effected by Addenda, Change Order, Work Change Directives, or Field Order must be annotated on the affected page or pages of the specifications, or adjacent thereto.

1.6 SUBMISSION OF DOCUMENTS

- A. At completion of the project, and before submitting invoice for final payment, deliver record documents to OWNER.
- B. Record documents must be delivered neatly and efficiently packaged.
- C. Submission of record documents must be accompanied with a transmittal letter, in duplicate, containing the following information:
 1. Date of submission.
 2. Project title and number.
 3. CONTRACTOR's name and address.

4. Title and number of each record document. (Shop drawings may be grouped in basic categories or divisions of work.)
5. Certification that each document as submitted is complete and accurate.
6. Signature of CONTRACTOR or their authorized representative.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

DIVISION 2

SITEWORK

SECTION 02100 CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Clearing and stripping vegetation, grass and other organic material from project construction areas.
- B. Stockpile stripped material.

1.2 RELATED SECTIONS

- A. Section 02221 – Excavating and Stockpiling.
- B. Section 02222 – Earth Fills.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PREPARATION

- A. OWNER will provide CONTRACTOR with a copy of the approved landscaping plans for the GLF development.
- B. Verify that any existing plant life designated to remain is tagged and identified.
- C. Verify plants to be salvaged are tagged or identified.

3.2 PROTECTION

- A. Protect survey benchmarks from damage or displacement.
- B. Protect existing utilities in the work area.

3.3 STRIPPING FOR LANDFILL CELL

- A. Strip vegetation, roots, organic soils, and other deleterious materials prior to excavating.
- B. Strip to a maximum depth of 6 inches below existing ground surface.

- C. CONTRACTOR to haul all stripped material to the landfill working face and placed for disposal unless approved otherwise by the OWNER.

END OF SECTION

SECTION 02221 EXCAVATING AND STOCKPILING

PART 1 GENERAL

1.1 WORK INCLUDED

- A. The CONTRACTOR shall furnish all labor, materials, tools, supervision, and equipment necessary for excavating to the lines and grades shown on the Drawings and as specified herein.
- B. The CONTRACTOR shall construct all NC excavation as shown on the Drawings.
- C. CONTRACTOR shall transport all excavated materials and stockpile these materials at the stockpile location area as indicated on Drawings, or as designated by OWNER.

1.2 RELATED SECTIONS

- A. Section 02222 – Earth Fills.
- B. Section 02223 – Subgrade Preparation.

PART 2 PRODUCTS

2.1 ENGINEERED FILL

- A. Soil meeting requirements of Section 02222, Part 2.1.

2.2 GENERAL FILL

- A. Soil meeting requirements of Section 02222, Part 2.2.

2.3 OPERATIONS LAYER

- A. Soil meeting requirements of Section 02222, Part 2.3.

2.4 ANCHOR TRENCH BACKFILL

- A. Soil meeting requirements of Section 02222, Part 2.4.

2.5 SURPLUS SOILS

- A. Remaining soils excavated.

PART 3 EXECUTION

3.1 PREPARATION

- A. Establish required lines, levels, contours, and datum by construction staking.
- B. Notify utility company to locate utilities, if applicable.
- C. Provide for dust control including applicable permits.
- D. Protect benchmarks and fences from excavation equipment and vehicular traffic.
- E. Provide for dewatering as necessary for finish excavation and place fill.
- F. Note that topography shown on Drawings may differ from topography at time of construction. A pre-construction survey shall be performed by the CONTRACTOR and provided to the OWNER to document site conditions prior to starting work.

3.2 LANDFILL CELL AREA

- A. Mass excavation of the NC area has been previously performed under separate contract. Excavation work under this contract is finish excavation necessary to establish final liner subgrades. Excavate soil as required to the lines, grades, and elevations to construct the landfill cell subgrade. Excavate sufficient volume of Phase 1 termination berm and sideslope operations soil to accomplish tie in to all layers (drainage layer (as applicable), geomembrane, and GCL) as indicated on the Drawings.
- B. Machine grade slopes and base of landfill cell to design grades.
 - 1. Grade top perimeter of excavation to prevent surface water from draining into excavation.
 - 2. Remove lumped subsoil, boulders, and rock from completed subgrade elevation as necessary to comply with Section 02779.3.1 of these specifications.
 - 3. Notify OWNER of unexpected subsurface conditions such as significant sand lenses at or near subgrade surface and discontinue affected work in area until notified to resume work.
 - 4. Correct areas over-excavated by placing engineered fill per Section 02222, and as approved by the OWNER.

5. Place engineered fill per Section 02222.
6. Selectively excavate engineered fill, operations layer, and anchor trench backfill and stockpile near the project area.
7. Haul remaining material, surplus soils, to stockpile(s) designated on the Drawings or approved by OWNER.

3.3 SOIL STOCKPILING

- A. Excavated soil not used for other fill operations shall be placed into the existing stockpile in the northern portion of the North Cell.
- B. Coordinate selective soil stockpiling with OWNER.
 1. Place soil such that maximum slope is 3H:1V, and minimum slope is 5 percent.
 2. Placement and mass configuration of soil stockpiles shall be performed at the direction of the OWNER.
 3. Provide uniform final graded surface for the soil stockpile(s).
 4. Provide erosion/sedimentation controls around perimeter of stockpile per requirements of the Stormwater Pollution Prevention Plan (SWPPP).
 5. Outboard slopes shall be continuously track-walked and maintained in good appearance. Grouser marks should be used to minimize erosion.

3.4 CONTRACT ALLOWANCE

- A. Contract allowance items are provided for the purpose of encumbering funds to cover the costs of possible contract amendment work. No work shall be conducted under this contract allowance without prior approval by the ENGINEER. The amount, if any, of the allowance item is determined by the ENGINEER and is not subject to individual bid pricing. All bidders shall incorporate the amount pre-entered in the bid proposal and shall reflect the same in the total amount bid for this project.
- B. This allowance item provides an estimated funding to cover unforeseen changes that may be encountered and corresponding extra work needed to complete the contract per plan. Unforeseen extra work, if any, shall be in accordance with the Contract Amendment section of the General Conditions.

It shall be understood that this allowance item in an estimate only and is based on contract amendment history of similar projects. It shall not be utilized without an approved contract amendment. It is further understood that authorized extra work, if any, may be less than the allowance item. The CONTRACTOR, by submittal of his bid, acknowledges that the total bid and individual items were prepared without anticipation of use of the contract allowance.

END OF SECTION

SECTION 02222 EARTH FILLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Engineered Fill.
- B. General Fill.
- C. Operations Layer.
- D. Backfill material for geosynthetics anchor trench.
 - 1. LCRS Trench Gravel

1.2 RELATED SECTIONS

- A. Section 02221 – Excavating and Stockpiling.
- B. Section 02223 –Subgrade Preparation.

1.3 REFERENCES

- A. Latest ASTM Standards or other recognized agency standards at the time construction documents are issued for the following items:
 - 1. Soil density, Sand Cone Method;
 - 2. Compaction Characteristics of Soil;
 - 3. Water content of Soil Aggregate Mixtures;
 - 4. Permeability;
 - 5. Soil Classification;
 - 6. Soil Moisture and Density by Nuclear Method;
 - 7. Particle Size Analysis of Soil;
 - 8. Liquid Limit, Plastic Limit, and Plasticity Index; and
 - 9. Unified Soil Classification System (USCS).

PART 2 PRODUCTS

2.1 ENGINEERED FILL

- A. Predominantly cohesionless or low-plastic soil obtained from on-site excavations or stockpiles.
- B. Free of organic material.
- C. Maximum particle dimension: 3 inches, 1 inch for near surface material within 6 inches of the top of subgrade.
- D. Free of excessive moisture.

2.2 GENERAL FILL

- A. Predominantly cohesionless or low-plastic soil obtained from on-site excavations or stockpiles.
- B. Free of organic material.
- C. Maximum particle dimension: 3 inches
- D. Free of excessive moisture.

2.3 OPERATIONS LAYER

- A. Operations layer material shall be obtained from on-site sources identified by the OWNER.
- B. Operations layer shall meet the following requirements:
 - 1. Maximum particle size of 1 inch.
 - 2. If placed immediately above geosynthetic liner materials on the liner side slopes and benches, particles larger than ¼ inch shall be sub-rounded to rounded, and free of sharp edges that could damage underlying geomembrane liner.

2.4 ANCHOR TRENCH BACKFILL

- A. Predominantly cohesionless or low-plastic soil obtained from on-site excavations.
- B. Free of organic material.
- C. Maximum particle size 1 inch.

2.5 LCRS GRAVEL

- A. Free of organic or other deleterious material.
- B. Having a hydraulic conductivity of greater than or equal to 1 cm/sec when placed in accordance with this section.
- C. Material greater than ½ inch in largest dimension must be rounded to sub-angular as defined in ASTM D2488.
- D. Meeting the following gradation:

TABLE 02222-1 LCRS GRAVEL MATERIAL REQUIREMENTS	
U.S. Sieve Size	Percent Passing
2-inch	100
1-1/2-inch	85-95
1-inch	50-85
3/4-inch	0 – 20
1/2 inch	0 – 10
#4	0 – 3
#40	0 – 3
#200	0 – 2

- E. Gradation requirements are an index test. Gradation of materials below the 1-inch dimension and above the #200 sieve can be modified if the hydraulic conductivity requirements are met. If used around LCRS piping, rock must be of a gradation such that D⁵⁰ size is greater than ½-inch.
- F. Using the following testing frequencies:

TABLE 02222-2
MATERIAL EVALUATION OF GRAVEL DRAINAGE MATERIAL
SOURCE EVALUATION TESTING FREQUENCIES

Test	Test Method	Frequency
Particle Size (Without Hydrometer)	ASTM D 422	1 Per 2,500 cy
Permeability Test $>1 \times 10^{-2}$ cm/sec	ASTM D 2434	1 Per 2,500 cy
Notes: ¹ Material changes, suspect areas, or other field conditions may require the engineer to increase testing and sampling frequencies.		

PART 3 EXECUTION

3.1 ENGINEERED FILL PREPARATION

- A. All subgrade for engineered fill shall be prepared in accordance with the requirements of Section 02223, 3.1.
- B. Begin engineered fill placement only when underlying subgrade has been accepted by the OWNER.
- C. Prior to placement of engineered fill verify that no substantial thickness of loose or uncompacted soil is present in the fill area.

3.2 ENGINEERED FILL PLACEMENT

- A. Place Engineered Fill to the lines and grades shown on the Drawings.
- B. Place in loose lift thickness not exceeding 8 inches.
- C. Unless a more stringent compaction requirement is specified on the drawings, compact each lift to a minimum of 95 percent relative compaction at a moisture content from 4 percent below to 4 percent above optimum as determined by ASTM D 698. Completed lifts of fill cannot yield under equipment loads.
- D. Grade final surface to a vertical tolerance of 0.1 foot.

3.3 GENERAL FILL PREPARATION

- A. Begin General Fill placement only when underlying subgrade has been accepted by the OWNER.
- B. Prior to placement of General Fill, verify that no substantial thickness of loose or uncompacted soil is present in the fill area.

3.4 GENERAL FILL PLACEMENT

- A. Place General Fill to the lines and grades shown on the Drawings.
- B. Place in loose lift thickness not exceeding 8 inches.
- C. Compact each lift to a minimum of 90 percent relative compaction at a moisture content from 4 percent below to 4 percent above optimum as determined by ASTM D 698. Completed lifts of fill cannot yield under equipment loads.
- D. Grade final surface to a vertical tolerance of 0.1 foot.

3.7 OPERATIONS LAYER PREPARATION

- A. Verify the liner and leachate collection layer is installed and all CQC and CQA documentation verifies installation in accordance with these specifications.
- B. Verify borrow source meets specified requirements of this section and has been approved for use by the OWNER.

3.8 OPERATIONS LAYER PLACEMENT

- A. Backfill and compact geosynthetics anchor trenches prior to placing operations layer on side slopes.
- B. Do not put any equipment on the operations layer unless there is a minimum of 12 inches of material covering the geomembrane. Minimum thickness may be greater depending on the associated ground pressure for the specified placement equipment as defined in Table 02222-3, below.
- C. Place in a single lift to the thickness indicated on the drawings.
- D. Place and grade material up slope, do not push material downslope.
- E. Use as few passes as possible. There are no compaction requirements.
- F. Place without damaging underlying installations.

- G. CONTRACTOR shall provide spotter to observe operations layer placement operation. This spotter shall ensure that the placement operation is not inducing folds or other damage in the underlying geosynthetics and that any oversized particles in the operations layer material are picked out and hauled to an appropriate stockpile location.
- H. Do not exceed allowable ground pressure as specified below:

TABLE 02222-3 MAX. ALLOWABLE GROUND PRESSURE OVER GEOSYNTHETICS	
Allowable Equipment Ground Pressure (psi)	Thickness of Material Above Geomembrane (in.)
<5	12
<10	18
<20	24
>20	36

psi = Pounds per square inch; in = Inch

- I. Construct haul routes over geomembrane having a minimum material thickness of 24 to 36 inches. The 24-inch minimum coverage includes the initial material dumping and spreading areas, haul roads and stockpile areas that cover the geomembrane and are utilized by rubber-tired vehicles.
- J. Deploy soil ahead of the equipment in a manner that does not create folds or excessive stresses on the liner components, and the maximum equipment ground pressure does not exceed the values shown in Table 02222-3 above.
- K. Maximum equipment speed over operations layer: 5 miles per hour.
- L. Do not make sharp turns when placing operations layer.

3.9 BACKFILL FOR ANCHOR TRENCH

- A. Begin only when geosynthetic installations have been completed in accordance with deployment and seaming criteria.
- B. Place earthfill to the lines and grades shown on the Drawings.
- C. Place in loose lift thickness not exceeding 12 inches; no scarification is required.
- D. Compact each lift to a minimum of 95 percent relative compaction as determined by wheel rolling with rubber-tired equipment, or similar.
- E. Do not damage geosynthetic installation.
- F. Grade final surface to a vertical tolerance of plus or minus 0.10 feet.

3.10 PLACEMENT OF LCRS TRENCH GRAVEL

- A. Place only when underlying geosynthetic installations are complete in accordance with Specifications.
- B. Prior to beginning material placement, demonstrate that gravel layer placement techniques will not damage the underlying geosynthetic materials. Demonstrate this by constructing test fall over geosynthetics in an area not part of final construction.
- C. Place to the lines, grades and dimensions indicated on the Drawings.
- D. Place in a single lift without damaging underlying geosynthetics.
- E. Construct haul routes over geomembrane having a minimum material thickness of 24 to 36 inches. The 24-inch minimum coverage includes the initial material dumping and spreading areas, haul roads and stockpile areas that cover the geomembrane and are utilized by rubber-tired vehicles.
- F. When placing gravel layer to its final thickness over the geomembrane use low ground pressure track-mounted equipment with a maximum allowable ground pressure equal to or less than a LGP D-6 dozer.
- G. Verify thickness of the gravel layer on a 50-foot grid pattern using survey control or soft plastic cones (i.e., traffic cones) marked with graduated depth increments.
- H. Grading tolerance for gravel layers:
 - 1. Line: Plus or minus 1.0 feet.

2. Grade: Plus 0.2 feet to minus 0.0 feet

- I. Do not put any equipment on the gravel layer unless there is a minimum of 12 inches of gravel covering the geomembrane. A larger thickness may be required depending on the ground pressure of the equipment as indicated on Table 02222-3, above.
- J. Maximum equipment speed over gravel layer: 5 miles per hour.
- K. Do not make sharp turns when placing the gravel layer.

3.11 FIELD QUALITY ASSURANCE (BY OWNER)

- A. The facility's Construction Quality Assurance Plan "CQA Plan".
- B. The OWNER will collect and test samples of soil materials covered in this Section in accordance with the procedures outlined in the CQA Plan. In-place density and moisture content will be measured during construction by the OWNER in accordance with the procedures outlined in the CQA Plan.

END OF SECTION

SECTION 02223 SUBGRADE PREPARATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Final grading and compaction of finished subgrade in preparation for Geosynthetic Clay Layer (GCL) placement.

1.2 RELATED SECTIONS

- A. Section 02221 – Excavating and Stockpiling.
- B. Section 02222 – Earth Fills.
- C. Section 02779 – GCL.

1.3 REFERENCES

- A. Latest ASTM Standards or other recognized agency standards at the time construction documents are issued for the following items:
 - 1. Compaction Characteristics of Soil;
 - 2. Density of Soil and Soil-Aggregate in Place;
 - 3. Water Content of Soil and Rock in Place;
- B. Water (Moisture) Content of Soil and Rock;
- C. Density and Unit Weight of Soil in Place, Sand-Cone Method; and
- D. Density of Soil in Place by the Drive-Cylinder Method.

PART 2 PRODUCTS

2.1 ENGINEERED FILL

- A. See Section 02222.

PART 3 EXECUTION

3.1 EXAMINATION

1. Verify that excavation is complete and in compliance with slopes and dimensions shown on the Drawings.
2. If excavation of unsuitable material is required prior to replacement with engineered fill, coordinate excavation with OWNER.
3. Verify surface is free of ponded water before fill is placed.
4. Scarify and recompact upper 6-inches of subgrade to 95% minimum relative compaction as determined by ASTM D 698.

3.2 FINISHED GRADING AND COMPACTION OF SUBGRADE

A. Liner Subgrade Soils

1. Moisture condition engineered fills or liner subgrade soils from 2 percent below to 2 percent over optimum moisture, then compact to a minimum of 95 percent relative compaction as determined by ASTM D 698.
2. Finish grade compacted within a vertical tolerance of plus or minus 0.1 feet of design grade. Bench grades shall be within plus or minus 0.1 feet of design grade.
3. Subgrade shall be rolled with a smooth-drummed compactor to a smooth and level surface.
4. Surface shall be free of organics or other deleterious material.
5. Fill voids and cracks.
6. Ruts shall be limited to 1-inch maximum depth.
7. The CONTRACTOR may use a scraper or other heavy equipment to verify compaction of subgrade materials by proof-rolling. The subgrade surface will be accepted by the ENGINEER if the specified compaction is obtained, and no materials greater than one inch in dimension are visible. It should be noted that areas of the subgrade may be unsuitable and require removal and replacement with engineered fill. No additional compensation will be provided by the OWNER for the removal and replacement of unsuitable subgrade materials.

8. Ultimately, CONTRACTOR shall provide a subgrade surface that warrants preparation of a subgrade acceptance certification by the geosynthetics liner installer and CQA Monitor. Certification may be issued in phases to facilitate project completion.

3.3 FIELD QUALITY ASSURANCE (BY OWNER)

- A. The OWNER will collect samples of subgrade materials to determine the material's optimum moisture content and maximum density (ASTM D 698).
- B. The OWNER will measure in-place density and moisture content of the subgrade (by one or more of the following methods: ASTM D 2922, ASTM D 1556, ASTM D 2216, and ASTM D 3017), at the frequencies outlined in the CQA Plan.
- C. For liner subgrade excavated into native soil (i.e., not including filled areas) conditions only, if in the opinion of the CQA Monitor the subgrade is comprised of unyielding, firm soils, the testing requirements listed above in paragraph (B) may be replaced with the following field verification test:
 1. Following smooth drum compaction of the subgrade, the CQA Monitor and OWNER shall observe the CONTRACTOR "proof-rolling" the subgrade with a fully-loaded scraper. If the subgrade appears firm and no "pumping" or soft spots areas are observed, the CQA Monitor can certify that the subgrade soils are approved for placement.
- D. CONTRACTOR shall cooperate fully with the OWNER in performing compaction control tests. Include costs for assistance in unit or lump sum prices.

END OF SECTION

SECTION 02224
TRENCHING, BACKFILLING, & COMPACTING
PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Backfilling and compaction.

1.2 RELATED SECTIONS

- A. Section 02221 – Excavating and Stockpiling.
- B. Section 02222 – Earth Fills.

1.3 QUALITY ASSURANCE

- A. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.
- B. Comply with all requirements of governmental agencies having jurisdiction, particularly as it relates to trench safety systems.

1.4 REFERENCES

- A. OSHA Safety Requirements for Trenching and Shoring.
- B. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³)(600 kN-m/m³).
- C. ASTM D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
- D. ASTM D 2937 – Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
- E. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- F. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- G. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

1.5 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.

1.6 FIELD MEASUREMENTS

- A. Verify that survey benchmarks, control points, and intended elevations for the Work are as shown on drawings.

1.7 COORDINATION

- A. Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 - PRODUCTS

2.1 BACKFILL AND BEDDING MATERIALS

- A. Trench backfill: Engineered Fill, as specified in Section 02222. Backfill material is subject to the acceptance of the OWNER, and is that material removed from excavations or imported from on-site borrow areas, and is soil free from roots and other deleterious matter.
- B. Pipe Bedding: Material meeting the requirement of MAG Standard Specification Section 702.2.1, Table 702-1 for aggregate base course (ABC).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISHED ELEVATIONS AND LINES

- A. Comply with pertinent provisions of the Drawings and Specifications.

3.3 PROCEDURES

- A. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.
- B. Maintain access to adjacent areas at all times.

3.4 PROTECTION OF PERSONS AND PROPERTY

- A. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or within public access.

- B. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
- C. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.

3.5 DEWATERING

- A. Remove all water, including storm water, encountered during trench and sub-structure work to an approved location by pumps, drains, and other approved methods.
- B. Keep trenches and site construction area free from water.

3.6 TRENCHING

- A. Comply with pertinent provisions of this Section.
- B. Provide sheeting and shoring necessary for protection of the Work and for the safety of personnel. Provide shoring where required for safe entry.
- C. Prior to backfilling, remove all sheeting.
- D. Do not permit sheeting to remain in the trenches except when, in the opinion of the ENGINEER, field conditions or the type of sheeting or methods of construction such as use of concrete bedding are such as to make removal of sheeting impracticable. In such cases, the OWNER may permit portions of sheeting to be cut off and remain in the trench.

3.7 EXCAVATING FOR APPURTENANCES

- A. Over excavation beyond such appurtenances that has not been directed will be considered unauthorized. Fill with sand, gravel, or lean concrete as directed by the OWNER, and at no additional cost to the OWNER.
- B. Trench to the minimum width necessary for proper installation of the utility, with sides as nearly vertical as possible. Accurately grade the bottom to provide uniform bearing for the utility.

3.8 DEPRESSIONS

- A. Except where rock is encountered, do not excavate below the depth indicated or specified.
- B. Where rock is encountered, excavate rock to a minimum overdepth of 4 inches below the trench depth indicated or specified.

3.9 COVER

- A. Provide minimum trench depth to maintain a minimum cover over the top of the installed item below the finish grade or subgrade.

3.10 BEDDING

- A. Provide a minimum 4-inch bedding, as approved by the OWNER, under pipe, or as shown on plans. Hand grade the bedding to proper grade ahead of pipe laying. Provide a firm, unyielding support along the entire pipe length.

3.11 BACKFILLING

- A. Place backfill material in layers not greater than 6 inches thick and in a manner that equalizes pressures on the structure and minimizes stresses. Moisture condition material to achieve 0 to plus 4 percent of optimum moisture content as determined by the proctor test method (ASTM D698). Thoroughly tamp and compact all trench backfill with machine or pneumatic operated tampers of a size and type that will obtain the required density.
- B. Reopen trenches that have been improperly backfilled, to a depth as required for proper compaction. Refill and compact as specified, or otherwise correct to the approval of the ENGINEER.
- C. Do not allow or cause any of the Work performed or installed to be covered up or enclosed by work of this Section prior to required inspections, tests, and approvals.
- D. Should any of the Work be so enclosed or covered up before it has been approved, uncover all such Work and, after approvals have been made, refill and compact as specified, all at no additional cost to the OWNER.
- E. Backfill the pipe zone with material hand placed simultaneously on both sides of the pipe for the full trench width and hand tamp with approved tamping sticks supplemented by "walking in" and slicing with a shovel.
- F. Consolidation of backfill by jetting is prohibited.

3.12 FIELD QUALITY CONTROL

- A. The OWNER will inspect open cuts and trenches before installation of utilities.
- B. Assure that trenches are not backfilled until all tests have been completed.
- C. Check backfilling for proper layer thickness and compaction.

- D. Verify that test results conform to the specified requirements, and that sufficient tests are performed.
- E. Assure that defective work is removed and properly replaced.

3.13 FIELD QUALITY ASSURANCE

- A. The OWNER will determine optimum moisture content and maximum density for trench backfill. Maximum dry density and optimum moisture will be determined in accordance with ASTM D698.
- B. The OWNER will determine in-place density and moisture content by one or more of the following methods: ASTM D2937, ASTM D2922, and ASTM D3017.
- C. Cooperate fully with the OWNER in performing compaction control tests. Include costs for assistance in unit or lump sum prices.

END OF SECTION

SECTION 02225 GEOCOMPOSITE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Placement of single-sided geocomposite as part of leachate collection system and liner system for the landfill.

1.2 RELATED SECTIONS

- A. Section 02222 – Earth Fills.
- B. Section 02711 – Polyethylene Pipe.
- C. Section 02771 – Geotextile.
- D. Section 02778 – Geomembrane.

1.3 REFERENCES

Latest ASTM International (ASTM) Standards or other recognized agency standards at the time construction documents are issued for the following items:

- A. ASTM D5199– Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
- B. ASTM D792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics
- C. ASTM D1505 – Standard Test Method for Density of Plastics by the Density-Gradient Technique
- D. ASTM D1603 – Standard Test Method for Carbon Black in Olefin Plastics
- E. ASTM D5261 - Standard Test Method for Measuring Mass per Unit Area of Geotextiles
- F. ASTM 7005 - Standard Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposites
- G. ASTM D4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus
- H. ASTM D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity
- I. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

- J. ASTM D4716– Standard Test Methods for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
- K. ASTM D6241– Static Puncture Strength
- L. ASTM D4751 - Standard Test Methods for Determining Apparent Opening Size of a Geotextile

1.4 DEFINITIONS

- A. Manufacturer: Responsible for the production of geocomposite rolls.
- B. Installer: The party responsible for field handling, storing, deploying, seaming, repairing, anchoring, and any other aspects of installing the geocomposite. The installer is also responsible for the transportation of the material to the site.
- C. Construction Quality Assurance Consultant (CQAC): The party, independent from the manufacturer or installer, responsible for observing and documenting activities related to the quality assurance of the production and installation of the geosynthetic components of the geocomposite. Also responsible for issuing a construction management report and certification sealed by a Registered Professional Engineer.

1.5 MANUFACTURER SUBMITTALS FOR REVIEW

- A. Submit the following 7 days prior to scheduled installation:
 - 1. Manufacturer’s certificates of compliance with specified product requirements.
 - 2. Manufacturer’s Quality Control (MQC) test results performed on materials produced for this project.

1.6 TRANSMISSIVITY VERIFICATION MQC TESTING (PERFORMED BY MANUFACTURER)

- A. The Manufacturer must provide transmissivity test results for the geocomposite proposed for the primary leachate collection system to qualify its use on this project. Refer to Article 2.1 of this Section for other product requirements for the components of the geocomposite (geotextile and geonet) as well as the geocomposite itself.
- B. Testing: Test with liner system components in contact with each side of the geocomposite as shown on the drawings. Tests must be performed by a GRI accredited lab or as approved by the ENGINEER.
- C. Test as described below:
 - 1. Transmissivity shall be measured in a 12-inch x 12-inch box using the same boundary conditions, load, duration and gradient as those used by the manufacturer to establish the min. avg. for the required test value.
 - 2. Minimum transmissivity required:

- a. Primary Leachate Collection: 10,368 GPD/ft (7.2 GPM/ft)
- D. Test report shall indicate the orientation relative to flow of the ribs of the geonet in contact with the geomembrane.

1.7 CONFORMANCE TESTING (PERFORMED BY OWNER)

- A. The OWNER will perform conformance testing on geocomposites as outlined in Table 02225-1 and 2 and in the CQA Plan.
- B. Allow a minimum of 7 calendar days for conformance tests to be performed and data to be reviewed.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect geocomposite from ultraviolet light exposure, precipitation, inundation, mud, dirt, dust, puncture, cutting, and other damaging or deleterious conditions.
- B. Immediately restore damaged protective covering.

PART 2 PRODUCTS

2.1 MANUFACTURED GEOCOMPOSITE FOR PRIMARY LEACHATE COLLECTION SYSTEM

- A. Description: A drainage geocomposite manufactured by heat-bonding non-woven needle punched geotextile to one side of a polyethylene geonet.
- B. Provided in roll lengths that accommodate the maximum slope lengths on 3:1 or steeper slopes without requiring butt seams.
- C. Manufactured with a thickness adequate to meet specified flow capacity.
- D. Manufactured with a non-collapsible waterway for unrestricted flow.
- E. Manufactured with core material made of polyethylene that maintains the required flow under specified loads.
- F. Manufactured and installed with geotextile overlapped at the upstream end of the geocomposite drain to prevent soil intrusion.
- G. Interface shear strength for the geocomposite as part of the liner system shall be tested per the requirements of Section 02779 Article 2.2.
- H. Manufactured to meet or exceed the following product requirements based on minimum average roll values:

2.2 GEONET COMPONENT OF GEOCOMPOSITE PRIMARY LEACHATE COLLECTION SYSTEM

**TABLE 02225-1
GEONET COMPONENT PROPERTIES AND
TESTING FREQUENCIES**

Test⁽¹⁾	ASTM Test Designation	Minimum MQC Test Frequency⁽¹⁾	Minimum Conformance Test Frequency	Required Test Values
Thickness (min. avg.)	D5199	1/100,000 sf	1/250,000	250 mil ⁽²⁾
Density (min. avg.)	D792 or D1505	1/100,000 sf	1/250,000	0.940 g/cm ³
Carbon Black Content (range)	D1603 ⁽³⁾	1/100,000 sf	1/250,000	2-3%
Mass/Unit Area (min. ave.)	D5261	1/100,000 sf	1/250,000	lbs/sf ⁽²⁾

1. Testing the geonet component shall be performed in accordance with the upper portion of this table. The geotextile component shall meet the required test values and the manufacturer's QC test frequency requirements from the Geotextile Separator (see Section 02771, 2.1). Tracking of the frequency of the Manufacturer's QC testing and Conformance QA testing shall be based on the geocomposite roll numbers.
2. Required value shall be taken from manufacturer's standard material specifications sheet for the selected geonet/Geocomposite material. Geonet/Geocomposite selection shall be based on the material's ability to meet or exceed the transmissivity identified in the site's design.
3. Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.

2.3 GEOTEXTILE COMPONENT OF GEOCOMPOSITE FOR PRIMARY LEACHATE COLLECTION SYSTEM

A. Per Article 2.1, Section 02771.

2.4 MANUFACTURED GEOCOMPOSITE FOR PRIMARY LEACHATE COLLECTION SYSTEM

**TABLE 02225-2
GEOCOMPOSITE PROPERTIES AND
TESTING FREQUENCIES**

Test	ASTM Test Designation	Minimum MQC Test Frequency⁽¹⁾	Minimum Conformance Test Frequency	Required Test Values
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Peel Strength (min. avg.)	D7005	1/100,000 sf	1/250,000	1.0 lb/in
Transmissivity ⁽²⁾	D4716	1/Project	1/Project	0.0015 m ² /sec

1. Unless otherwise noted, all values represent minimum average roll values (MARV), (i.e. any roll in a lot should meet or exceed the values in this table)
2. Transmissivity shall be measured in a 12-inch x 12-inch box using the same boundary conditions, load, duration and gradient as those used by the manufacturer to establish the min. avg. for the required test value.

2.5 MANUFACTURER SOURCE

2.6 MANUFACTURER SOURCE QUALITY CONTROL

- A. Perform Manufacturer's Quality Control (MQC) tests for geocomposites manufactured for this project. Perform tests necessary to verify geocomposites meet specified product requirements. Perform each MQC test at a minimum of the frequencies defined in this Section.
- B. Provide the following information with MQC test data:
 1. Roll numbers and identification
 2. Results of quality control tests, including a description of test methods used.
- C. OWNER will reject rolls for which quality control requirements are not met.

2.7 LABELING

- A. Mark or tag geocomposite rolls with the following information:
 1. Manufacturer's name
 2. Product identification
 3. Lot number
 4. Roll number
 5. Roll dimensions
- B. Mark special handling requirements on rolls.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Prior to installation of geocomposite, examine underlying construction for conformance with specifications. Verify the following:
 1. Underlying installations are complete, installed as designed, and as-built documentation has been obtained.
 2. There is no debris, excessive dust or rocks on the geomembrane in areas where geocomposite will be deployed.

3.2 PROTECTION

- A. When placing other geosynthetics over the geocomposite ensure the following:
 - 1. No damage occurs to the geocomposite.
 - 2. The geocomposite does not slip on the underlying geosynthetics.
 - 3. There are no excessive tensile stresses in the geocomposite.

3.3 DEPLOYMENT

- A. Follow manufacturer's recommendations, standards, and guidelines.
- B. Deploy geocomposite as indicating in Drawings.
- C. Do not entrap excessive dust, stones or moisture in geocomposite that could damage or clog drains or filters or hamper subsequent seaming.
- D. Deploy geocomposite such that the orientation of the ribs on the lower surface of the geocomposite matches that of the transmissivity testing preformed under Article 1.6 of this Section.
- E. Deploy rolls down slope not across slope.
- F. Lay smooth with no wrinkles and free of stresses.
- G. Examine geocomposite over entire installed surface to ensure that no potentially harmful foreign objects, such as needles, are present. Remove any foreign objects.
- H. Do not drag geocomposite across rough or textured surfaces to avoid damage to the geocomposite. Use a smooth geosynthetic slip sheet or rub sheet as necessary to reduce friction damage during deployment.

3.4 PANEL SEAMS (IF REQUIRED)

- A. Ensure that no soil is present between geocomposite seams.
- B. Overlap geonet 3 inches along panel edges and tie at five-foot intervals with plastic ties of contrasting color to the geonet material.
- C. Overlap geotextile and sew or heat bond.

3.5 BUTT SEAMS (IF REQUIRED)

- A. Overlap geonet 3 inches along panel ends and tie at 12-inch intervals with plastic ties of contrasting color to the geonet material.
- B. Overlap geotextile and sew.

3.7 REPAIRS

- A. Repair with same geocomposite product overlapped 12 inches beyond the repair area and secure with plastic ties of contrasting color to the geonet material spaced 12 inches on center. Overlap geotextile and sew or heat bond.

3.8 FIELD QUALITY ASSURANCE

- A. The CQAC will collect sample of geocomposite delivered to the site, for conformance testing at a minimum frequency of one (1) per 250,000 thousand square feet of geocomposite and perform tests as outlined in the CQA Plan to determine product compliance with specified values.

3.9 ACCEPTANCE

- A. CONTRACTOR retains all ownership and responsibility for geocomposite until acceptance by OWNER.
- B. OWNER accepts geocomposite when:
 - 1. The installation is complete.
 - 2. Conformance tests verify product requirements.
 - 3. Documentation of installation is complete including the CQAC's final report.
 - 4. Verification of the adequacy of all seams and repairs, including associated testing, is completed.
 - 5. Written certification documents have been received by the OWNER.

END OF SECTION

SECTION 02711 POLYETHYLENE PIPE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Installation of high-density polyethylene (HDPE) pipe in locations shown on the drawings.
- B. Installation of all HDPE pipe fittings and appurtenances.

1.2 RELATED SECTIONS

- A. Section 02771 – Geotextile.

1.3 REFERENCES

- A. Latest ASTM Standards or other recognized agency standards at the time construction documents are issued for the following items:
 - 1. Polyethylene Plastics Molding and Extrusion Materials
 - 2. Polyethylene Plastics Pipe and Fittings Materials

1.4 DEFINITIONS

- A. Standard Dimensional Ratio (SDR): The actual outside pipe diameter divided by the wall thickness.

1.5 SUBMITTALS

- A. Submit product data for pipe materials and welding system to be used. Submit 10 days prior to installation.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

- A. All pipe sizes shown on the Drawings and specified in this Section reference nominal diameter, unless otherwise indicated on the Drawings or in this Section. Pipe sizing in accordance with ASTM F714, and ASTM D3035 83.
- B. All pipes: as shown in Drawings.
- C. Designated as PE4710 and classified as 445474C (ASTM D3350).

D. Conforming to the following requirements:

TABLE 02711-1 PROPERTIES FOR POLYETHYLENE PIPE		
Property	Test Procedures	Values
Density (gm/cm ³)	ASTM D1505	0.947-0.955
Melt Index (gm/10 min)	ASTM D1238, (E)	<0.15
Flexural Modulus (psi)	ASTM D790	min. 133,000
Tensile Strength (psi)	ASTM D638	min. 3,200
Slow Crack Growth Resistance (PENT) (hrs)	ASTM F1473	> 5,000
Hydrostatic Design Basis (psi)	ASTM D2837	min. 1,600
UV Stabilizer (% Carbon Black)	ASTM D1603	2-3%

- E. Containing no recycled compound except that generated in the manufacturer's own plant and from resin of the same specification as the raw material supplier.
- F. Resin for pipe and fittings listed by both National Sanitation Foundation (NSF) and Plastic Pipe Institute (PPI) and manufactured in accordance with ASTM D305/F714-81.
- G. Homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other injurious defects; Being uniform in color, capacity, density, and other physical properties.
- H. Provide the following information continuously marked on the pipe or spaced at intervals not exceeding 5 feet.
1. Name and/or trademark of the pipe manufacturer.
 2. Nominal pipe size.
 3. Standard Dimensional Ratio (SDR).
 4. PE 4710.
 5. Manufacturer's Standard Reference.

6. A production code from which the date and place of manufacturer can be determined.

2.2 PIPE COUPLINGS

- A. Where required, provide HDPE blind flange adapters, molded stub ends, and molded end caps and other fittings in accordance with the drawings.

2.3 FABRICATED FITTINGS

- A. Provide fabricated or molded fittings as shown on the drawings.

2.4 PIPE PERFORATIONS AND LEACHATE COLLECTION PIPES

- A. Where plans call for perforated leachate collection pipe, perforate with 1/2-inch diameter holes. Drill four equally spaced holes around pipe perimeter, a minimum of every six inches along the pipe lengths.
- B. See Drawings for perforation details for sump collector pipe.

PART 3 EXECUTION

3.1 GENERAL

- A. When shipping, delivering, and installing pipe, fittings and accessories, do so to ensure a sound, undamaged installation.
- B. Provide adequate storage for all materials and equipment delivered to the job site.
- C. Handle and store pipe and fittings in accordance with the manufacturer's recommendations.

3.2 PLACING AND LAYING PIPE

- A. Provide maintenance of all such material and equipment.
- B. Follow the manufacturer's recommendations when hauling, unloading, and stringing of the pipe.
- C. Do not push or pull pipe and fittings over sharp projections, drop, or have objects dropped on it.

- D. Inspect for defects before installation.
- E. Any piping showing kinks, buckles, cuts, gouges, or any other damage which in the opinion of the OWNER will affect performance of the pipe must be removed from the site.
- F. Replace material found to be defective before or after laying with sound material without additional expense to the OWNER.

3.3 FUSION WELDING PIPE

- A. Join the polyethylene pipe by the method of thermal butt or side wall fusion, outlined in ASTM D2657. Perform fusion joining of pipe and fittings in accordance with the procedures established by the pipe manufacturer. Of particular importance is the use of proper interface pressures and heater plate temperatures. Ensure that shavings generated during butt surface preparation are cleaned from interior of piping prior to fusing.
- B. Use fusion pressures, temperatures, and cycle times according to pipe manufacturer's recommendations. Use personnel adequately trained and qualified in the technique involved.
- C. Do not perform pipe fusion in water when trench conditions are unsuitable for the work. Keep water out of the trench until joining is completed. Secure open ends of pipe and close valves when work is not in progress, so that no trench water, earth, or other substance will enter the pipe or the fittings. Plug or cap or valve pipe ends left for future connections.
- D. Clear welding and grade sites, if necessary, to provide enough space for pipe storage and fusion. Keep the site free of rocks, stumps, and debris which could cut, scar, or gouge the pipe. In order to allow the joining operation to continue in adverse weather conditions, a shelter may be required for the joining machine. Particular caution should be exercised to prevent the pipe from becoming wet, and to prevent the heater plate from coming in contact with water.
- E. Polyethylene Fusion Qualification: All pipe fusion must be performed by a supplier, or a factory supplied and/or certified fusion operator.
- F. Provide training sessions as required to train welding personnel, and quality control personnel in polyethylene fusion machine operation as applicable for the project. Only fully trained personnel will be allowed to perform the installation, supervision, or inspection of polyethylene-fusion joints. Submit a listing of those authorized/instructed for polyethylene fusion welding for review by the OWNER. Make all on-site training sessions during this contract available to quality assurance personnel at no charge to the OWNER.

- G. Training: Provide assistance from the manufacturer/supplier in instructing welding personnel in proper fusion procedures and techniques. Notifications will be required in writing, listing the names of those persons so familiarized. A manufacturer's representative shall be certified in writing by the manufacturer to be technically qualified and experienced.

END OF SECTION

SECTION 02771 GEOTEXTILE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Installation of geotextile around gravel fill, over trench fills, as a separation or cushion medium, or as a component of a LCRS drainage layer.

1.2 RELATED SECTIONS

- A. Section 02222 – Earth Fills
- B. Section 02278 – Geomembrane.

1.3 REFERENCES

Latest ASTM Standards or other recognized agency standards at the time construction documents are issued for the following items:

- A. Industrial Filament Yarns Made From Man-Made Organic Base-Fibers;
 - 1. Water Permeability of Geotextiles by Permittivity;
 - 2. Peel Strength;
- B. Burst Strength;
- C. Grab Breaking Load and Elongation of Geotextiles;
- D. Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products;
- E. Apparent Opening Size of a Geotextile; and
- F. Measuring Mass per Unit Area of Geotextiles.

1.4 DEFINITIONS

- A. Manufacturer: Responsible for the production of geotextile rolls.
 - 1. Installer: The party responsible for field handling, storing, deploying, repairing, anchoring, and any other aspects of installing the geotextile. The installer is also responsible for transportation of the material to the site.

2. Construction Quality Assurance Consultant (CQAC): The party, independent from the manufacturer or installer, responsible for observing and documenting activities related to the quality assurance of the production and installation of the geosynthetic components of the geotextile. Also responsible for issuing a construction monitoring report, and certification sealed by a Registered Professional Engineer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect geotextile from ultraviolet light exposure, precipitation, inundation, mud, dirt, dust, puncture, cutting, and other damaging or deleterious condition.
- B. Ship geotextile in closed trailer.
- C. Immediately restore damaged protective covering.

PART 2 PRODUCTS

2.1 GEOTEXTILE

- A. Products comprised of non-woven, continuous-filament or staple fiber needle punched polypropylene or polyester fabric; oriented into a stable network that maintains its structure during handling, placement, and long-term service.
- B. The product cannot be heat burnished.
- C. Resistant to soil chemicals.
- D. New product made from virgin materials.
- E. Geotextile used for filtration conforming to the following minimum average roll values (MARV) as defined by the Federal Highway Administration for the properties listed.

Table 02771-1
Properties for Geotextiles

Test	ASTM Test Designation	Unit	Requirement ⁽⁵⁾	Manufacturer's QC Test Frequency ⁽¹⁾	Conformance QA Test Frequency
Mass per Unit Area	D 5261	oz/SY	8/12/16 min ⁽⁴⁾	1/100,000	1/250,000
Grab Tensile Strength	D 4632	lbs	190/300/370	1/100,000	1/250,000
Puncture Resistance	D 6241	lbs	630/800/900	1/100,000	1/250,000
UV Resistance	D 4355	%	70/70/70 ⁽²⁾	1/resin formulation	N/A
Permittivity	D 4491	sec ⁻¹	0.02/NA/0.02 ⁽³⁾	1/540,000	1/project
Apparent Opening Size	D 4751	mm	0.60/NA/0.60 ⁽³⁾	1/540,000	1/project

Notes:

1. Manufacturer may elect to provide certification of values for geotextiles.
2. After 500 hours of exposure.
3. AOS and Permittivity shall only be tested for geotextiles used in filter applications. .
4. Provide 8 oz/yd² geotextile as the top component of single-sided geocomposite per Section 02225 of these specifications, 12 oz/yd² geotextile for landfill cell side slopes and 16 oz/yd² geotextile for "burrito wrap" on LCRS piping as shown in drawings.
5. First value shown is for 8 oz/yd² material, second value shown is for 12 oz/yd² material, third value shown is for 16 oz/yd² material.

2.2 MANUFACTURER SOURCE QUALITY CONTROL

- A. Perform quality control tests of geotextile, at a minimum of once for every one hundred thousand (100,000) square feet to evaluate materials conformance to published material properties.
- B. Reject rolls for which quality control requirements are not met.
- C. Certify the quality of the rolls of geotextile.
- D. Provide quality control certificates for each lot and each shift's production. The quality control certificates shall include:
 1. Roll numbers and identification.
 2. Sampling procedures

3. Results of quality control tests, including a description of test methods used

2.3 LABELING

- A. Mark or tag geotextile rolls with the following information:
 1. Manufacturer's name
 2. Product identification
 3. Lot number
 4. Roll number
 5. Roll Dimensions
 6. Mark special handling requirements on rolls.

Part 3 Execution

3.1 EXAMINATION

- A. Prior to installation of geotextile, examine underlying construction for conformance with specifications. Verify the following:
 1. Underlying installations are complete, installed as designed, and as-built documentation has been obtained.

3.2 PROTECTION

- A. When placing soil materials over geotextile, ensure the following:
 1. No damage to geotextile.
 2. No slippage of geotextile on underlying layers.
 3. No excessive tensile stresses in the geotextile.

3.3 DEPLOYMENT

- A. Follow manufacturer's recommendations, standards, and guidelines.
- B. Anchor geotextile in anchor trenches on slopes greater than 20 percent. Roll geotextile down slope in such a manner as to continually keep the geotextile sheet in sufficient tension to preclude folds and wrinkles.

- C. Weight geotextile with sandbags or equivalent as ballast during deployment. Leave ballast in place until geotextile is covered with succeeding construction layer.
- D. Cut geotextile using approved cutter only. Take care to protect other in-place geosynthetic materials when cutting geotextile.
- E. Do not entrap in geotextile excessive dust, stones, or moisture that could damage or clog drains of filters or hamper subsequent seaming.
- F. Examine geotextile over entire completed surface to ensure that no potentially harmful foreign objects, such as needles, are present. Remove any foreign objects.

3.4 SEAMS AND OVERLAPS

- A. Sew all seams for geotextiles used in separation and cushion applications. Overlap geotextile 3 inches minimum prior to seaming. Do not seam horizontal on slopes steeper than 10 percent (i.e., seam along, not across slopes). Stagger horizontal butt seams.
- B. Ensure that no soil materials are inadvertently inserted into the seams of geotextiles.
- C. Sew with polymeric thread having chemical resistance and strength properties equal to or exceeding those of geotextile.
- D. For sewing, use a 401 two-thread chain stitch, or equivalent.
- E. Stitching material to be in a contrasting color.

3.5 REPAIRS

- A. Repair holes or tears in a geotextile with a patch from the same geotextile material, seamed in place with a minimum seam overlap of 12 inches in all directions.
- B. Remove any soil or other material that may have penetrated the torn geotextile.

3.6 FIELD QUALITY ASSURANCE

- A. The CQAC will collect samples of geotextile delivered to the site for conformance testing at a minimum frequency as identified in the CQA Plan, and perform tests to determine product compliance with specified values.
- B. Samples will be taken across the entire width excluding the first three feet of the roll unless otherwise approved. Sample size will be three feet long by the roll width.

3.7 ACCEPTANCE

- A. CONTRACTOR retains all ownership and responsibility for geotextile until acceptance by OWNER.
 - 1. OWNER accepts geotextile when:
 - 2. The installation is complete.
 - 3. Conformance tests verify product requirements.
 - 4. Documentation of installation is complete, including the CQAC's final report.
 - 5. Verification of the adequacy of all seams and repairs, including associated testing, is complete.
 - 6. Written certification documents have been received by the OWNER.
 - 7. End of section

SECTION 02778 GEOMEMBRANE

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes installation of textured surface HDPE geomembrane for the landfill composite liner.

1.2 REFERENCES

- A. Latest ASTM Standards or other recognized agency standards at the time construction documents are issued for the following items:
 - 1. Tensile Properties of Plastics;
 - 2. Brittleness Temperature of Plastics and Elastomers;
 - 3. Specific Gravity (Relative Density) and Density of Plastics;
 - 4. Initial Tear Resistance of Plastic Film and Sheeting;
 - 5. Flow Rates of Thermoplastics;
 - 6. Plastics by the Density-Gradient Technique;
 - 7. Carbon Black in Olefin Plastics;
 - 8. Copper-Induced Oxidative Induction Time of Polyolefins;
 - 9. Index Puncture of Geotextiles, Geomembranes, and Related Products;
 - 10. Nominal Thickness of Geotextiles and Geomembranes;
 - 11. Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction;
 - 12. Evaluation of Stress Crack of Polyolefin Geomembranes;
 - 13. Microscopic Evaluation of Dispersion of Carbon Black;
 - 14. Multi-Axial Tension Test for Geosynthetics;
 - 15. Using Notched Constant Tensile Load Test;

16. Oxidation Induction Time of Polyolefin Geosynthetics; and
17. Integrity of Non-reinforced Geomembrane Seams.

1.3 DEFINITIONS

Batch: A quantity of resin, usually the capacity of one rail car, used in the manufacture of high density polyethylene (HDPE) geomembrane sheet. The finished sheet will be identified by a roll number corresponding to the particular lot of resin used.

Bridging: The condition when geomembrane becomes suspended over its subgrade due to contraction of the material or poor installation.

Construction Quality Assurance Consultant (CQAC): The party, independent from Manufacturer or Installer, that is responsible for observing and documenting activities related to the quality assurance of production and installation of the geosynthetic components of the lining system.

Construction Quality Assurance (CQA) Laboratory: The party, independent from the OWNER, Manufacturer, Fabricator, and Installer, responsible for conducting tests on samples of geosynthetics obtained at the site.

Construction Quality Assurance (CQA) Monitor: The site representative of the CQAC. Also referred to as the CQA ENGINEER or CQA Officer.

Extrudate: The molten polymer, which is emitted from an extruder during seaming using either extrusion fillet or extrusion flat methods. The polymer is initially in the form of a ribbon rod, bead or pellets.

Fabricator: The party responsible for the fabrication of geomembrane panels constructed from rolls received from the manufacturer.

Geomembrane Manufacturer: The party responsible for the production of the geomembrane rolls from resin and for the quality of the resin.

Geomembrane: An essentially impermeable membrane used as a solid or liquid barrier. Synonymous term for flexible membrane liner (FML).

Geomembrane Subsurface: The soil or geosynthetic surface on which the geomembrane lies.

Installer: The party responsible for field handling, transporting, storing, deploying, seaming, temporary restraining (against wind), and installation of the geomembrane.

Panel: The unit area of geomembrane that will be seamed in the field. If the geomembrane is not fabricated into panels in a factory, a panel is identified as a roll or portion of a roll without any seams.

1.4 SUBMITTALS (MANUFACTURER AND INSTALLER)

- A. Submit the following to the OWNER, 7 days prior to receiving material at site.
- B. Resin Data (Manufacturer)
 - 1. Statement of production date or dates.
 - 2. Certification stating that the resin meets the product requirements (see Article 2.1 of this Section).
 - 3. Certification stating that all resin is from the same manufacturer.
 - 4. Copy of quality control certificates issued by manufacturer.
 - 5. Test reports from manufacturer.
- C. Geomembrane Roll (Manufacturer)
 - 1. Statement of production date or dates.
 - 2. Laboratory test results and certification stating that the geomembrane meets the product requirements (see Article 2.3 of this Section).
 - 3. Certification stating that all geomembrane rolls are furnished by one supplier, and that all rolls are manufactured from one resin type obtained from one resin supplier.
 - 4. Copy of quality control certificates issued by manufacturer.
 - 5. Test reports from the manufacturer.
 - 6. Typical test results of complete notched constant tensile load test (ASTM D 5397) for specified resin and sheet thickness.
 - 7. Statement certifying that no reclaimed polymer is added to the resin.
 - 8. Statement listing percentages of processing aids, antioxidants, and other additives other than carbon black added to or in the resin.
 - 9. Geomembrane delivery, storage, and handling instructions.

10. Geomembrane installation instructions.

11. Sample warranties for review.

D. Extrudate Beads and/or Rod (Manufacturer)

1. Statement of production date or dates.

2. Laboratory certification stating that the extrudate meets the product requirements (see Article 2.4 of this Section).

3. Certification stating that all extrudate is manufactured by one manufacturer and resin is supplied from one supplier.

4. Copy of quality control certificates issued by manufacturer.

5. Test reports from the manufacturer.

6. Certification stating that the extrudate bead or rod resin is the same type, from the same manufacturer and compatible with the resin used to manufacture the geomembrane supplied for this project.

E. Schedules and Drawings (Installer)

1. Submit installation schedule one week prior to installation. Include hours worked per day, week and per shift. Indicate all weather delays built into schedule.

2. Installation layout drawings: Two weeks prior to installation of geomembrane, submit drawings showing the panel layout indicating both fabricated (if applicable) and field seams, and details not conforming to the Contract Drawings. Upon acceptance, use these drawings for installation of geomembrane.

F. Qualifications (Installer)

1. Submit, two weeks prior to installation, name of installer, and resume of installation supervisor/field engineer to be assigned to the project.

2. Submit, two weeks prior to installation, resume of master seamer.

G. Equipment and Personnel: Submit the following two weeks prior to installation: (Installer)

1. Equipment List Stating Quantity and Types.

2. List of personnel to perform field-seaming operations.

1.5 SUBMITTALS DURING CONSTRUCTION (INSTALLER)

- A. Submit quality control documentation prepared during installation.

1.6 SUBMIT UPON COMPLETION OF THE INSTALLATION (INSTALLER)

- A. Certificate stating the liner has been installed in accordance with the plans and specifications.
- B. The warranty obtained from the manufacturer/fabricator and the installation warranty.
- C. As-built drawings showing location of panels, seams, repairs, patches, and destructive samples, including measurements.
- D. Copies of seam test results and statistical analysis of each welder's performance.

1.7 QUALIFICATIONS

- A. Installer: Must have successfully installed a minimum of 10,000,000 square feet of welded polyethylene geomembrane with documented references.
- B. Master Welder Qualifications: Must have completed a minimum of 5,000,000 square feet of polyethylene geomembrane seaming work using the same type of seaming apparatus proposed for use on this projects.
- C. Other Seamers Qualifications: Must have seamed a minimum of 1,000,000 square feet of HDPE geomembrane.

1.8 QUALITY ASSURANCE

- A. All work shall be constructed, monitored, and tested in accordance with the requirements of the CQA Plan.
- B. The OWNER will engage and pay for the services of (1) Construction Quality Assurance Consultant (CQAC), and (2) Construction Quality Assurance (CQA) Laboratory for monitoring the quality and installation of geomembrane material being installed unless otherwise specified.
- C. The Geosynthetics Installer shall be aware of all activities outlined in the CQA Plan, and the CONTRACTOR shall account for these activities in the construction schedule.
- D. The OWNER shall assure that the geomembrane is delivered to the site at least 14 calendar days prior to installation to allow sufficient time for conformance testing.

- E. Any geomembrane rolls that do not meet the requirements of this Specification will be rejected. The Geosynthetics Installation CONTRACTOR shall replace the rejected material with new material that conforms to the Specification requirements, at no additional cost to the OWNER.
- F. Personnel Qualifications
 - 1. Ensure that all personnel performing geomembrane seaming operations are qualified by experience or by successfully passing seaming tests (see Article 3.3 of this Section).
 - 2. Personnel qualifications in accordance with Article 1.7 of this Section.
- G. Field Samples
 - 1. Geomembrane sampling shall be conducted in accordance with those specifications and the CQA Plan for the following:
 - a. Conformance Testing (Article 3.1 of this Section)
 - b. Destructive Seam Testing (Article 3.3 of this Section)
- H. In order to prevent wind-damaged geomembranes from being placed, the following Quality Assurance procedures shall be followed:
 - 1. The Geosynthetics Installation CONTRACTOR shall perform their work to prevent wind damage to the geomembrane.
 - 2. Wind damage shall be determined by the CQA Monitor during deployment of the geomembrane. Wind damage to the geomembrane will include wrinkles, creases, and tears, as determined by the CQA ENGINEER.
 - 3. Repair of the wind-damaged geomembrane shall be completed by the Geosynthetics Installation CONTRACTOR at no additional cost to the OWNER.
 - 4. As determined by the CQA Monitor, the geomembrane panel may be rejected and shall be replaced by the geosynthetics installation CONTRACTOR at no cost to the OWNER.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping
 - 1. Labels on each roll delivered to site shall identify the following:

- a. Manufacturer's name;
- b. Product Identification;
- c. Thickness;
- d. Roll number;
- e. Batch or lot number;
- f. Panel number (when applicable); and
- g. Roll dimensions.

2. Ensure that geomembrane rolls are properly loaded and secured to prevent damage during transit.

3. Protect geomembrane from excessive heat, cold, puncture, cutting, or other damaging or deleterious conditions.

4. Ensure personnel responsible for loading, transport and unloading of geomembrane are fully aware of the consequences of damage to geomembrane, and are familiar with handling and transport constraints imposed by manufacturer.

B. Delivery

1. Deliver materials to the site only after the OWNER accepts required submittals.

2. Separate damaged rolls from undamaged rolls and store in locations designated by the OWNER until proper disposition of material is determined by OWNER.

3. OWNER will determine the extent of damage to geomembrane.

4. Delivery in rolls, do not fold.

C. Acceptance at Site

1. Perform inventory and surface inspection for defects and damage of all geomembrane rolls upon delivery.

2. Unroll and inspect any geomembrane roll that shows signs of internal damage.

3. Damage resulting from handling and transport of geomembranes shall be repaired at no cost to OWNER. If irreparable, in the opinion of the CQA ENGINEER, damaged materials shall be replaced at no cost to OWNER.

D. Storage and Protection

1. OWNER will provide on-site storage area for geomembrane rolls from time of delivery until installation.
2. The storage of the materials is the responsibility of the CONTRACTOR from the time the materials are off-loaded until used by the Geosynthetic Installer.
3. After Geosynthetic Installer has removed material from storage area, protect geomembrane from puncture, dirt, grease, water, moisture, mud, mechanical, abrasion, excessive heat and other sources of damage.
4. Preserve integrity and readability of geomembrane roll labels.
5. Store geomembrane rolls on prepared surface (not on wooden pallets).
6. Stack no more than three rolls high.

1.10 SITE CONDITIONS

A. Geomembrane Deployment

1. Do not proceed with deployment at an ambient temperature below 40 degrees F or above 110 degrees F unless otherwise authorized, in writing, by OWNER. If surface temperatures exceed 140 degrees F, regardless of ambient temperature, deployment shall continue only if CQA Monitor allows after testing trial welds.
2. Do not deploy during precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, or in the presence of excessive winds.

- B.** Do not undertake deployment if weather conditions will preclude material seaming on same day as deployment.

- C.** At the end of each day, the Geosynthetic Installer will weight down the leading edge of the geomembrane using sandbags or other approved measures provided by the Geosynthetic Installer.

- D. The final side slope liner termination will be completed by the CONTRACTOR per the termination details in the Drawings along the exposed edge of the geomembrane.
- E. Seaming
 - 1. Normal seaming procedures may take place if the following weather conditions exist:
 - a. Ambient temperature, measured 6 inches above the liner surface, shall be between 40 degrees F and 105 degrees F. Do not seam if ambient temperature is below or above 40 degrees F and 105 degrees F, respectively, unless approved by the CQA Monitor.
 - b. Dry conditions (i.e., no precipitation or other excessive moisture, such as fog or dew).
 - c. No excessive winds.

PART 2: PRODUCTS

2.1 MATERIALS

- A. Geomembrane Liner
 - 1. Geomembrane shall be 60-mil high-density polyethylene (HDPE), textured as indicated on the Drawings.
 - 2. Only geomembranes and resins that meet these specifications.
 - 3. Geomembrane shall be manufactured from new polyethylene resin.
 - 4. Geomembrane manufactured from non-complying resin shall be rejected.
 - 5. Resin shall be designed and manufactured specifically for use in geomembranes.
 - 6. The geomembrane shall have the following characteristics:
 - a. Contain a maximum of 2 percent by weight of additives, fillers, or extenders (not including carbon black).

- b. Contain between 2 percent and 3 percent carbon black for ultra-violet light resistance. This shall be added to the otherwise pure polyethylene resin as part of resin manufacturing or roll manufacturing processes.
- c. No thin spots, striations, pinholes, or bubbles on surface. Free of blisters, undispersed raw materials, or other signs of contamination by foreign matter.
- d. The geomembrane is to be roughened or textured during the manufacturing process.

2.2 SEAMING AND TESTING EQUIPMENT

A. Welding

- 1. Maintain on-site a minimum of two spare operable seaming apparatus, unless otherwise agreed upon at pre-construction meeting.
- 2. Seaming equipment shall not damage geomembrane.
- 3. No solvent or adhesive is used unless the product is approved in writing by the OWNER prior to use.
- 4. Use extrusion welding apparatus equipped with gauges giving temperature of extrudate at nozzle of apparatus.
- 5. Use fusion welding apparatus which are self-propelled devices equipped with the following:
 - a. A gauge indicating temperature of heating element.; and
 - b. A method of monitoring relative pressure applied to geomembrane.
- 6. Use power source capable of providing constant voltage under combined line load.
- 7. Provide protective lining and splash pad large enough to catch spilled fuel under electric generator, if located on liner.
- 8. Provide tensiometers capable of measuring seam strength, calibrated and accurate within 2 pounds.
- 9. Provide dies for cutting seam samples.

B. Vacuum Testing

The equipment shall consist of the following:

1. Vacuum box assembly consisting of: rigid housing, transparent viewing window, soft neoprene gasket attached to bottom of housing, port hole or valve assembly, and vacuum gauge;
2. Pump assembly equipped with pressure controller and pipe connections;
3. Rubber pressure/vacuum hose with fittings and connections;
4. Bucket of soapy solution; and
5. Wide paint brush, or other means of applying soap solution.

C. Air Pressure Testing (for double fusion seam only)

The equipment shall consist of the following:

1. Air pump (manual or motor driven), equipped with a pressure gauge, capable of generating, sustaining, and measuring pressure between 24 and 35 pounds per square inch (psi) and mounted on a cushion to protect geomembrane.
2. Rubber hose with fittings and connections.
3. Sharp hollow needle, or other approved pressure feed device.
4. An air pressure-monitoring device.

2.3 SOURCE QUALITY CONTROL TESTING

All of the specified tests are the CONTRACTOR'S responsibility. Testing during manufacturing shall be accomplished by the manufacturer's laboratory.

A. Tests and Inspection

1. Geomembranes shall be tested by geomembrane manufacturer for quality control to demonstrate that resin meets specifications in Table 02778-1.
2. Geomembrane manufacturer shall continuously monitor during manufacturing process for inclusions, bubbles, or other defects. Geomembranes which exhibit defects shall not be acceptable for installation.
3. Geomembrane manufacturer shall monitor thickness continuously during manufacturing process. No geomembrane which fails to meet specified values shall be acceptable for installation.

4. At a minimum, the following tests shall be performed in accordance with test methods specified in Table 02778-2:
 - a. Density;
 - b. Carbon black content;
 - c. Carbon black dispersion;
 - d. Puncture resistance;
 - e. Tear resistance; and
 - f. Tensile properties.
5. Geomembrane manufacturer shall perform these tests on geomembrane, at a minimum of once every 50,000 ft². Samples not satisfying specifications shall result in rejection of the rolls represented by the tests. At the geomembrane manufacturer's discretion and expense, additional testing of individual rolls may be performed to more closely identify the non-complying rolls and to qualify individual rolls.
6. The Environmental stress crack resistance test need not be run at 1 per 50,000 ft² frequency. Geomembrane manufacturer shall certify that these tests have been performed for each resin in accordance with test methods specified in Table 02778-2.

Table 02778-1
Properties for High Density Polyethylene Resin

Test	Test Method	Requirement
Specific Gravity (Density)	ASTM D-1501	>0.93
Melt Index	ASTM D-1238	<1.0 g/10 min

Table 02778-2
Properties for High Density Polyethylene Liner (60 mil)

Properties	Test Method	Manufacturer QC Test Frequency	Conformance QA Test Frequency	Required Test Values ⁽¹³⁾
Thickness (min. ave.) - Lowest individual for 8 out of 10 values - Lowest individual for any of the 10 values	ASTM D5994	1 per Roll	1 per 250,000 sf	57 mil 54 mil 51 mil
Asperity Height (min. ave.) ⁽¹⁾⁽²⁾	GM 12	1 per 50,000 sf	1 per 250,000 sf	20 mil
Sheet Density (min.)	ASTM D792 or ASTM D1505	1 per 50,000 sf	1 per 250,000 sf	0.940 g/cc
Tensile Properties ⁽³⁾ (min. ave.) - Yield Strength - Break Strength - Yield Elongation - Break Elongation	ASTM D6693	1 per 50,000 sf	1 per 250,000 sf	126 lb/in 90 lb/in 12% 100%
Tear Resistance (min. ave.)	ASTM D1004 Die C	1 per 50,000 sf	N/A	42 lbs
Puncture Resistance (min. ave.)	ASTM D4883	1 per 50,000 sf	1 per 250,000 sf	90 lbs
Stress Crack Resistance ⁽⁴⁾	ASTM D5397 (App.)	⁽¹²⁾	N/A	300 hours
Carbon Black Content (range)	ASTM D1603 (5)	1 per 50,000 sf	1 per 250,000 sf	2-3%
Carbon Black Dispersion ⁽⁶⁾	ASTM D5596	1 per 50,000 sf	1 per 250,000 sf	Category 1, 2, or 3 ⁽⁶⁾

Properties	Test Method	Manufacturer QC Test Frequency	Conformance QA Test Frequency	Required Test Values ⁽¹³⁾
Oxidative Induction Time (OIT) (min. ave.) ⁽⁷⁾ - Std. OIT, or - High Pressure OIT	ASTM D3895 ASTM D5885	(12)	N/A	100 min 400 min
Oven Aging at 85°C ⁽⁵⁾⁽⁶⁾ - Std. OIT (min. ave.), % retained after 90 days, or - High Pressure OIT(min. ave.), % retained after 90 days	ASTM D5721 ASTM D3895 ASTM D5885	(12)	N/A	55% 80%
UV Resistance ⁽⁹⁾ - Std. OIT (min. ave.), or - High Pressure OIT(min. ave.), % retained after 1600 hrs⁽¹¹⁾	GM 11 ASTM D3895 ASTM D5885	(12)	N/A	(10) 50%
Min. Seam Strengths - Shear, ppi - Peel, ppi	ASTM D6392 ASTM D6392	1/1000 LF of seam 1/1000 LF of seam	1/1000 LF of seam 1/1000 LF of seam	120 88 for wedge seams 78 for extrusion seams

Properties	Test Method	Manufacturer QC Test Frequency	Conformance QA Test Frequency	Required Test Values ⁽¹³⁾
Notes: (1) The lowest individual reading must be ≥ 17 mils (2) Test each side of the textured geomembrane recording a measurement every lineal foot of textured roll width. (3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. - Elongation is calculated using a gage length of 1.3 inches. - Break elongation is calculated using a gage length of 2.0 inches. (4) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials. (5) Other methods such as D 4218 (muffle furnace) appropriate correlation to D 1603 (tube furnace) can be established. (6) Carbon black dispersion (only near spherical agglomerates) for different views: 9 in Categories 1 or 2, and 1 in Category 3. (7) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant in the geomembrane. (8) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response. (9) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C. (10) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples. (11) UV resistance is based on percent retained value regardless of the original HP-OIT value. (12) Manufacturer may provide certification letter. (13) Based on GRI GM13, Rev. 6, 6/23/03.				

2.4 EXTRUDATE ROD OR BEAD

- A. Meeting the geomembrane manufacturer requirements.
- B. Made from same resin as the geomembrane.
- C. Thoroughly disperse additives throughout rod or bead.
- D. Containing 2 to 3 percent carbon black.
- E. Free of contamination by moisture or foreign matter.

PART 3 EXECUTION

3.1 EXAMINATION

A. Conformance Testing

1. The CQA ENGINEER shall collect samples of geomembrane for conformance testing, as outlined in the CQA Plan and as described herein.
2. The following tests shall be performed by the CQA Consultant using the test methods listed in Table 02778-2 at the frequency specified in the CQA Plan:
 - a. Thickness (minimum);
 - b. Density;
 - c. Tensile properties (all); and
 - d. Carbon black content.
3. Geomembrane shall be rejected if conformance test results do not meet or exceed the values presented in Table 02778-2.

3.2 INSTALLATION

A. Panel Layout

1. Any anticipated modification to the geomembrane panel layout, particularly at penetrations, or other critical locations should be presented to the OWNER in writing or by drawing by the Geosynthetic Installer a minimum of three (3) working days in advance of the Work requiring the modification.

B. Panel Nomenclature

1. A field panel is defined as a unit of geomembrane that is to be seamed in the field (i.e., a field panel is a roll or a portion of roll cut in the field).
2. Identify each field panel with an identification code (number or letter-number) consistent with Geosynthetics Installer's layout plan. This identification code shall be agreed upon by the OWNER, Geosynthetic Installer, and CQA ENGINEER.

3. The Geosynthetics Installer shall be responsible for labeling each panel as it is installed in bold print which is easily visible. The labels shall include, as a minimum: identification code, which indicates the sequence of deployment, the roll number from which the panel was obtained and the date the panel was placed. The OWNER may refuse to accept any panel, portion of panel, or roll which is not correctly labeled.

C. Protection

1. Do not use equipment or tools that damage geomembrane or GCL by handling, trafficking, excessive tear, leakage of hydrocarbons, or other means.

2. Ensure prepared surface underlying geomembrane and GCL has not deteriorated since previous acceptance, and remains acceptable immediately prior to geomembrane and GCL deployment.

3. Keep geosynthetic elements immediately underlying the geomembrane clean and free of debris.

4. Do not permit personnel to smoke or wear damaging shoes while working on geomembrane.

5. Unroll panels in a manner which does not cause excessive scratches or crimps in geomembrane and does not damage the underlying GCL or subgrade. Rub sheets must be used when deploying textured geomembrane over GCL or prepared subgrade.

6. Place panels in a manner which minimizes wrinkles (especially differential wrinkles between adjacent panels.).

7. Prevent wind uplift by providing adequate temporary loading and/or anchoring (e.g., sandbags, tires) that will not damage geomembrane. In case of high winds, continuous loading along panel edges is recommended. It is the responsibility of the Geosynthetic Installer to prevent wind damage to liner components.

8. Minimize direct contact with geomembrane.

9. Protect geomembrane in areas where excessive traffic is expected with geotextiles, extra geomembrane, or other suitable materials, as approved by the CQA ENGINEER.

10. Install material to account for shrinkage and contraction while avoiding wrinkles. Install material stress-free with no bridging before it is covered. Add material as needed to avoid bridging.

11. Do not drive over the GCL, unless a proper demonstration has been performed to assure survivability of the GCL

D. Field Panel Deployment

1. Install field panels at locations indicated on the Geosynthetics Installer's layout plan, as approved by OWNER.

2. Replace damaged (torn, twisted, or crimped) field panels, or portions thereof, at no cost to OWNER. Repair lesser damage according to Article 3.2.I of this Section. CQA ENGINEER shall determine if material is to be repaired or replaced.

3. Remove damaged panels or portions of damaged panels which have been rejected from Work area.

4. Do not deploy more geomembrane field panels in one day than can be seamed during that day.

E. Seam Layout

1. When possible, orient seams parallel to line of maximum slope (i.e., oriented along, not across or at an angle to the slope).

2. No horizontal seam shall be on a slope or less than 5 feet (1.5m) from the toe of a slope, without prior acceptance by the CQA ENGINEER.

3. Do not locate seams in areas of potential stress concentrations, unless otherwise authorized by OWNER.

4. In general, maximize lengths of field panels and minimize number of field seams.

5. Use seam numbering system compatible with panel numbering system.

F. Temporary Bonding

1. Hot air device ("Lister") may be used to temporarily bond geomembrane panels that are to be extrusion welded.

2. Do not damage geomembrane when temporarily bonding adjacent panels. Apply minimal amount of heat to lightly tack geomembrane panels together. Control temperature of hot air at nozzle of any temporary welding apparatus to prevent damage to geomembrane.
3. Do not use solvent or adhesive unless product is approved for use, in writing, by the OWNER.

G. Seaming Methods

Approved processes for field seaming are extrusion welding and dual-track fusion welding. Proposed alternate processes shall be documented and submitted to OWNER for approval.

1. Align geomembrane panels to have a nominal overlap of 3 inches for extrusion welding and 4 inches for fusion welding. The Geosynthetics Installation CONTRACTOR shall indicate the lap by making reference marks prior to seaming at an interval of not more than fifty (50) feet. The location and type of reference mark shall be agreed upon by all parties at the pre-construction meeting.
2. After seaming operations have occurred, the remaining overlap(s) shall be enough to destructively test. If insufficient overlap for destructive testing is determined to exist on a portion of a seam, that portion of the seam shall be reconstructed by the procedures described in Article 3.2.I of this Section.
3. Use double-fusion welding as primary method of seaming adjacent field panels.
 - a. For cross seam tees associated with fusion welding, extrusion weld to a minimum distance of 4 inches on each side of tee. The edge of the cross seam is ground to an incline prior to welding.
 - b. Place electric generator on a smooth base such that no damage occurs to geomembrane.
 - c. Place a protective layer (e.g., insulating plate or fabric) beneath hot welding apparatus after usage.
 - d. When subgrade conditions dictate, use a movable protective layer directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between sheets and prevent debris from collecting around pressure rollers.

4. Use conventional extrusion welding as a secondary method for seaming between adjacent panels and as a primary method of welding for detail and repair Work.
 - a. Purge heat-degraded extrudate from barrel of extruder under the following conditions:
 - 1) Prior to beginning a seam; and
 - 2) Whenever extruder has been inactive.
 - b. Place electric generator on a smooth base such that no damage occurs to geomembrane.
 - c. Place a smooth insulating plate or fabric beneath hot welding apparatus after usage.
 - d. Use clean and dry welding rods or extrudate pellets.
 - e. Complete grinding process without damaging geomembrane according to manufacturer's instructions within 1 hour of seaming operation.
 - f. Minimize exposed grinding marks adjacent to an extrusion weld. Do not extend exposed grinding marks more than 1/4 inch from seam area. The OWNER may request that all abraded areas be covered with extrudate.
 - g. Extrusion weld all cross seam tees to a minimize distance of 4 inches on each side of the tee.

H. Seaming Procedures

1. General Seaming Procedures; Ensure That:
 - a. Spare operable seaming equipment is on-site at all times;
 - b. Equipment used for seaming will not damage the geomembrane;
 - c. The electric generator is placed on a smooth base such that no damage occurs to the geomembrane;
 - d. A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage;
 - e. The geomembrane is protected from damage in heavily trafficked areas, using a method approved by the CQA ENGINEER;
 - f. No solvent or adhesive is used unless the product is approved in writing by the OWNER prior to use;

- g. Areas to be seamed shall be cleaned and free of moisture, debris, or any marking on the geomembrane;
- h. Use a flat board, a conveyor belt, or similar hard surface directly under the seam overlap to achieve proper support, if required;
- i. Cut fishmouths or wrinkles at the seam overlap along the ridge of the wrinkle in order to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same geomembrane extending a minimum of six (6) inches beyond the cut in all directions;
- j. Provide adequate illumination if seaming operations are carried out at night;
- k. Extend seaming to the outside edge of panels placed in the anchor trench;
- l. No field seaming shall be performed without the Seaming Supervisor being present; and
- m. The welding process (Restart/Reseaming procedures) shall start with grinding the existing seam and rewelding a new seam. Welding shall commence where the grinding started and must overlap the previous seam by at least two (2) inches. Reseaming over an existing seam without regrinding shall not be permitted.

I. Repair Procedures

- 1. All seams and non-seam areas of the geomembrane shall be inspected by the CQA Officer for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane shall be clean at the time of inspection. The geomembrane surface shall be brushed, blown, or washed by the Installer if the amount of dust or mud inhibits inspection. The CQA Officer shall decide if cleaning of the geomembrane is needed to facilitate inspection.
- 2. Repair portions of geomembrane exhibiting a flaw, or failing a destructive or nondestructive test.
- 3. Final decision as to appropriate repair procedure shall be agreed upon between OWNER, Geosynthetics Installation CONTRACTOR, and CQA ENGINEER.
- 4. Available repair procedures include the following:

- a. Patching: A piece of geomembrane extrusion welded into place. Use to repair large holes, tears, undispersed raw materials, and contamination by foreign matter.
- b. Spot welding or seaming: A bead of molten extrudate placed on flaw. Use to repair small tears, pinholes, or other minor, localized flaws.
- c. Capping: A strip of geomembrane extrusion welded into place over an inadequate seam. Use to repair large lengths of failed seams.
- d. Extrusion welding the flap: A bead of molten extrudate placed on exposed flap of fusion weld. Use to repair areas of inadequate fusion seams which have an exposed edge. Repairs of this type shall be reviewed by CQA ENGINEER and shall not exceed 50 feet in length.
- e. Removal and replacement: Remove defective seams and replace with a strip of new material welded into place. Use to repair large lengths of failed seams.
- f. Acceptable wrinkle size and extent shall be determined and agreed upon by all parties during the pre-construction meeting. Wrinkles larger than that specified shall be cut and seamed, if the overlap is sufficient, or cut and patched or capped.

5. For any repair method, satisfy the following:

- a. Surfaces of the geomembrane that are to be repaired using extrusion methods shall be abraded no more than one (1) hour prior to the repair. No more than 10 percent of the thickness shall be removed.
- b. Ensure surfaces are clean and dry at time of repair.
- c. Ensure seaming equipment used in repairing procedures meets requirements of this section.
- d. Extend patches or caps at least 6 inches beyond edge of defect. Round corners of patches with a radius of approximately 3 inches.

6. Do not place overlying layers over locations which have been repaired until appropriately passing nondestructive and laboratory test results are obtained.

J. Anchor Trench

- 1. Earthwork CONTRACTOR shall excavate anchor trenches, unless otherwise specified, to lines and grades shown on design Drawings, prior to geomembrane placement.

2. Provide slightly rounded corners in anchor trench to avoid sharp bends in geomembrane.
3. If anchor trench is excavated in clay material susceptible to desiccation, the amount of trench open at any time shall be minimized, subject to the approval of the CQA ENGINEER.
4. Earthwork CONTRACTOR shall backfill and compact anchor trench as described in Section 02222. Care shall be taken when backfilling trenches to prevent any damage to geosynthetics.
5. Earthwork CONTRACTOR will ensure that the anchor trench will be adequately drained to prevent ponding or softening of adjacent soils while trench is open.

3.3 FIELD QUALITY CONTROL

A. Visual Inspection

1. CQA ENGINEER shall examine seam and non-seam areas of geomembrane for identification of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
2. Clean and wash geomembrane surface if CQA ENGINEER determines that the amount of dust or mud inhibits examination.
3. Do not seam any geomembrane panels that have not been examined for flaws by CQA ENGINEER.
4. Nondestructively test each suspect location of seam and non-seam areas using methods described in Article 3.3.C of this Section, as appropriate.

B. Trial Seams

1. Make trial seams on fragment pieces of geomembrane liner to verify that conditions are adequate for production seaming.
2. Make trial seams at beginning of each seaming period, at the CQA ENGINEER's direction and at least once each four (4) hours, for each production seaming apparatus used that day. Each seamer shall make at least one trial seam each day. The CQA ENGINEER may, at their sole discretion, require additional trial seams if surface temperatures exceed 140 degrees Fahrenheit.
3. Make trial seams under same conditions as actual seams.

4. Make trial seams only under observation by CQA ENGINEER.
5. Overlap seam of geomembrane pieces as indicated in Article 3.2 G of the Section.
6. Make trial seam sample at least 5 feet long by 1 foot wide (after seaming) with seam centered lengthwise.
7. Cut two specimens from sample with a 1-inch wide die. These specimen locations shall be selected randomly along the trial seam sample by the CQA ENGINEER. Test specimens in peel using a field tensiometer. The tensiometer shall be capable of maintaining a constant jaw separation rate of 2 inches per minute. These tests shall not fail according to criteria in Table 02778-2.
8. If a specimen fails, repeat the entire operation. If the additional specimen fails, do not use seaming apparatus and seamer until the deficiencies are corrected and two consecutive successful trial seams are achieved.
9. Cut remainder of successful trial seam into three pieces; one to be retained in OWNER's archives, one to be retained by Geosynthetics Installation CONTRACTOR, and one to be retained by CQA ENGINEER for possible laboratory testing. Alternatively, if required by OWNER, remaining portion of trial seam sample may be subjected to destructive testing as discussed in Article 3.3.D of this Section.

C. Nondestructive Seam Testing

1. General

- a. The purpose of nondestructive tests is to check the continuity of the seams. It does not provide quantitative information on seam strength. Nondestructively test field seams over their full length using a vacuum test unit, air pressure (for double fusion seams only), or other method approved by the CQA ENGINEER. Perform nondestructive testing as seaming Work progresses, not at the completion of all field seaming.

2. Vacuum Testing

- a. Energize vacuum pump and reduce tank pressure to approximately 5 psi (10 inches of mercury (in Hg)) gauge pressure.
- b. Wet strip of seam area approximately 12 inches by 48 inches with soapy solution.

- c. Place box over wetted area.
- d. Close bleed valve and open vacuum valve.
- e. Ensure that a leak tight seal is created.
- f. For a period of not less than 10 seconds, apply vacuum and examine seam area through viewing window for presence of soap bubbles.
- g. If no bubbles appear within 10 seconds, close vacuum valve and open bleed valve, move box over to next adjoining area with a minimize 3-inch overlap and repeat process.
- h. Mark and repair areas where soap bubbles appear in accordance with Article 3.2.I of this Section.

3. Air Pressure Testing (for double fusion seam only)

- a. Temporarily seal both ends of seam to be tested using locking pliers or other similar devices.
- b. Insert needle or other approved pressure feed device into air channel created by fusion weld.
- c. Place a protective layer between air pump and geomembrane.
- d. Pressurize air channel to a pressure of approximately 30 psi. Close valve and allow pressure to stabilize for approximately 2 minutes. Ensure after 2-minute stabilization period that the pressure is between 27 and 33 psi.
- e. Observe the air pressure 5 minutes after the initial 2-minute stabilization period ends. If pressure loss exceeds 3 psi or the pressure does not stabilize, locate the faulty area and repair in accordance with Article 3.2.I of this Section.
- f. Once pressure testing is completed, cut end of tested seam area opposite to needle insertion end to verify continuity of the air channel. If air does not escape, locate blockage and retest unpressurized area. Repair cut end of air channel in accordance with Article 3.2.I of this Section.
- g. Remove needle or other approved pressure feed device and seal hole in geomembrane with extrusion weld.

4. Inaccessible Seams

- a. Install cap strip over any seam that cannot be nondestructively tested. Cap strip material shall be composed of the same type and thickness geomembrane as the geomembrane to be capped.
- b. CQA ENGINEER shall observe cap stripping operations for uniformity and completeness.

D. Destructive Seam Testing

1. General

- a. The purpose of destructive seam testing is to evaluate seam strength. Perform destructive seam tests as seaming progresses, not at the completion of all field work. A failed destructive seam sample shall result if grips of testing machine cannot be closed on sample test flap due to excessive temporary welding.

2. Frequency

- a. A minimum frequency of one test location per 1,000 feet of seam length performed by each welder. This minimum frequency is to be determined as an average taken throughout the entire facility.
- b. OWNER reserves the right to increase the frequency of testing in accordance with performance results of samples previously tested.

3. Sampling Procedures

- a. Cut samples at locations as directed by CQA ENGINEER. CQA ENGINEER shall number each sample and record sample number and location on the panel layout Drawing.
- b. Repair holes in geomembrane resulting from destructive seam sampling immediately in accordance with repair procedures described in Article 3.2.I of this Section.
- c. Nondestructively test continuity of new seams in the repaired area according to Article 3.3.C of this Section.

4. Sample Dimensions

Take the following two types of samples at each sampling location:

- a. Take two samples for field testing. Cut each of these samples with a 1-inch-wide die, with seam centered parallel to width. The distance between these two samples shall be 42 inches. If both samples pass the field test described in Article 3.3 D of this Section, take a sample for laboratory testing as described in paragraph b below.

- b. The sample for laboratory testing shall be located between the samples cut for field testing. Cut sample for laboratory testing 12 inches wide by 42 inches long with seam centered lengthwise. Cut this sample into three parts. CQA ENGINEER shall distribute the parts as follows:

- 1) One portion to Geosynthetics Installation CONTRACTOR for optional laboratory testing, 12 inches by 12 inches.
- 2) One portion to Geosynthetic Quality Assurance Laboratory for testing, 12 inches by 18 inches.
- 3) One portion to OWNER for archive storage, 12 inches by 12 inches.
- 4) Final determination of sample sizes shall be agreed upon at the pre-construction meeting.

5. Field Testing

- a. Test the two 1-inch-wide strips described in Article 3.3.D of this Section for peel strength. Use a tensiometer as described in paragraph (b) below to conduct these tests. These tests shall exceed the strength criteria in Table 02278-2.
- b. Use a tensiometer capable of maintaining a constant jaw separation rate of two inches per minute.
- c. Test field samples only under CQA ENGINEER's observation.
- d. If test sample passes in accordance with the Section, the seam qualifies for laboratory testing. If any field test sample fails to pass, the follow procedures outlined in Article 3.3.D of this Section.
- e. Final judgment regarding seam acceptability, based on failure criteria in these specifications, rests with CQA ENGINEER.

6. Destructive Test Failure Procedures

Apply following procedures when a sample fails destructive testing, when conducted by CQA Laboratory or by the Geosynthetics CONTRACTOR using a field tensiometer.

- f. Geosynthetics CONTRACTOR has the following options:
 - 1) Repair seam between any two passing destructive test locations, or
 - 2) Trace welding path to an intermediate point (10 feet minimum from point of failed test in each direction) and take a small sample at each location with a 1-inch-wide die for an additional field test. If these additional samples pass the test, take full laboratory samples. If these

laboratory samples pass the tests, repair seam between these locations. If either sample fails, repeat process to establish zone in which seam should be repaired.

- a) Acceptable repaired seams shall be bound by two locations from which samples passing laboratory destructive tests have been taken. Passing laboratory destructive tests of trial seam samples, taken as indicated in Article 3.3.D of this Section, may be used as a boundary for the failing seam. In cases exceeding 150 feet of repaired seam, a sample taken from the zone in which seam has been repaired shall pass destructive testing. Make repairs in accordance with Article 3.2.I of this Section.
- b) When a sample fails, OWNER may require additional testing of seams that were welded by the same welder and/or welding apparatus during the same time shift.

E. Repair Verification

1. Nondestructively test each repair using methods described in Article 3.3.C of this Section, as appropriate. CQA ENGINEER shall number and log each repair.
2. Passing nondestructive test results indicate an adequate repair.
3. Repairs more than 150 feet long require destructive test sampling, in accordance with Article 3.3.D of this Section.
4. Failed destructive or nondestructive tests indicate that the repair shall be redone and retested until a passing test results.

F. Large Wrinkles

Wrinkles are considered to be large when a geomembrane can be folded over onto itself.

1. Cut and reseam all wrinkles identified by CQA ENGINEER. Test repair seams in accordance with Article 3.3.E of this Section.

3.4 PROTECTION OF WORK

- A. The Geosynthetics Installation CONTRACTOR shall use all means necessary to protect all materials and all partially completed and completed Work of these Specifications.

- B. In the event of damage, the Geosynthetics Installation CONTRACTOR shall make all repairs and replacements necessary to the approval of the CQA ENGINEER and at no additional cost to the OWNER.
- C. The CQA ENGINEER will issue an approval of the geomembrane liner installation and inspection to the OWNER prior to placement of any material over the geomembrane.

3.5 RECORD DRAWINGS

- A. After the completion of installation of geomembrane liner, the installer shall complete an “as-built” record drawing. The plan shall be prepared by the installer and reviewed/approved by the CQA ENGINEER and shall be at a scale of no less than 1 inch = 100 feet. It shall indicate the limits of geomembrane installed, panel layout with panel identification per Article 3.2.B of this Section, location of destructive seam testing samples, and location of repairs. Identification of destructive seam testing samples and repairs shall be coordinated with the CQA ENGINEER to match with the identification used in sampling and repair logs and test reports. Additionally, the limits of geomembrane will be surveyed by CONTRACTOR.

END OF SECTION

SECTION 02779 GEOSYNTHETIC CLAY LINER

PART 1: GENERAL

1.1 SUMMARY

- A. The Geosynthetics Installation CONTRACTOR shall furnish all labor, materials, tools, equipment supervision, transportation, and installation services necessary for the installation of the Geosynthetic Clay Liners (GCL) of the cell. The Work shall be carried out in accordance with these Specifications, the CQA Plan, and the Construction Drawings.

1.2 RELATED SECTIONS

- A. Section 02221 – Excavating and Stockpiling.
- B. Section 02222 – Earth Fills.
- C. Section 02778 – Geomembrane.

1.3 REFERENCES

Latest ASTM Standards or other recognized agency standards at the time construction documents are issued for the following items:

- A. Sieve Analysis of Fine and Course Aggregates;
- B. Particle Size Analysis of Soil;
- C. Tensile Properties of Plastics;
- D. Compaction Characteristics of Soil;
- E. Initial Tear Resistance of Plastic Film or Sheeting;
- F. Water (Moisture) Content of Soil, Rock, and Soil-aggregate Mixtures;
- G. Mass Per Unit Area (Weight) of Fabric;
- H. Sampling of Geosynthetics for Testing;
- I. Grab Breaking Load and Elongation of Geotextiles;
- J. Water (Moisture) Content of Soil by the Microwave;
- K. Specification Conformance of Geosynthetics;
- L. Identification, Storage, and Handling of Geosynthetic Rolls;

- M. Hydraulic Conductivity of Saturated Porous Materials;
- N. Measuring Nominal Thickness of Geotextiles and Geomembranes;
- O. Mass per Unit Area of Geotextiles;
- P. Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction;
- Q. Index Flux through Saturated Geosynthetic Clay Liner;
- R. Guide for Storage and Handling of Geosynthetic Clay Liners;
- S. Quality Control of Geosynthetic Clay Liners;
- T. Fluid Loss of Clay Component of Geosynthetic Clay Liners;
- U. Mass Per Unit of Geosynthetic Clay Liners; and
- V. Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.

1.4 DEFINITIONS

Bentonite: Clay soil, comprised primarily of sodium montmorillonite, characterized by high-swelling potential and low-hydraulic conductivity.

Construction Quality Assurance (CQA) Consultant: The OWNER or the monitoring firm responsible for implementation of the CQA plan.

Construction Quality Assurance (CQA) Laboratory: The party, independent from the OWNER, Manufacturer, Fabricator, and Installer, responsible for conducting tests on samples of geosynthetics obtained at the site. Also referred to as the Geosynthetics Laboratory.

Construction Quality Assurance (CQA) Officer: The professional representative of the CQA monitoring firm who shall be responsible for implementation of the CQA plan.

Construction Quality Assurance (CQA) Monitor: Site representative of the CQA Monitor responsible for documenting field observations and tests.

ENGINEER: The individual or firm responsible for the design and preparation of the project Construction Drawings and Specifications.

Geomembrane: An essentially impermeable synthetic membrane used as a solid or liquid barrier. Synonymous term for flexible membrane layer (FML).

Geosynthetic Clay Liner (GCL): Relatively thin factory-manufactured liner material consisting of bentonite supported by textile backing or geomembrane held together by needling, stitching, or chemical adhesives.

Installer: The party responsible for field handling, transporting, storing, deploying, and temporary restraining (against wind) of the GCL.

Lot: Group of consecutively numbered rolls from the same manufacturing line.

GCL Manufacturer (Manufacturer): The party responsible for the production and quality of GCL.

Minimum Average Roll Value (MARV): Minimum value of a limited series of tests that represents a value two standard deviations lower than the overall average value. Ninety-five percent of any individual samples will have greater than the MARV for any given property.

Textile Backing (textile or geotextile): Geosynthetic support material consisting of woven slit film, needle-punched nonwoven, or spunlaced polymer fabric, used for supporting bentonite in a GCL.

1.5 SUBMITTALS

A. **Product Data (Manufacturer):** Submit the following 7 days prior to shipping material to the site.

1. Textile Backing

- a. Certification stating that the textiles meet the product requirements and are needle-free.
- b. Copy of quality control tests performed by textile supplier (if different from GCL manufacturer).
- c. Copy of quality control tests performed by GCL manufacturer.

2. Bentonite

- a. Certification stating that the bentonite meets the product requirements (Table 02779-1).
- b. Copy of quality control tests performed by bentonite supplier.
- c. Copy of quality control tests performed by GCL manufacturer (if different than supplier).

3. GCL

- a. Certification stating that the GCL meets the product requirements (Table 02779-1).
- b. Copy of quality control tests performed by GCL manufacturer.
- c. Permeability testing on typical product by independent laboratory (not necessarily for product delivered to site).
- d. Laboratory test data on typical product for:
 - 1) Swell
 - 2) Permeability of overlapped GCL
 - 3) Freeze-thaw behavior of GCL
- e. Supply 3-foot by 12-foot sample to CQA organization for testing.

1.6 QUALITY ASSURANCE

- A. The OWNER will engage and pay for the services of (1) Construction Quality Assurance Monitor, and (2) Construction Quality Assurance (CQA) Laboratory to monitor the quality and installation of the GCL unless otherwise specified.
- B. The manufacturer shall not charge any time or material expenses to the OWNER, related to a plant visit by the OWNER/ENGINEER representations, the CQA Monitor, or designated representative to visit the plant during manufacturing.
- C. The GCL Installer shall aid the CQA Monitor in product sampling by providing personnel and equipment necessary to move, cut, and protect GCL rolls.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. General: Conform to the manufacturer's requirements unless otherwise specified.
- B. Delivery
 - 1. Deliver materials to the site only after the CQA Monitor accepts required submittals.
 - 2. Material shall be covered with a waterproof, tightly-fitting, plastic covering resistant to ultraviolet degradation.
 - 3. Ship less than one month prior to scheduled installation.
 - 4. Ship in closed trailer or securely tarped flat bed.
 - 5. Each roll shall be marked with the following information:

- a. Manufacturer's name;
- b. Product identification;
- c. Lot and roll numbers; and
- d. Roll dimensions and weight.

C. Storage

- 1. Store rolls in the GCL storage pad location indicated on the drawings.
- 2. Stack no more than three (3) rolls high, and provide continuous support under each roll.
- 3. Protect rolls from precipitation, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions.
- 4. Preserve integrity and readability of roll labels.

D. Handling

- 1. Use appropriate handling equipment to load, move, or deploy GCL rolls. A 3-inch Schedule 120 steel support pipe, long enough to go through the entire roll core, mounted on a fork lift or lifted with a wide spreader bar, shall be used. If a spreader bar is used, it shall be wide enough to prevent damage to the edges of the rolls from the lifting strap or chain.
- 2. Handling of rolls shall be done in a competent manner such that damage does not occur to the product or to its protective wrapping. Follow handling procedures outlined in ASTM D-4873.
- 3. Damage to protective covering due to mishandling or sampling must be repaired immediately. Repairs shall be such that the GCL roll is protected from moisture or other deleterious conditions.
- 4. Installer is responsible for off-loading, storage, and transporting material from storage area to installation site.

PART 2: PRODUCTS

2.1 GEOSYNTHETIC CLAY LINER (GCL)

- A. The GCL shall consist of a layer of bentonite encapsulated between two geotextiles, meeting characteristics as indicated on the Drawings. The bentonite

shall be a high quality, natural sodium bentonite composed of a minimum of 80 percent montmorillonite, by dry weight, when tested by X-ray diffraction methods.

- B. The GCL shall be internally reinforced through a process such as needle punching through the top and bottom layers of geotextile and the bentonite. The reinforcing fibers shall be a polypropylene thread.
- C. Continuous water-proof laplines and matchlines shall be printed directly on the geotextile-type GCL at 6 and 9 inches from the edges of the rolls, respectively.
- D. Wrapped around structurally-sound core that can support weight of GCL without excessive bending or buckling. The core shall be accessible to stingers or rods placed full-length within the core.
- E. Meet the requirements of Table 02779-1.

2.2 MANUFACTURER SOURCE QUALITY CONTROL

- A. Perform the quality control tests at the frequencies meeting, at a minimum, the requirements of Geosynthetic Research Institute (GRI) Test Method GRI-GCL3. Provide a certification letter that states all quality control tests were performed in accordance with this Specification and all properties met or exceeded the requirements listed in Table 02779-1.
- B. Supply copies of testing data, results, and certification letter to CQA Monitor.

**Table 02779-1
Properties for Geosynthetic Clay Liner**

Test	Test Designation ⁽¹⁾	Manufacturer QC Test Frequency	Conformance QA Test Frequency	Requirement
<u>Bentonite</u>				
Moisture Content	ASTM D-5993	(8)	1 per 100,000 sf	<40% when installed for geotextile-type GCL <20% passing #200 U.S. sieve >24 ml/2 g
Particle Size	ASTM D-422	(8)		
Swell Index	ASTM D5890	(8)		
Fluid Loss, max.	ASTM D5891	1 per 100,000 lbs	N/A	18 ml
<u>Geotextile</u> ⁽²⁾				
Mass per Unit Area	ASTM D-5291	1 per 50,000 sf	1 per 100,000 sf	>5.0 oz/yd ²
<u>GCL</u> ⁽²⁾				
Mass per Unit Area	ASTM D-5993	1 per 50,000 sf	1 per 100,000 sf	>0.75 pounds ⁽³⁾
Tensile Strength	ASTM D-6768	1 per 50,000 sf	1 per 250,000 sf	>23 pounds/in

Test	Test Designation ⁽¹⁾	Manufacturer QC Test Frequency	Conformance QA Test Frequency	Requirement	
Peel Strength	ASTM D-6469	1 per 50,000 sf	1 per 250,000 sf	⁽⁶⁾	
Puncture ⁽⁷⁾	ASTM D4833	1 per 100,000 sf	1 per 250,000 sf	90 lbs	
Hydraulic Conductivity	ASTM D-5887	1 per 100,000 sf	1 per 250,000 sf	<5.0 x 10 ⁻⁹ cm/sec ⁽⁴⁾	
Internal Shear Strength (min)	ASTM D6243	1 per project	N/A	Lbs/sf ⁽⁶⁾	
Residual Shear Strength ⁽⁵⁾	ASTM D-6243	N/A	See Note 5	Confining Stress psf 5,000 10,000 15,000	Shear Stress psf 1,278 2,280 3,935
Notes: (1) Alternate tests are allowed only with prior written approval of ENGINEER. (2) Required values for geotextile and GCL are MARV. (3) Weight of GCL minus weight of geotextiles or geomembrane and corrected to 0 percent bentonite moisture content. (4) Measured at 5 - 10 psi confining pressure and 2 psi head pressure. (5) As a performance test for the liner system materials, determine residual shear strength (at each confining stress level) of the liner system with shear failure possible via the following mechanisms: (1) internal GCL strength, (2) HDPE geomembrane/GCL interface strength, (3) GCL/soil subgrade interface strength and (4) geomembrane/geocomposite interface strength. Failure should occur first within the geomembrane/geocomposite interface. As an alternative, and upon approval by the ENGINEER, each interface may be tested separately at each confining stress level. The interface with the lowest peak shear strength at each confining stress level shall be deemed to control and the residual strength of the interface shall be compared to the values listed to identify conformance with this Section. (6) Required value shall be taken from manufacturer's standard material specification sheet for the selected GCL material. GCL selection shall be based on material's ability to meet or exceed the requirements identified in the site's design. (7) Puncture test to be performed on GCL material used in base liner applications where material is placed directly on subgrade. (8) A. Perform the quality control tests at the frequencies meeting, at a minimum, the requirements of Geosynthetic Research Institute (GRI) Test Method GRI-GCL3. Provide a certification letter that states all quality control tests were performed in accordance with this Specification and all properties met or exceeded the requirements listed in Table 02779-1.					

PART 3: EXECUTION

3.1 PREPARATION OF SUBGRADE

- A. The Earthwork CONTRACTOR shall be responsible for preparing the supporting subgrade for placement of the geosynthetics. The OWNER shall coordinate the Work of the earthwork CONTRACTOR and the Geosynthetic Installation CONTRACTOR so that the requirements of the specifications and the project CQA Plan are met.
- B. Subgrade shall be compacted as specified in Section 02223.
- C. Subgrade shall be rolled to a smooth and level surface.
- D. Surface shall be free of organics or other deleterious material.
- E. Fill voids and cracks.
- F. Ruts shall be limited to 1-inch maximum depth.

3.2 SUBGRADE CONFORMANCE REVIEW

- A. Before the geomembrane installation begins, the CQA ENGINEER shall verify that:
1. A qualified land surveyor has verified all lines and grades;
 2. A qualified engineer has verified that the supporting subgrade meets all requirements in the project specifications;
 3. The surface to be lined has been rolled, compacted, or handworked so as to be free of irregularities, protrusions, loose soil, and abrupt changes in grade;
 4. Round edges of Anchor Trenches or cushion with geotextiles;
 5. The surface to be lined does not contain stones which may be damaging to the geosynthetics;
 6. There is no area excessively softened by high water content;
 7. The Geosynthetic Installer, on a daily basis, shall certify in writing that the surface on which the geosynthetics will be installed is acceptable. A certificate of acceptance shall be given to the Geosynthetic Installer and to the CQA ENGINEER prior to commencement of liner deployment in the area under consideration. The OWNER shall be given a copy of this certificate by the CQA ENGINEER;
 8. After the supporting subgrade has been accepted by the Geosynthetic Installer, it is the Geosynthetic Installer's responsibility to indicate to the OWNER any change in the support subgrade condition that may require repair Work. The surface to be lined must exhibit adequate strength, as required by the OWNER, prior to liner deployment. Any damage to the subgrade caused by installation activities shall be repaired at the Geosynthetic Installer's expense. The OWNER may consult the CQA ENGINEER regarding the need for repairs. If the CQA ENGINEER concurs with the Geosynthetic Installer, the OWNER shall ensure that the supporting subgrade is repaired; and
 9. At any time before or during the liner installation, the CQA ENGINEER shall indicate to the OWNER any locations, which may not be adequately prepared for the liner.

3.3 DEPLOYMENT

- A. General

1. Deploy only after subgrade is accepted by CQA Monitor.
2. Place nonwoven side up, or in accordance with Manufacturer's recommendation.
3. Deploy manually or by use of spreader bar attached to loader or backhoe with support rod through entire roll width.
4. Take care not to entrap objects or moisture beneath GCL.
5. Beginning deployment implies acceptance of subgrade by installer.

3.4 JOINING

A. Overlaps

1. Using the lapline and matchline as guides, overlap a minimum of 6 inches along length and 18 inches along width (butt seams).
2. Overlap a minimum of 18 inches along width and in sump areas.
3. Overlaps or seams are not allowed perpendicular (horizontal seams) to slopes greater than 10 percent. In these areas, GCLs must be placed in one piece along the entire slope.
4. If length of slope is greater than manufactured length, horizontal seams staggered between adjacent panels will be allowed at the direction of the OWNER.

B. Seams

1. Spread granular bentonite at the rate of 4 ounces per lineal foot of overlap. Bentonite along overlaps parallel to the length of the roll is not required if manufacturer can document (through GRI GCL-3 or similar testing) that the edges of the roll are manufactured in a manner such that permeability at the overlaps is no greater than the permeability of the GCL material. Approval to forego the use of additional bentonite along seams must be received in writing from the design ENGINEER before installation begins.
2. Bentonite shall be same material used in the GCL.
3. Use lime spreader for powder bentonite to reduce wind-blown particles.
4. Do not sew or use mechanical connections (except for repairs).

3.5 RESTRAINING AND PROTECTING

- A. Restrain GCL against wind using sandbags filled with fine-grained material, or other approved methods. Protect GCL from water intrusion in the event of precipitation.
- B. Sandbags must remain until GCL is covered.
- C. GCL must be fully covered with geomembrane the day it is installed. No more than two acres will be exposed prior to covering to minimize GCL hydration from wet weather. If overlying geomembrane is not seamed the same day, the Monitor may request geomembrane edges to be pulled back to inspect GCL at no additional cost to OWNER. Torn, punctured, or hydrated material shall be removed and replaced in accordance with Section 3.6 at no additional cost to OWNER.
- D. GCL bentonite material that becomes hydrated to a moisture content greater than 40 percent before being covered by a seamed geomembrane may be rejected. Rejected material shall be removed and replaced at no additional cost to the OWNER.

3.6 REPAIR PROCEDURES

- A. Remove punctured, torn, or hydrated material, and as instructed by the CQA Monitor.
- B. Repair subgrade, if necessary.
- C. Cover area with same type of GCL material with same side up.
- D. Overlap defective area by a minimum of 12 inches in all directions.
- E. Adhesion tape or wood glue may be used to keep patch in place.
- F. Apply granular bentonite as with normal overlaps at 4 ounces per linear foot.

3.7 FIELD QUALITY CONTROL AND QUALITY ASSURANCE

- A. General
 - 1. Field quality control is the responsibility of the GCL Installer who must document that the installation proceeds in accordance with this specification.
 - 2. Field quality assurance is the responsibility of the CQA Monitor.
- B. The GCL Installer and CQA Monitor shall inspect:
 - 1. The underlying surface for entrapped particles that may impact the GCL.

2. The surface of the GCL for needles, punctures, tears, thinning, or other evidence that the material may not meet specification requirements.
3. The GCL for evidence of premature hydration such as wet areas or swelling. Hydrated areas (moisture content >40%) shall be removed and replaced with dry material.
4. Overlaps using the laplines and matchlines as a guide. The Monitor shall periodically measure the distance of the laplines and matchlines from the edge of the GCL.
5. The bentonite seam (if necessary) to check the location of the seams over the overlap and the amount of bentonite being used.
6. The Monitor must approve each section of the GCL before the GCL is covered.

C. The GCL Installer shall aid the CQA Monitor in collecting samples for testing. The collection of samples shall be conducted in accordance with the CQA Plan, this specification, and the manufacturer's requirements.

1. Any roll that cannot be identified shall be rejected.
2. Samples shall be tested at a minimum frequency as specified in the CQA Plan for mass per unit area, grab strength, and permeability. Only one sample per GCL type is required for interface shear and internal shear testing.
3. A minimum of one sample shall be taken from each lot.
4. Sample shall be a minimum of two (2) feet long and run the entire width of the roll.
5. Mark the roll number and machine direction on each sample.

D. Quality Assurance Laboratory Testing (by CQA Monitor)

1. The following laboratory tests will be conducted by the CQA Monitor at the frequencies identified in the CQA Plan:
 - a. Mass per unit area (ASTM D 5993);
 - b. GCL Grab strength (ASTM D 4632);
 - c. Permeability (ASTM D5887);
 - d. Moisture Content (ASTM D 2216); and
 - e. Internal Shear Strength (ASTM D-6243), see note 2 below.

2. Test specimens shall be hydrated under 200 psf normal load for 24 hours, and subsequently tested for shear strength at normal loads of 5,000, 10,000, and 15,000 pounds per square foot.
3. The test results shall be evaluated according to ASTM D-4759 and must the minimum requirements stated in Table 02779-1.

3.8 ACCEPTANCE

- A. CONTRACTOR shall retain ownership and responsibility of GCL until acceptance by the OWNER.
- B. OWNER will accept GCL installation when:
 1. All required documentation from the manufacturer and installer has been received and accepted;
 2. Test reports verifying material properties have been received and accepted;
 3. The CQA Monitor has completed final inspection and any noted defects have been repaired; and
 4. The material is in place and covered with seamed and anchored geomembrane.

END OF SECTION

APPENDIX A

PROJECT DRAWINGS

EXHIBIT F

Statement of All Clarifications and Assumptions

1 page

Exhibit F – Clarifications

1. GMP is based on the following documents:
 - a. Project Specifications dated April 2024
 - b. Project Plans dated 4/26/2024
2. GMP quantities are based on Rummel's take-offs, which vary from Engineer's Quantities
3. Bench Liner Termination has been priced per detail 9/C501; PLEASE NOTE
 - a. Bench liner termination includes
 - i. Grading slopes above termination – with this detail, there is not a way to grade slope above termination during phase 3/phase 4. These slopes are subject to erosion/rilling which will need to be addressed during phase 3/phase 4.
 - ii. GCL and Liner material and installation across bench and up slope approximate 8'. These quantities were not included in the main GCL and Geomembrane quantities.
 - iii. Sacrificial HDPE cap to protect GCL. Any future moisture penetration/absorption of GCL due to water infiltration from upslope which may require GCL repairs/replacements would be considered extra work or work to be done under future phases.
 - iv. Plywood and snow fence protection.
4. LCRS drain rock is ASTM No. 4 rock which might differ slightly from specification.
5. Owner's contingency is 5% of DCC
6. Contractor's contingency is cover any possible geosynthetic material increases due to continued supply chain concerns.

EXHIBIT G

Schedule of Major Milestones

1 page

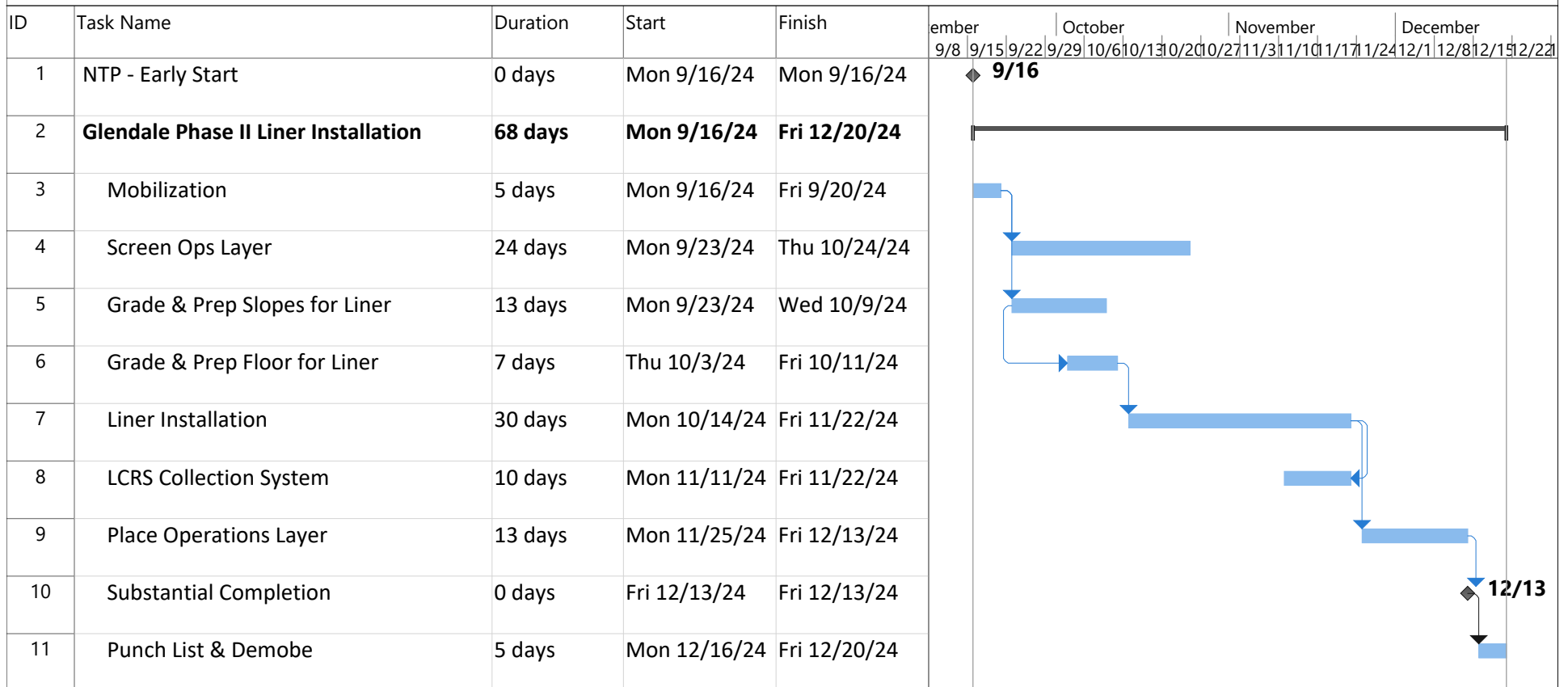
Exhibit G

City of Glendale Municipal Landfill North Cell Liner Phase II; Project Number 232425

Preliminary Schedule

May 30, 2024

Rummel Construction, Inc.



Project: Glendale Phase 2 Liner Date: Thu 5/30/24	Task		Inactive Summary		External Tasks	
	Split		Manual Task		External Milestone	
	Milestone		Duration-only		Deadline	
	Summary		Manual Summary Rollup		Progress	
	Project Summary		Manual Summary		Manual Progress	
	Inactive Task		Start-only			
	Inactive Milestone		Finish-only			

EXHIBIT H
Dispute Resolution Procedures

1. Disputes.

- 1.1** Each Dispute arising out of or related to this Agreement (including Disputes regarding any alleged breaches of this Agreement) shall be initiated and decided under the provisions of this Exhibit.
- 1.2** CMAR and City shall each designate in writing to the other party, from time to time, a member of senior management who shall be authorized to attempt to expeditiously resolve any Dispute relating to the subject matter of this Agreement in an equitable manner.
- 1.3** A party shall initiate a Dispute by delivery of written notice to the members of management designated by the respective parties under Section 1.2 of this Exhibit.
- 1.4** The parties must:
 - (A) Attempt to resolve all Disputes promptly, equitably and in a good faith manner; and
 - (B) Provide each other with reasonable access during normal business hours to any and all non-privileged records, information and data pertaining to any such Dispute.
- 1.5** With respect to matters concerning modification of the GMP or any schedule, CMAR must first follow the provisions of any Claim procedure established by the Design-Build Agreement before seeking relief under these Procedures.

2. Emergency Arbitration.

- 2.1** If the parties are unable to accomplish resolution of a Dispute, the expedited resolution of which either party considers necessary to prevent or mitigate a material delay to the critical path of the Services (a "Time Sensitive Dispute") within two days after the Time Sensitive Dispute has been initiated by a party, either party may thereafter seek emergency relief before an emergency arbitrator (the "Emergency Arbitrator") appointed as follows:
 - (A) The parties will exercise best efforts to pre-select an Emergency Arbitrator within 20 days after entering into this Agreement;
 - (B) If the Emergency Arbitrator has not been selected at the time a party delivers Notice of a Time Sensitive Dispute, the parties will each select a representative within one day after the Notice is delivered and the two representatives will then select the Emergency Arbitrator by the third day following delivery of the Notice.
 - (C) The Emergency Arbitrator shall be an attorney with at least ten (10) years' experience with commercial construction legal matters in Maricopa County, Arizona, be independent, impartial, and not have engaged in any business for or adverse to either party for at least ten (10) years.
- 2.2** The Emergency Arbitrator will conduct a hearing and render a written determination on the Dispute to both parties within five business days of the matter being referred to him or her, all in accordance with Rules O-1 to O-8 of the

American Arbitration Association ("AAA") Commercial Rules-Optional Rules for Emergency Protection Commercial Rules ("AAA Emergency Rules").

- 2.3 Although the hearing will be conducted using AAA rules, unless both parties agree otherwise, this dispute process will not be administered by the AAA but will be conducted by the parties in accordance with these procedures.
- 2.4 If, however, an Emergency Arbitrator has not selected within three days after delivery of the Notice, either party may upon three days additional notice, thereafter seek emergency relief before the AAA, in accordance with the AAA Emergency Rules, provided that the Emergency Arbitrator meets the qualifications set forth above.
- 2.5 All proceedings to arbitrate Time Sensitive Disputes shall be conducted in Glendale, Arizona.
- 2.6 Presentation, request for determination (i.e., a party's prayer), and the Emergency Arbitrators decision will adhere to the procedures required in Section 3.6 of this Exhibit.
- 2.7 The finding of the Emergency Arbitrator with respect to any Time Sensitive Dispute will be binding upon the parties on an interim basis during progress of the Services, subject to review de novo by arbitration after the Project Substantial Completion Date.
- 2.8 The time and extent of discovery will be as determined by the Emergency Arbitrator.
 - (A) Discovery orders of the Emergency Arbitrator will consider the time sensitivity of the matter and the parties desire to resolve the issue in the most time and costs efficient manner;
 - (B) The parties are obligated to cooperate fully and completely in the provision of documents and other information, including joint interviews of individuals with knowledge such that the matter moves toward resolution in the most time and costs efficient manner and the Emergency Arbitrator is empowered to fashion any equitable penalty against a party that fail to meet this obligation.

3. Non-Emergency Arbitration.

- 3.1 Except as provided in Section 5 of this Exhibit, any Dispute that is either a non-emergency Dispute that has not been resolved by negotiation, or a de novo review of an AAA emergency arbitration will be decided by binding arbitration by a panel of three arbitrators in accordance with, but not necessarily administered by, the Construction Industry Rules of the AAA.
 - (A) The parties shall each select an arbitrator within 15 days after notice that a party desires to resolve a dispute by arbitration.
 - (B) The two arbitrators shall then each select a third arbitrator. If an arbitrator is not selected within any such 15 day period, then the arbitrator shall be appointed by the AAA.
- 3.2 The arbitrator(s) shall meet the qualifications of Emergency Arbitrators as provided in Section 2 of this Exhibit.

- 3.3 The arbitrators do not have the authority to consider or award punitive damages as part of the arbitrators' award.
- 3.4 In connection with such arbitration, each party shall be entitled to conduct up to five depositions, and, no less than 90 days prior to the date of the arbitration hearing, each party shall deliver to the other party copies of all documents in the delivering party's possession that are relevant to the dispute.
- 3.5 The arbitration hearing shall be held within 150 days of the appointment of the arbitrators.
- 3.6 At the arbitration hearing, each party will argue its position to the arbitrators in support of one proposed resolution to the dispute (a "Proposed Resolution").
- (A) Each party's Proposed Resolution must be fully dispositive of the dispute.
 - (B) The arbitrators must select one Proposed Resolution by majority consent and are not free to fashion any alternative resolutions.
 - (C) The parties must submit their proposed resolution of the matter to the arbitrators and the other party 15 days prior to the date set for commencement of the arbitration proceeding.
 - (D) The decision of the arbitrators will be forwarded to the parties within 15 days after the conclusion of the arbitration hearing.
 - (E) The decision of the arbitration panel is final and binding on the parties and may be entered in any court of competent jurisdiction for the purpose of securing an enforceable judgment.
 - (F) All costs and expenses associated with the arbitration, including the reasonable legal fees and costs incurred by the prevailing party, must be paid by the party whose position was not selected by the arbitrators.
4. **Continuing Work.** Unless otherwise agreed to in writing, CMAR must continue to perform and maintain progress of the Work during any Dispute Resolution or arbitration proceedings, and City will continue to make payment to CMAR in accordance with the Agreement.
5. **Exceptions.**
- 5.1 Neither City nor CMAR are required to arbitrate any third-party claim, cross-claim, counter claim, or other claim or defenses in any action that is commenced by a third-party who is not obligated by contract to arbitrate disputes with City and CMAR.
 - 5.2 City or CMAR may commence and prosecute a civil action to contest a lien or stop notice, or enforce any lien or stop notice (but only to the extent the lien or stop notice the party seeks to enforce is enforceable under Arizona law), including, without limitation, an action under A.R.S. § 33-420, without the necessity of initiating or exhausting the procedures of this Exhibit.
 - 5.3 This Exhibit does not apply to, and may not be construed to require arbitration of, any claims, actions or other process undertaken, filed, or issued by the City of Glendale Building Safety Department, Code Compliance Department, Police Department, Fire Department, or any other agency of City acting in its

governmental permitting, for the benefit of public health, safety, and welfare, or other regulatory capacity.

- 5.4** In connection with any arbitration, the arbitrators do not have the authority to, and may not enforce, any provision of the Federal or Arizona Rules of Civil Procedure.